Children's accidents, accident causation, and remedy

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Examples from OECD-countries

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Children's accidents, accident causation, and remedy; examples from OECD countries

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This paper presents children's accident data, drawn from IRTAD, completed with data on separate countries drawn from other sources. Analysis of differences between girls and boys reveal a number of accident causing factors. Finally, some successful safety measures are presented.

I. Children's accident data OECD countries

Introduction

The International Road Traffic and Accident Database, IRTAD, contains many accident data on all OECD countries plus Hungary on the one hand, and population data on the other. This makes it possible to calculate accidents per capita ('in fact 'per 100,000' will be used). But the IRTAD data also have some restrictions.
Firstly, figures of different countries on injured victims are hardly comparable. The definition of 'injured' differs greatly. Secondly, the reporting to the police of injury-accidents is insufficient, not equally distributed on different groups of road users and different roads, and not comparably insufficient between countries. Thus this paper will only use IRTAD-data on fatal accidents.
The third restriction is that the data are not complete enough to make interesting analyses over all countries. Every analysis necessitates exclusion of at least some countries, sometimes of many countries. The excluded countries will be mentioned each time. The list of countries can be found in the supplement.
The fourth restriction, especially relevant to this study, is that only three age categories are distinguished in the 0-14 year age group, and that these categories cannot be used in many analyses. Finally, gender is not recorded in the IRTAD data.
These restrictions make it necessary to complete the accident picture of children with other data.
For the purpose of this study, the term 'child' is taken to mean a child from 0 up to its 15th birthday.

Fatalities

To give an impression of the importance of the problem, rough data will be given, to start with.
In 1993, 7189 children, 0-14 years of age, were killed in traffic in the OECD countries (except P, N and CDN) (Table 1). No large differences exist in the number of children killed per year.

'Year' means: per age group, divided by the number of years in the age group. Thus the number of the 0-5 age group is divided by 6, etc.

Age	0-5	6-9	10-14	0-14
number	2,842	1,860	2,487	7189
year	474	465	497	479

Table 1. *Children killed in OECD countries (except P, N and CDN) in 1993, by age group, and by year (per age group, divided by the number of years in the age group).*

6.47 % of all killed traffic victims belong to the 0-14 year age group (Table 2). This group constitutes nearly 20% of the total population (except I, N, TR, and P).

	0 - 14	> 14	all
number	7,188	103,938	111,126
percentage	6.47	93.53	100

Table 2. *Children and others, killed in OECD countries (except P, N and CDN) in 1993.*

The figures of 1993 and 1983 show a decrease in number of child fatalities of 32%, compared to 10% for the others (older than 14) (Table 3). This table also shows that the proportion of children killed as a percentage of all killed victims has decreased from 7% to 5.4%.

	0 - 14	> 14	all
1983	8,140	108,641	116,781
percentage	6.97	93.03	100
1993	5,536	97,398	102,934
percentage	5.38	94.62	100
1993 as % of 1983	68.01	89.65	88.14

Table 3. *Number of children killed in OECD countries (except P, N, CDN, and TR) in 1983 and 1993; and decrease as a percentage of 1983.*

The decrease is not equal for the different age groups. The 6-9 group decreased 37%, the 10-14 group only 29% (Table 4, Figure 1).

	0 - 5	6 - 9	10 - 14	0 - 14
1983	2,949	2,238	2,949	8,136
1993	2,015	1,415	2,106	5,536
'93 as % of '83	68.33	63.23	71.41	68.04

Table 4. *Number of children of different age groups killed in OECD countries (except IS, P, N, CDN, and TR) in 1983 and 1993; and decrease as a percentage of 1983.*

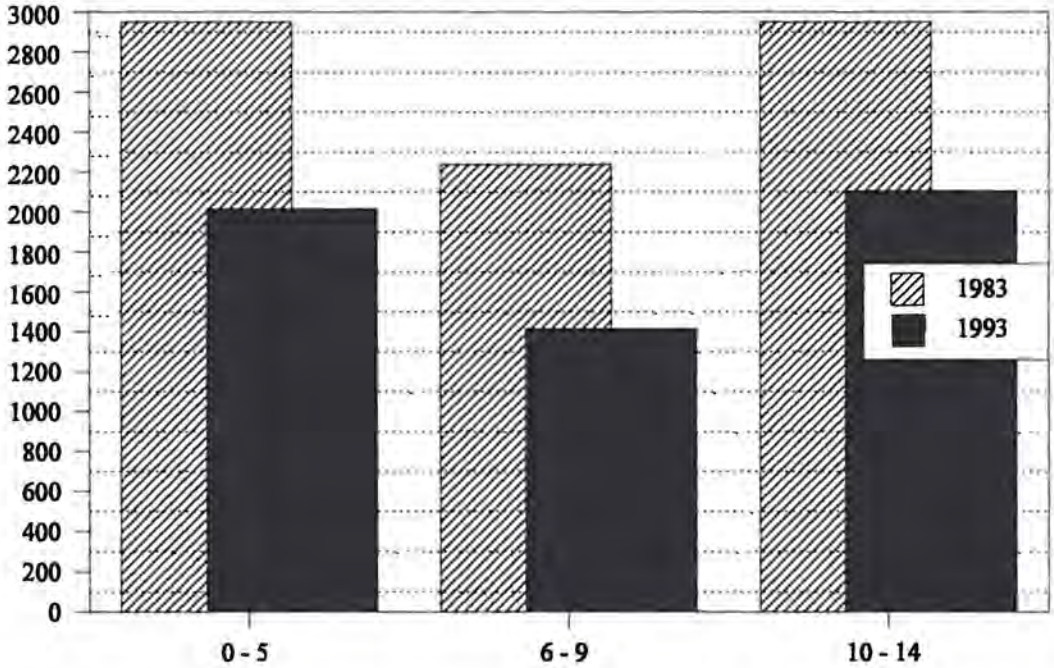

Figure 1. *Number of children of different age groups killed in OECD countries (except IS, P, N, CDN, and TR) in 1983 and 1993.*

Data related to number of children in the population

The figures till now show only part of the picture. Differences between groups, and differences between years could be attributed to differences in number of children. 'Number of children per 100,000 children' will be used as unit in this paragraph. IRTAD-population figures only are available for the complete age group 0-14.
Figures 2 and 3 compare the data of 1983 and 1993 for the OECD countries except TR, I, P, N, and CDN.
Population data differ a lot between countries, from 56 million children in the USA to 66 thousand in Iceland.
The peak of Luxembourg in 1993 means that 7 children were killed on a population of 70,000 children.
'All' does not mean the average rate, but the number per 100,000 children in all countries under review together. The figures for 1983 and 1993 are 5.33 and 3.78 respectively.
Figure 2 sorts the data for the year 1983. Figure 3 sorts the same data for 1993. It is clear that a bad position in the row is not an unchangeable fate. On the other hand, a good position in 1983 is not a guarantee for a good position in 1993. Only four of the worst ten countries of

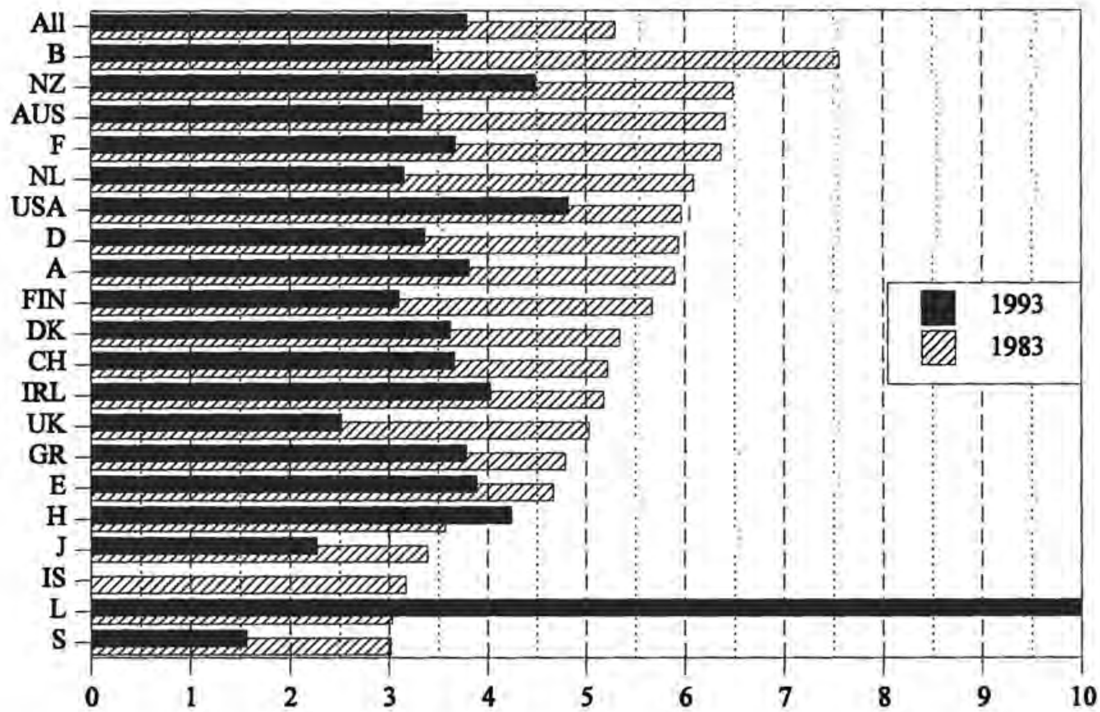

Figure 2. *Number of children (0-14) killed per 100,000 children in OECD countries in 1983 and 1993 (Except TR, I, P, N, and CDN). Countries are sorted to 1983.*

1983 have remained in this group; only four of the best have remained in their group. The correlation over these 20 countries is 0. However, by leaving out the exceptional case of Luxembourg, the correlation increases to .57.

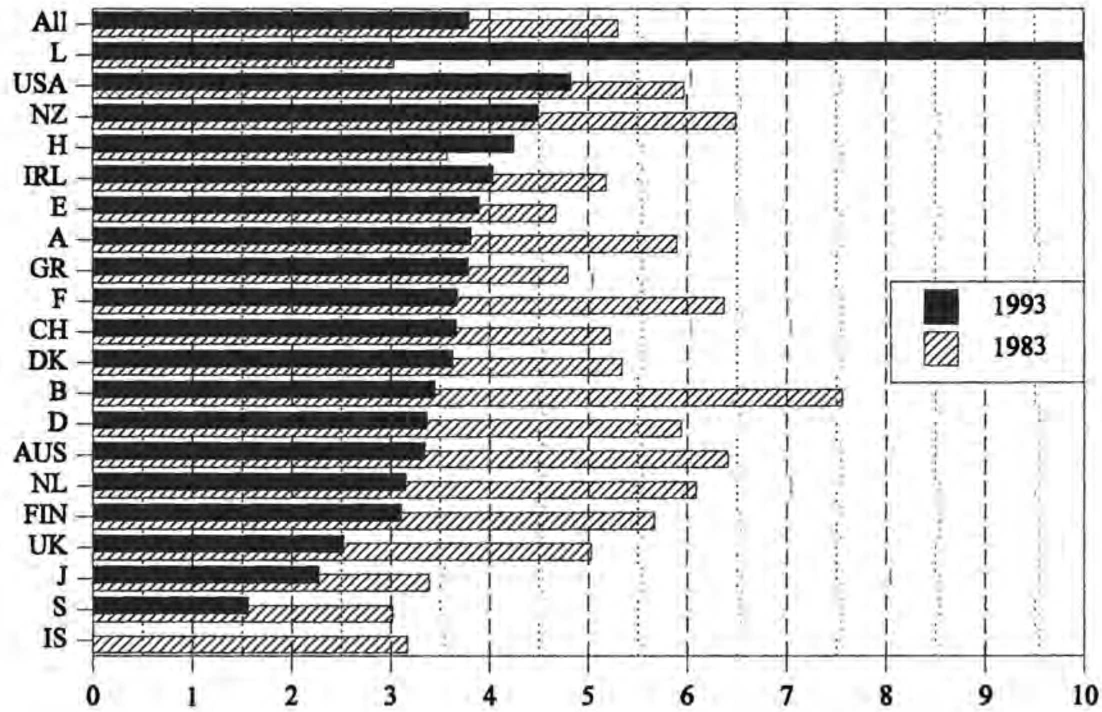

Figure 3. *Number of children (0-14) killed per 100,000 children in OECD countries in 1983 and 1993 (Except TR, I, P, N, and CDN). Countries are sorted to 1993.*

Countries differ in the amount of decrease over ten years. Figure 4 shows the decrease in number *per million* children, and the decrease in percentage of the number of 1983. Goals of safety campaigns are often formulated in terms of percentage decrease over a certain period of time. The percentage decrease in all countries together (except L, TR, N, I, P, and CDN) is nearly 30%. The number of children in these countries decreased only 3.4%.

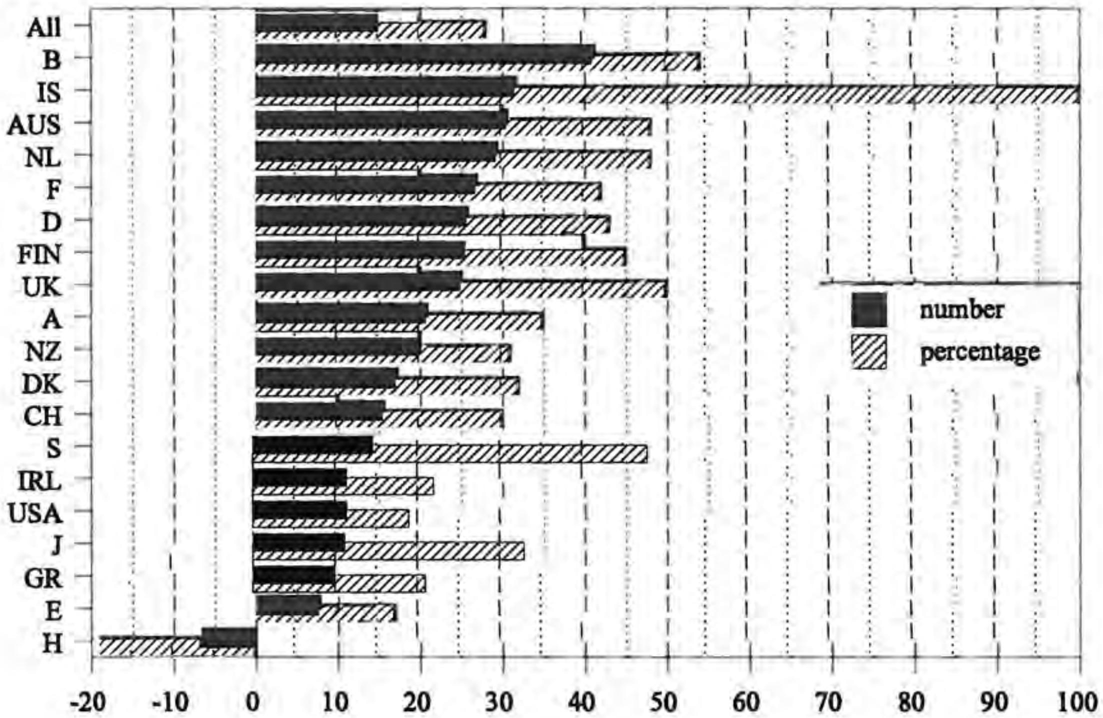

Figure 4. *Decrease (1983-1993) in number of children killed per 1,000,000 children in OECD Countries (Except L, TR, I, P, N, and CDN), compared to decrease in percentage.*

No children were killed in Iceland, in 1993. That explains the 100% decrease. Improvements in large countries contribute a lot to the general results. But, do large countries have more difficulties in realizing a considerable decrease? Figure 5 shows the relation between decrease (1983-1993) in percentage of children killed in OECD Countries (Except L, TR, I, P, N, and CDN), and the number (population/100,000) of children in 1983. No clear relation exists. The Spearman rank correlation is -0.08. The small decrease of the USA, the largest country, is conspicuous. A better performance would have increased the OECD performance considerably.

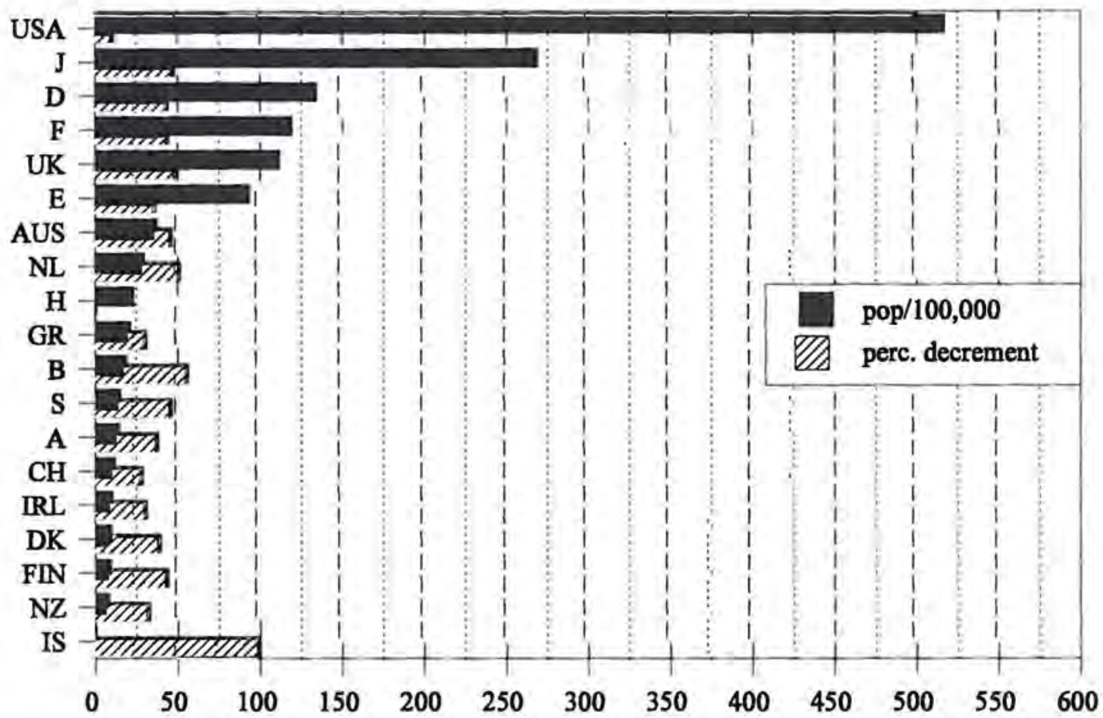

Figure 5. *Decrease (1983-1993) in percentage of children killed in OECD Countries (Except L, TR, I, P, N, and CDN), compared to the number (population/100,000) of children in 1983.*

Mode of transport

Table 5 presents the child fatalities broken down by mode of transport and age group, for a limited number of OECD countries (except I, P, L, IS, USA, CDN, and N). Data on motorised two-wheelers and the IRTAD rest-category are left out. The contribution of each mode of transport to all fatalities of an age group is expressed as percentages.

% car	age	pedestrian	% ped	bicyclist	% bic	car occ.	all
41	0 - 5	812	56	43	3	604	1459
26	6 - 9	646	61	138	13	275	1059
34	10 - 14	479	41	290	25	398	1167
35	all	1937	53	471	13	1277	3685

Table 5. *Number of fatalities by mode of transport and age group in OECD countries (except I, P, L, IS, USA, CDN, and N), in 1993.*

The rough data and percentages are also presented in Figure 6 and 7 respectively.

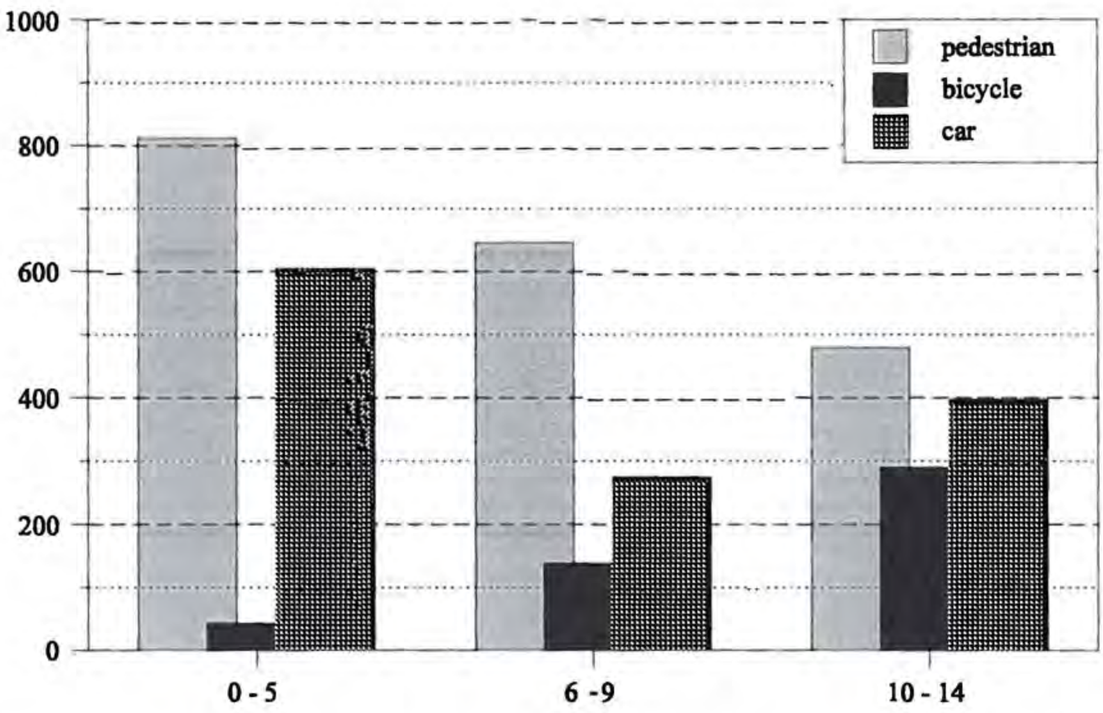

Figure 6. *Number of fatalities by mode of transport and age group in OECD countries (except I, P, L, IS, USA, CDN, and N), in 1993.*

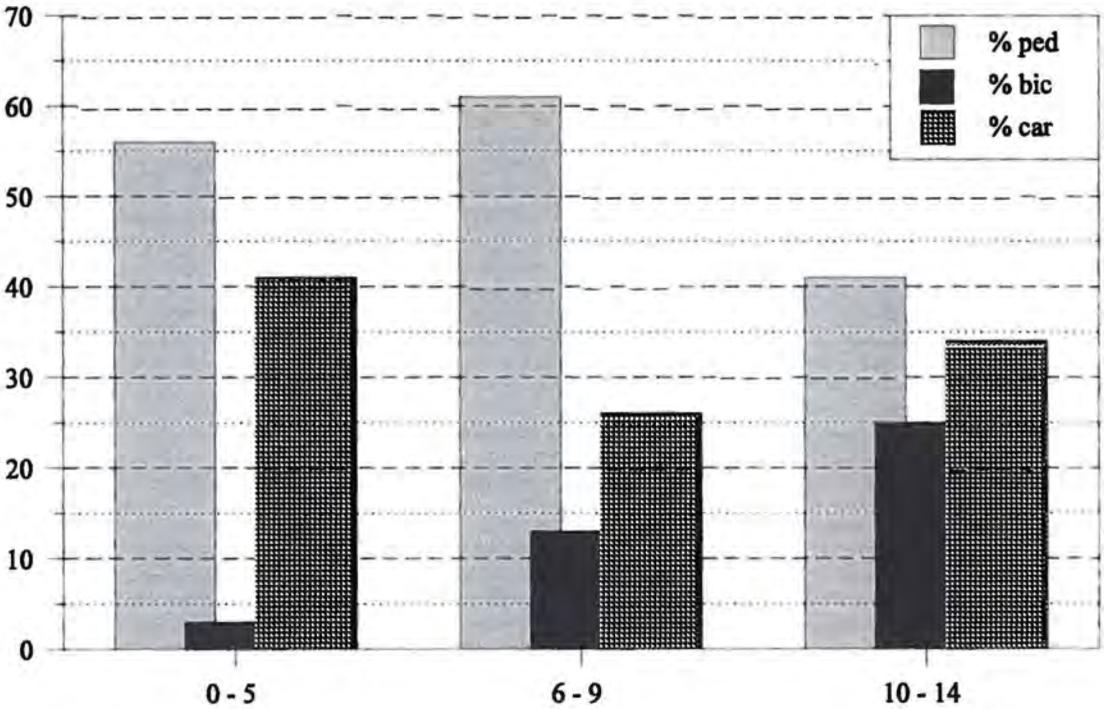

Figure 7. *Percentage of fatalities per age group by mode of transport in OECD countries (except I, P, L, IS, USA, CDN, and N), in 1993.*

Figure 6 shows that the number of pedestrian fatalities decreases, and the number of bicycle accidents increaseas with increasing age. But, the age groups contain different numbers of children. Figure 7 presents the contribution of each mode of transport to the fatalities of each age group. Here it shows that the contribution of pedestrian fatalities only decreases for the 10-14 group. The contribution of bicycle fatalities increases with increasing age.

Another picture is presented in Table 6 and Figure 8. The rough numbers are divided by the number of age years per age group (0-5 contains 6 age years etc.). Here it becomes probable, but we do not know the number of children per age group, that the most dangerous period for children as pedestrians is 6 to 9; as bicyclists is 10 to 14, and as car passengers is 0 to 5. It also shows that pedestrian fatalities are most common, bicycle fatalities are least common. It must be emphasised that modes of transport do not mean: independent travelling. Children as car occupants are passengers. Child pedestrians and bicyclists can be, and often are, independent travellers.

age	pedestrian	bicyclist	car occ.	all
0 - 5	135	7	101	243
6 - 9	162	35	69	266
10 - 14	96	58	80	234
all	129	31	85	

Table 6. *Number of fatalities by mode of transport and age group per age year in OECD countries (except I, P, L, IS, USA, CDN, and N), in 1993.*

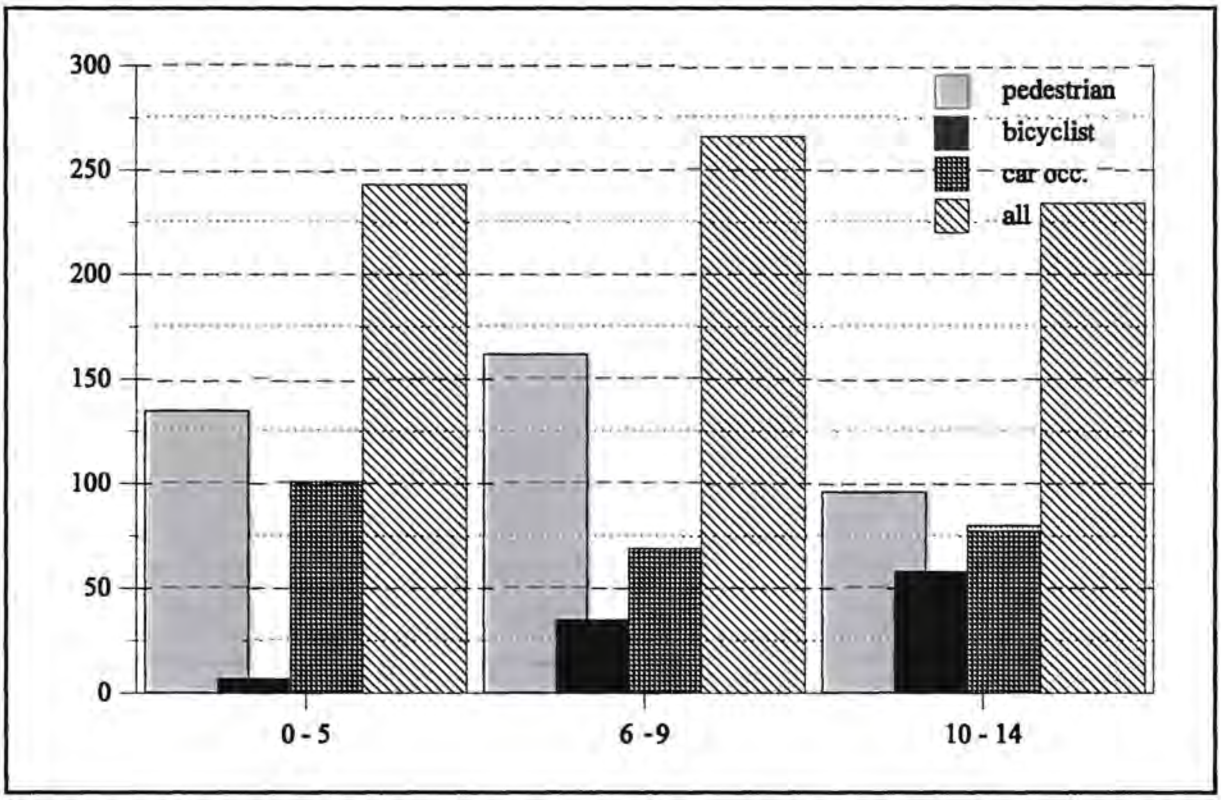

Figure 8. *Number of fatalities by mode of transport and age group per age year in OECD countries (except I, P, L, IS, USA, CDN, and N), in 1993.*

Differences between girls and boys

In many countries, girls are less at risk in traffic than boys. Table 7 presents Dutch figures on pedestrian and bicycle casualties. 185 Girls, 0-19 years of age, were killed, from 1989 to 1993, 2854 were treated in a hospital, and 10005 were slightly injured. The figures for boys are: 298, 4404, and 11805. In other words: 39% of all serious victims are girls, 61% boys. The difference between slightly injured girls and boys is smaller.
Comparable figures are found in Britain and Germany.
Boys experience more serious pedestrian and cycle accidents than girls in Britain. Twice as many boys as girls are involved (Avery and Jackson, 1993).
Thirty two per cent of 0-18 year old traffic victims (passengers included) were girls, in West Germany in 1982 (Wittenberg et al., 1987).

	Girls		Boys		Total	
	N	%	N	%	N	%
Killed	185	38%	298	62%	483	100%
Seriously I.	2854	39%	4404	61%	7258	100%
Slightly I.	10005	46%	11805	54%	21810	100%

Table 7. *Killed, Seriously Injured (Seriously I.: hospital), and slightly injured (Slightly I.) girls and boys (0-19): pedestrians and bicyclists together, Netherlands, 1989-1993.*

The difference in *accident involvement* of girls and boys is smaller when bicycles are concerned than when the victims are pedestrians, as can be seen in Table 8. It could be that the danger of bicycling is more dependent on other road users than the danger of walking, which is more dependent on own initiative.

	Girls		Boys		Total	
	N	%	N	%	N	%
Pedestrians						
Killed	50	34%	98	66%	148	100%
Seriously I.	833	33%	1729	67%	2562	100%
Slightly I.	2146	42%	3001	58%	5147	100%
Bicyclists						
Killed	135	40%	200	60%	335	100%
Seriously I.	2021	43%	2675	57%	4696	100%
Slightly I.	7859	47%	8804	53%	16663	100%

Table 8. *Killed, Seriously Injured (Seriously I.: hospital), and slightly injured (Slightly I.) girls and boys (0-19): pedestrians and bicyclists separately, Netherlands, 1989-1993.*

Swiss figures (Hubacher, 1994), based on a sample of seriously injured children (age: 1-16), show the same pattern. Of the pedestrian victims 28.5% are girls, of the cycling victims 40%. Nothing, however, is mentioned about the use of bicycles.

Wittenberg et al. (1987) report the general trend in accident involvement (1983): a large difference between girls and boys: 33% of all victims in the 0-17 age group are girls. But my estimate for 1983, drawn from their Tabelle 13 and Abbildung 18, are as follows: 30% of killed and injured bicycle victims are girls, and 51% of pedestrian victims are girls. This is an indication that the difference in use of bicycles in Germany is reflected in accident involvement. Boys are more at risk because of their dangerous choice of transport mode.

With exception of these German figures, the large difference in accident involvement between girls and boys is shown in many countries, also when pedestrians are involved. Rates of pedestrian death and serious injuries are also about twice as high in boys as in girls in the USA (Wilson et al., 1991).

II. Some factors in accident causation related to gender

Earlier mentioned accident figures suggest a number of important factors. Table 1 and Figure 8 suggest that all ages are almost equally at risk. We know that the mobility, number of trips, time on the streets, goal of trips, and measure of independent mobility change with age. We can conclude from Figure 8 that the importance of bicycle riding as a factor increases with age. The use of bicycles, distance travelled, and difficulty of traffic situation will increase. This process starts at an earlier age for walking. The danger for children as car passengers remains the same. More detailed accident analyses, observation studies, risk studies and in depth studies reveal many other important factors. In this paragraph an example will be given how concentration on gender differences can reveal some important factors in accident causation.

An explanation for differences in traffic accidents between girls and boys can be sought in a difference in their use of public space, but also in factors related to biological or psychological differences, factors possibly underlying the use of space.

Differences in use of space

Differences in exposure
The amount of use of public space is sometimes measured in number of journeys or number of activities outside home, sometimes in time in the roads, sometimes in distance travelled. Data on distance travelled, comparing girls and boys, are only available for walking. Differences between accident involvement sometimes are related to differences in exposure. Mostly boys are more at risk. But an interaction between gender, age and traffic task is probable (Levelt, 1995).

Differences in modes of travelling
Part of the differential accident involvement could be attributed to differences in choice of traffic mode. This certainly concerns the use of mopeds, and perhaps the use of bicycles.

But this cannot explain the differential accident involvement of pedestrians found in many countries.

Independent travelling

The question is whether girls are more restricted in independent travelling than boys.
In some countries girls are more restricted in traffic than boys. In the UK 26% of girls travel from primary school home alone, compared with 44% of boys (Hillman et al., 1993). More boys than girls of junior school age are allowed to cross roads on their own, to go to leisure activities, to cycle on roads, to use public transport and to go out after dark. These differences have not been found in Germany and the Netherlands. But German parents are also much more permissive regarding their boys going out after dark.

Supervision alone is not enough to prevent accidents. Some studies show that children's accidents in many cases happen when an adult or a supervisory older child is present. Avery and Jackson (1993) report that one third of all pedestrian accidents happen when an adult or a supervisory older child is present.
Lawson, analysing 51 young (aged 0-19) pedestrian fatalities in Birmingham, mentions that ten children were accompanied by parents or other adults. Of the thirty 0-9 years olds eight were accompanied by parents or other adults.

Biological and psychological differences

The contribution of difference in amount of time, number of trips or distance travelled in public space to the difference in accident involvement of girls and boys is small, absent or unknown. Differences in mode of travelling and independent mobility both contribute to this difference. But the large difference in pedestrian accidents, and the fact that many pedestrian accidents also occur when the child is accompanied, suggest still other explanations.
Differences are not only found in traffic accidents. Girls are less involved in nearly all kinds of accidents, with the exception of horse-riding accidents!
An explanation can be sought in differences in vulnerability, in differences in skills of handling the space and objects in space, or in differences in risk taking.

Vulnerability

Table 7 can be rearranged so that the differences in vulnerability are made clear (Table 9). When girls are victim of an accident, 1.4% are fatal, 21.9% serious, and 76.7% not serious. For boys the percentages respectively are 1.8%, 26.&% and 71.5%. This could mean that the outcome of accidents is less serious with girls than with boys.

	Girls		Boys		Total
	N	%	N	%	N
Killed	185	1.4%	298	1.8%	483
Seriously I.	2854	21.9%	4404	26.7%	7258
Slightly I.	10005	76.7%	11805	71.5%	21810
Total	13044	100%	16507	100%	29551

Table 9. *Killed, Seriously Injured (Seriously I.: hospital), and slightly injured (Slightly I.) girls and boys (0-19): pedestrians and bicyclists together, Netherlands, 1989-1993.*

The Swiss data (Hubacher, 1994) report also heavier injuries in boys then girls. E.g. the large proportion of nerve and spinal cord injuries are found in boys: 87%. This also suggests greater vulnerability.
However, it could also mean that girls avoid extreme situations relatively more often than boys.

Skills and abilities
Girls are ahead of boys in development in many respects. E.g. the intellectual development is faster, and higher intelligence is related to less accidents.
Avery and Jackson (1993) state that girls score better in reaction time. This has been measured on computer-simulated road crossings and girls have been consistently better than boys with the more complex tests.

Risk taking
Jaworowski (1992) states that certain personality and behaviour characteristics have been associated with children involved in accidental injury, namely: aggression, overactivity and impulsiveness.
Many studies relate the higher accident involvement of boys to their higher level of physical activity and aggressiveness. Avery and Jackson (1993), referring to observation studies, describe differences in behaviour. Boys, walking in the street, tend to act in a more reckless, impulsive and adventurous way then girls. They are more likely to dash ahead or loiter behind at critical times when a road is to be crossed, than do girls. Overall, girls exercise more care and attention themselves near the road, and also are more likely to stay close to their parent or carer. In crossing, girls are more likely to stop on the kerb and look up and down the road before crossing, boys tend to look more as they approach the kerb and whilst crossing.
Boys adopt adult-like strategies for crossing roads earlier than girls do, without having the necessary abilities.
This picture contains two elements: differences in activity and impulsiveness, but also a difference in autonomy.

Women are less attracted to risk taking than men (Parker et al. 1992a and b). They evaluate outcomes of traffic violations as more negative and report to have more control over committing violations, are more afraid of having an accident, perceive traffic situations as more risky (Tränkle et al., 1990), judge their driving skill less optimistic (DeJoy, 1992), report less risky behaviour (Barjonet, 1992), etc. One of the consequences is that they avoid dangerous traffic situations to a larger degree than men.
Some would say that this is caused by a biologically based personality factor, e.g. 'Sensation Seeking': the need to participate in exciting activities (Zuckerman, 1985). Others would say that differences are the result of socialization. Boys are stimulated to be independent, to take initiatives.

Concluding remarks

The differential need for excitement and autonomy together could explain differential use of space, in quantity, but also in quality, and this could explain the differential outcome in accidents.

Two developments, among other things, could change the differential use of space by boys and girls: the meaning of traffic participation, and gender emancipation.

The case of bicycles can illustrate the first. Dutch girls and boys use bicycles in a similar way. We could explain that by taking into account the meaning bicycles have in the Netherlands. Riding a bicycle does not have the image of being 'sporty' and 'risky'. Bicycles are a normal mode of transport, not appealing to attributes as daring and exciting. Riding a moped does have these characteristics in the Netherlands. In some other countries bicycles probably are used to fulfil the need of seeking sensations. Then greater differences in use, and in accidents, can be expected between boys and girls. When the meaning changes, remaining differences can be attributed to the level of activity and autonomy.

Gender emancipation, increased involvement of women in society, could decrease their more careful use of space. A first indication is found in a UK study. Young female drivers drive faster than all other drivers, when they are alone (Parker, 1994). So, the inevitable emancipation will diminish the differences caused by socialisation.
On the other hand, mass media still offer a traffic world full of risks, and populated by men taking them. There still applies: traffic is toys for the boys.

III. Causation of decrease in accidents

Four factors have received increased attention during recent years. Hillman et al. (1990) have instigated a discussion on restriction of independent mobility as a key-factor in increased safety. Recent developments in Germany have given evidence of the positive effects of children's seats. Many countries are involved in the development of preschool education. And interest in traffic calming measures continues.

Diminished mobility

The central statement by Hillman et al. (1990) is that a large part of the decreased children's accident figures is caused by decreased safety. This decreased safety should affect the independent mobility of children. Their proof lies in the results of surveys in England and Germany. Children and parents were asked on a number of indicators of (in)dependent mobility. 1990 English data could be compared with 1971 data.
The English survey demonstrates an astonishing decrease in independent mobility. Escorting children from and to school increased. The ownership of bicycles increased from two-thirds in 1971 to 90 % in 1990, but whereas in 1971 two-thirds of cycle owners said that they were allowed to use them on the roads: by 1990, this proportion had fallen to only a quarter. German children were allowed more freedom than English children. From other studies the conclusion can be drawn that the independent mobility of German children has largely remaind unchanged during ten years. Figure 4 shows that improvements in Germany and the UK are comparable.
The conclusion by Hillman is interesting and suggests remedial measures. "It has been suggested to us that German parents are more willing to let their children out because they know that the whole German nation will 'tut-tut' if they do anything wrong. In England, child supervision appears to be a more private family affair, whereas in Germany it seems to have been 'collectivised' to a much greater degree".
A Dutch survey (van der Spek & Noyon, 1993) asked parents to compare old with recent times. Their conclusion is the same as Hillman's on England. However, the evidence is less convincing, because determining the reliability of this kind of oral history is difficult.

Restriction of independent mobility certainly contributes to less accidents, but collective responsibility seems here to be the prime safety measure without disrupting consequences for independent mobility.

Seats and seat belts

Everybody is convinced of the positive effects of children's restraints in protecting children from motor vehicle injuries. Recent developments in Germany confirm these expectations. A new law was implemented in April 1993, obliging the use of appropriate seats and seat belts for children (Marburger, 1995).
The use of the safety devices increased considerably (see Figure 9, after Marburger, 1995).

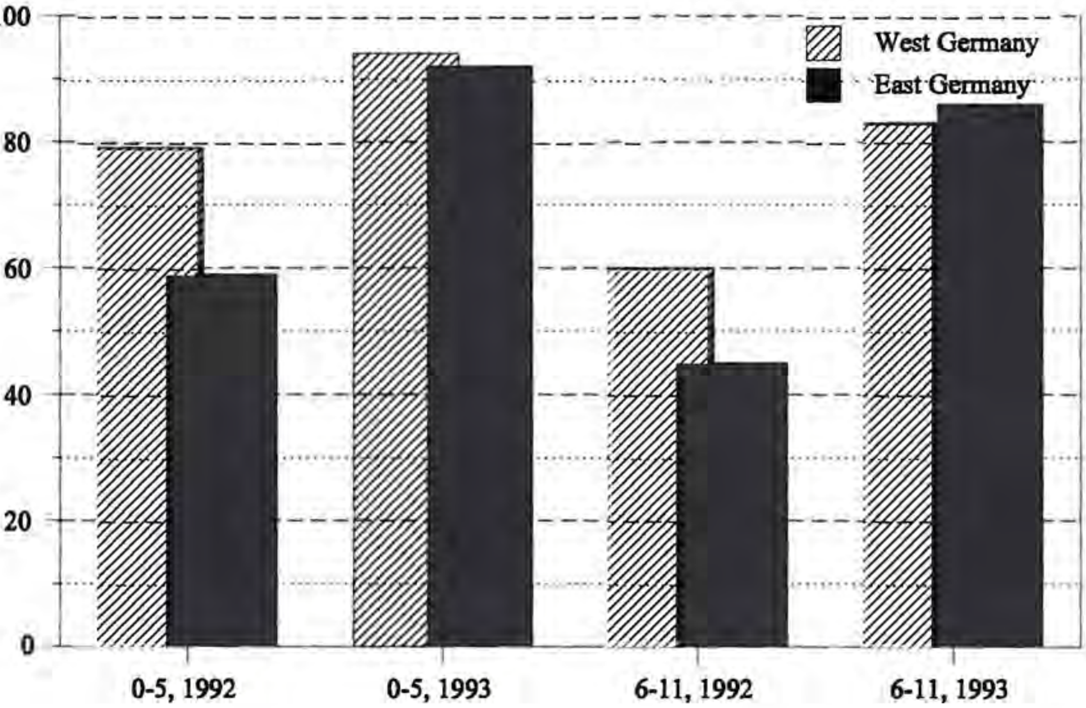

Figure 9. *The use of seat belts in built-up areas in former West and East Germany ten months before (1992) and five months after (1993) implementation of law, broken down by age.*

The result of the measure was an important reduction (1992-1993) in fatal and seriously injured victims of respectively 14.5% and 9.2%, compared to 4.7% and 0.9% respectively for older car passengers. No other explanation for this reduction could be found.

The conclusion could be that at least part of the car occupant fatalities (see Table 6 and Figure 6-8) are easily prevented.

Education

Traffic education is brought forward as an important safety measure. Many programmes have been evaluated in terms of behaviour of children. The influence on accident figures is less clear. Two recent surveys form an exception (Gregerson & Nolen, 1993; Bryan-Brown, 1995). Both are related to the work of so called 'Traffic Clubs'. These clubs are focussed on young children and their mothers. All children of a certain age, e.g. at their third anniversary, receive an offer to become members. The membership is free of charge, or they pay a small fee.

Members receive an envelope by mail, every half year, including information for their parents, work sheets, puzzles, gifts etc.
The Swedish survey (Gregerson & Nolen, 1993) shows a number of results like an increase in the use of safety equipment, the number of parents teaching and training the children, restriction of independent travelling etc. On the other hand, the results from the comparison of accident risk were negative.
Comparing the total traffic accident risk (accidents per 100 hours), the members had a significantly higer risk. The difference is attributed to cycling accidents.
The British accident study was preceded by a survey showing effects on behaviour and knowledge (West et al., 1994; Bryan-Brown, 1994). The accident study (Bryan-Brown, 1995) compared a region with members (50% of all children) with some regions without members. The only significant effect was a 20 % reduction in casualties involving children emerging from behind a vehicle. Other reductions in the experimental region when compared with the control region were observed but were not statistically significant.
In the meantime, the Swedish Traffic Club has been improved, and the British Clubs have rapidly grown.

Infrastructure

A development that takes place in many countries is traffic calming in residential areas.
The Dutch example, taken form Wouters et. al (1994) demonstrates the contribution to traffic safety, especially of vulnreable road users.
Of the total number of fatalities plus hospitalised injuries in the Netherlands in 1992, 54% (or 7003) occurred inside built-up areas.
Among these most serious casualties inside built-up areas, 32% (or 2233) concerned cyclists and 15% (or 1046) pedestrians.
A majority of traffic accident casualties inside built-up areas takes place on traffic arteries: those streets or roads where traffic or flow function dominates.
About 20-40% of the accidents occurs in streets with a residential function. It is an exception rather than a rule to find 'black spots' in residential areas. Accidents are scattered over the entire area. Therefore, an area-wide approach to solve traffic safety problems in residential areas is most appropriate.
Mainly children and elderly people, pedestrians and cyclists are casualties of traffic accidents in residential areas. These road user groups belong to the most intensive users of these areas.
Older areas seem to be less safe than newly built ones. No simple explanation can be found for this, but a combination of various factors play a part. For instance more mixed functions of streets in older areas, more (through) traffic and parking problems, less space for children to play, etc.

It was generally acknowledged that with regard to traffic safety in residential areas two features were essential: reducing speed of motorised traffic and reducing through traffic.
From accident studies it turned out that the collision speed should remain below 30 km/h, because then the probability of a serious injury will be minimal. From this finding it was deduced to set in residential areas the legal limit at 30 km/h.
Since 1983, Dutch municipal authorities can institute a maximum speed of 30 km/h on roads or in zones within built-up areas.

So, in fact, the concept of the '30 km/h zone' has been deduced from the 'woonerf'-concept.
It attempts to improve traffic safety and living quality in areas which predominantly serve as a

residential function. However, it seeks to offer safety to a wider residential area at far less cost, thus avoiding the major drawbacks of the 'woonerf'-approach.

Over the years many municipalities have decided to implement '30 km/h zones'. Based on a recent survey we expect that 300 out of almost 700 municipalities have realised one or more '30 km/h zones'.

The concept has been developed over these years. Design elements have been conceptualised, undergone further refinement and have been applied to various locations. Speed restricting engineering measures represent an essential element in the reorganisation of residential areas, where a speed limit of approx '30 km/h' is intended. The following objectives were aimed for:

- to lower the speed of motorised traffic;
- to discourage through traffic;
- to improve traffic safety, both in terms of accident reduction and diminishing the threat posed by traffic;
- to reduce traffic nuisance, such as parking congestion, noise and other pollution;
- to promote the mobility of cyclists and pedestrians.

To guide Dutch municipalities to select effective speed restricting measures a 'Handbook for 30 km/h measures' was developed. Nowadays these measures can be found in a publication called the ASVV-Recommendations for urban traffic engineering.

Recently, the effect on the number of injury accidents was studied in 151 of such '30 km/h zones' (Vis & Kaal, 1994). In order to enable correction of effects which were not associated with the realised measure, all injury accidents inside the built-up area were collected for the same municipalities over similar periods (control areas).
Following correction based on the trend shown in the control areas, it was determined that the number of injury accidents had dropped by 22% (± 13%).
It has been shown as well, that these areas tend to carry a lower volume of motorised (through) traffic, while the number of cars taking shortcuts through these zones has also diminished to a significant degree.

Although separate figures for children are not available, the conclusion must be that traffic calming in residential areas is of major importance to reduce children's accidents, especially of young children who still travel close to home, as pedestrians, and as bicyclists..

Conclusions and recommendations

1. Accident data of the three age groups are almost equal. All children deserve equal attention.
2. Indisputable facts are a considerable decrease in children's accidents, and a better result for children than for others.
3. Interpretation of reduced accident data as an indication of decreased safety combined with decreased independent mobility is not a rule.
4. Gender differences in accidents reveal important factors in traffic safety, factors as exposure, vulnerability, skills, and other personality factors.
5. Attention is asked for the effect of social responsibility for other peoples' children. This could prevent the decrease in independent mobility, keeping the decrease in accidents.
6. The promotion of the proper use of restraints is a promising approach.
7. Exposure starts at birth. Why not education?
8. Traffic calming of residential areas is a must, not only for safety, but also for a healthy development of children.

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Supplement

International Road Traffic and Accident Database, IRTAD

Countries mentioned in this paper:

A	Austria
Aus	Australia
B	Belgium
CDN	Canada
CH	Switzerland
D	Germany
DK	Denmark
E	Spain
F	France
FIN	Finland
GR	Greece
H	Hungary
I	Italy
IRL	Ireland
IS	Iceland
J	Japan
L	Luxemburg
N	Norway
NL	Netherlands
NZ	New Zealand
P	Portugal
S	Sweden
TR	Turkey
UK	United Kingdom (incl. Northern Ireland)
USA	USA