EFFECTS OF ROAD SAFETY MEASURES IN URBAN AREAS IN THE NETHERLANDS

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SUMMARY

In two urban areas in The Netherlands, each covering a surface of about a hundred hectares, a demonstration project of traffic measures was carried out; these areas were redivided and redesigned with the aims:
a) of better separating traffic zones and residential areas;
b) within the residential areas, of diverting through-traffic (countermeasure type 1), reducing the speed of the remaining traffic (type 2), and increasing environmental amenity (type 3, "woonerf");
c) within the traffic area, of organizing safe and speedy traffic for all types of road-users, by separating the different kinds of traffic, and by making provisions for pedestrians, cyclists and mopeds.

A before-and-after research study has been carried out to examine the effects of the countermeasures on traffic safety, traffic flows, environmental protection and socio-economical aspects. This paper reports on the traffic safety part of the study, in which changes in accidents, behaviour and experience have been considered.
In the short period (14 months) following the implementation of the new layout, the number of victims of traffic accidents decreased significantly in the residential areas, even taking into account the decrease in traffic volume and the number of residents. In the traffic zones, no important change in the numbers of accidents and victims was found.
Behavioural studies showed no clear difference in the number of conflicts for the residential areas where different types of countermeasures were applied. Countermeasures at junctions in the traffic zones were evaluated on the basis of before-and-after conflict studies, and the only conclusion drawn from the small number of conflicts was that cyclists from residential areas seemed to take a greater risk when crossing a traffic zone. Waiting periods before crossing, for cyclists and pedestrians, were shortened on some locations, especially where the carriageway had been narrowed.
The countermeasures applied to the traffic zones did not always facilitate the task of cyclists and pedestrians, as was further proven by the interviews carried out, in which many people declared finding their surroundings still unsafe.

EFFETS DES MESURES DE SECURITÉ ROUTIERE EN MILIEU URBAIN AUX PAYS-BAS

RESUMÉ

Un project expérimental a été mis en place aux Pays-Bas dans deux zones urbaines d'une superficie d'environ 100 hectares chacune. Ces zones ont été réorganisées et réaménagées dans le but de:
a) mieux séparer zones de circulation et zones de résidence;
b) à l'intérieur des zones de résidence, éliminer le transit (contremesure de type 1), réduire la vitesse du trafic résiduel (type 2) et rendre l'environnement plus attractif (type 3, "cours urbaines");
c) dans les zones de circulation, rendre les déplacements sûrs et rapides pour tous les types d'usagers, en séparant les diverses catégories de trafic et en réalisant des aménagements en faveur des piétons, des cyclistes et des cyclomotoristes.

Des recherches, sous la forme d'études avant-après, ont été menées pour analyser les effets des contremesures sur la sécurité, la circulation, la protection de l'environnement et les aspects socio-économiques. Cet article traite de la partie sécurité routière, dans laquelle les variations d'accidents, de comportements et d'expérience individuelle ont été analysées.

Pendant la courte période (14 mois) suivant le réaménagement des zones expérimentales, le nombre de victims d'accidents dans les zones de résidence a diminué de façon significative, même compte tenu de la baisse des volumes de trafic et du nombre des résidents. Sur les zones de circulation, les nombres d'accidents et de victimes n'ont pratiquement pas changé.

Les études de comportements n'ont pas mis en évidence de différenciation claire, du point de vue du nombre des conflits, entre les zones de résidence sur lesquelles différents types de mesures ont été appliqués. Les contremesures mises en places aux intersections des zones de circulation ont fait l'objet d'études de conflits avant-après, mais la seule conclusion qui a pu être tirée du petit nombre de conflits observés est que les cyclistes sortant des zones de résidences paraissaient prendre plus de risques en traversant les zones de circulation. Le temps d'attente avant

traversée, pour les cyclistes et les piétons, a été réduit sur certains sites, particulièrement ceux ayant fait l'objet d'un rétrécissement de chaussée.

Les contremesures appliquées aux zones de circulation n'ont pas toujours supprimé les difficultés éprouvées par les cyclistes et les piétons, constatation qui apparaît également dans les interviews, au cours desquelles de nombreuses personnes ont déclaré continuer à ressentir leur environnement comme dangereux.

INTRODUCTION

By no means the last factor which determines the quality of a traffic system is the safety of traffic: accidents interrupt the traffic process and cause damage to people, vehicles and the loads they carry, and to infrastructural facilities. Particularly worthy of attention are the risks to road users not only of physical injury but also of mental damage due to fear of traffic and the threat it presents. The lack of road safety can thus be related to opinions and feelings on the dangerousness of traffic, desirable and undesirable traffic behaviour (conflicts, etc.) and recorded accidents with their victims and all the other damage that can occur. The only relatively reliable national records of accidents kept are of those with victims (deaths and injuries); consequently these accidents are generally taken as the yardstick for comparison. If we look at more detailed traffic situations, however, we find that the number of accidents is generally too small to yield reliable statistical results. In that case observed conflicts or feelings of insecurity are used as a supplementary criterion.

This paper contains the results of a road safety study of the effects of infrastructural measures taken in two urban areas in the Netherlands. An accident survey has been carried out by S.T.M.C. Janssen, while J.H. Kraay (also SWOV) supervised behavioural studies and opinion polls.

PILOT SCHEMES IN TWO TOWNS, RIJSWIJK AND EINDHOVEN

The 1975 Dutch road safety policy plan announced two experimental schemes involving the reclassification and reconstruction of urban road nets: traffic zones and residential zones were reclassified, and a reconstruction was designed to make residential areas safer and more pleasant to live in, by reducing the nuisance due to traffic as much as possible. The schemes were put into practice in the municipalities of Rijswijk and Eindhoven during the 1979-81 period. In each municipality the road net of a self-contained urban area of some 100 hectares was reclassified and reconstructed so as to achieve the following objectives:

(A) To separate traffic zones from residential zones.

(B) Within the traffic zones: to separate clearly different types of traffic to achieve safe and smooth traffic flows, and to improve the safety of pedestrians and cyclists crossing the carriageway.

(C) Within the residential zones: (a) to keep out through-traffic, (b) reduce the speed of local traffic, and (c) make the environment attractive. The measures to achieve these objectives were applied in three sets: option 1 with objective (a), option 2 with objectives (a) and (b) and option 3 with all three objectives. The measures range from the simple (road signs) to the relatively radical ('woonerven').

Part of the project comprised a broadly based research programme, the aim of which was to ascertain the effects of the measures on the following aspects:

- traffic circulation;
- road safety;
- the environment;
- social and economic aspects;
- use of and opinions of public areas.

Development of road safety in urban areas of the Netherlands

Before we look at the areas under scrutiny in detail, let us outline the development of road safety in the Netherlands. If we start in 1972, after the first energy crisis, we find that the number of recorded accidents involving injury has subsequently fallen, from 60,328 in 1972 to 45,517 in 1982, about a 25% drop (see Figure 1). About three-quarters of the

figure for the Netherlands as a whole is accounted for by traffic in the built-up areas, where the drop from 1972 to 1982 was 23%. There has therefore been a sharper drop outside the built-up areas: 29%. If we compare the figures we find that the developments do not correspond entirely; the differences are difficult to explain.
Economic factors (a second energy crisis in 1975) and the weather (hard winters in 1978-9 and 1979-80) no doubt had an important influence. Provisional figures for 1983 and 1984 again show a rise in the number of accidents involving injury.

Design of the road safety study in Rijswijk and Eindhoven

The representativeness of the areas of Rijswijk and Eindhoven involved was assessed on the basis of comparisons with the urban areas of the Netherlands. It was assumed that the results of the study would be more likely to apply to areas where the development of road safety was the same than to those where it was markedly different. The scope for assessing the representativeness of the areas involved beforehand was not great, first because it was not possible to establish a criterion for road safety by which to characterize and distinguish urban areas, and second because it was not desirable for practical reasons to extend the area involved to include other municipalities. Nevertheless, to obtain some idea of their representativeness, Rijswijk and Eindhoven were first compared with the urban areas of the Netherlands with regard to the development of road safety, in particular the numbers of accidents involving victims since 1972.

Figure 2 gives the indexed figures for accidents involving victims in the Netherlands and in Rijswijk and Eindhoven combined. The developments correspond to a large extent if we consider the whole 1972-82 period, although differences are found if we compare shorter periods, especially prior to 1977.
Are Rijswijk and Eindhoven representative of urban areas in the Netherlands? Before answering this question let us look at differences between the two municipalities. Figure 3 gives the indexed figures for accidents in each. Here again the developments correspond roughly over the whole period, but over short periods, especially after 1976, the developments

are even conflicting. These differences cannot be explained as random deviations due to small numbers of accidents. In Eindhoven, where the deviations are greatest, the average number of accidents involving injury during the 197282 period was around 940 a year; in Rijswijk the figure was less than a quarter of this (see Figure 4). These figures demonstrate that comparisons between numbers of accidents over short periods can produce different results from comparisons over longer periods.
This affects not only the representativeness of Rijswijk and Eindhoven but also the corrections for the effects of the measures. Control areas were designated in the two municipalities to enable the effects of the measures in the areas covered by the schemes to be corrected to take account of the number of accidents which would have taken place without the measures.
Figure 4 gives the numbers of accidents involving injury each year for the control areas in Rijswijk and Eindhoven.

The control areas and experimental areas share the common factor that they consist of residential districts - built before 1972 - with adjacent main traffic arteries. It was not possible to identify beforehand local characteristics which might have been relevant to differences in the accident figures. The effects of the measures were established by comparing the accident figures in the experimental areas and the control areas before and after the schemes took effect. The 'before'-period was counted as being from 1972 to 1977; this was followed by a transition period when the measures were implemented. The 'after'-period began in 1982. In the first phase of the posttest the accidents which occurred in 1982 and the first two months of 1983 were ascertained - a very short period. Nevertheless, an attempt was made to obtain some idea of the effects of the experimental measures. The problem here was ascertaining the developments in the control areas. As Figure 4 shows, the Eindhoven control area displayed a drop from 1981 to 1982 whereas the Rijswijk control area displayed a rise. Should the control areas be combined because they would then correspond better to the urban areas in the rest of the Netherlands, or are we dealing with two separate experiments, each with a control area which may or may not be representative of the rest of the country?

Comparisons between the experimental area and the control area in one municipality raise problems because it is not possible to make corrections for differences in local characteristics: the experimental area in Rijswijk consists mainly of old residential districts, for instance, whereas the control area there is made up entirely of new housing estates (built before 1972). If the control areas alone are combined, the differences between the experimental areas in Rijswijk and Eindhoven become smaller.

For the time being we have opted for the first approach: both the experimental and control areas in the two municipalities were combined. The control areas do then represent the urban areas of the Netherlands to some extent. Within the control areas it is possible to distinguish between traffic and residential zones and the effects of the measures in each.
Before and after the pilot schemes were put into operation research was carried out into the effects on traffic behaviour and on opinions of safety. These studies were designed to supplement the accident survey; above all, they should enable the different effects of the various types of measure to be ascertained. Shorter 'after'-periods suffice for behavioural observations and opinion polls than for accident surveys. The restriction due to the sample of observations can be a disadvantage.

Various behavioural surveys were carried out during the project as part of the evaluation of road safety. The aim was to relate the conflicts observed and opinions collected to the records of accidents involving injury. Attempts to do so were unsuccesful, however, owing to the small numbers of both accidents and conflicts. The reliability of the poll results also left something to be desired.

RESULTS OF THE ACCIDENT SURVEY

The effects of the measures in the traffic and residential zones of the experimental areas are expressed in terms of the change in the number of accidents involving injury during the 'after'-period in comparison with the 'before'-period. Corrections are made for changes which took place in the traffic and residential zones of the control areas.

Figure 5 outlines the development of the number of accidents involving injury in the traffic zones. During the 'before'-period the developments in the experimental and the control areas corresponded. From 1972 to 1977 there was a drop of about 25% in both areas. During the transition period the number of accidents involving injury dropped still further, by almost 15% in the experimental areas and over 5% in the control areas. The brief 'after'-period also displayed a sharper drop in the experimental areas than in the control areas. Was this an effect of the experimental measures in the traffic zones? The following procedure was used to establish this.

Differences between the experimental and control areas were examined in relation to the numbers of accidents involving injury during the three periods. The total accidents in each period were calculated so that differences between one year and another within a period did not count. The method of analysis used to establish the significance of the differences in numbers of accidents between the areas and periods is known as the Weighted Poisson Model (WPM): it indicates the magnitude of the differences in the numbers of accidents (the effects) after weighting with correction and production criteria. The correction criteria used were the lenght of road (in kilometres) and the duration of the period; the production criterion was the number of vehicle-kilometres covered (including the traffic performance of bicycles and mopeds) in each period. The log-lineair model tests the hypothesis (zero-hypothesis) that the differences which have occurred are contingent, assuming a Poisson distribution of the number of accidents.

The magnitude of the differences is given as a 'standard score'; when the standard score has a value of 1.96 or over the difference is 95% certain not to be contingent. Such effects are regarded as significant here. For a description of this method of analysis see De Leeuw & Oppe (1976). In

the traffic zones of the experimental areas the number of accidents involving injury, weighted for length of road and traffic performance, remained the same. Thus the sharp drop in the experimental areas noted previously did not emerge from the analysis as being significant.

Figures 6 outlines the development of the numbers of accidents involving injury in the residential zones, the fluctuations in which are remarkable. No satisfactory explanation can be given for them. It is clear that this is also true of the differences between the experimental and control areas. Another problem in evaluating the measures is the short duration of the 'after'-period. According to the WPM analysis, however, which removed the fluctuations within each period, the number of accidents involving injury per kilometre of road in the residential zones of the experimental areas dropped. Weighted for traffic performance the drop was not significant. The amount of through-traffic (and thus the amount of traffic) in the residential zones dropped as a result of the measures. A longer 'after'-period will provide more reliable measurements of the effects of the measures in the experimental areas. Matters will also be improved when a more representative sample of traffic and residential zones in the Netherlands is available. It is impossible, in our view, to find a control area which is equivalent morphologically, social-economically and in terms of traffic to either or both of the experimental areas. The conclusions which have been drawn, in the first phase and on the assumptions stated, should be regarded as provisional.

RESULTS OF THE BEHAVIOURAL SURVEYS AND POLLS

The aim of the behavioural surveys was to establish differences in road safety from comparisons of traffic behaviour in situations with and without measures, also distinguishing between the different types of measure in the traffic and residential zones. Opinions polls were used to ascertain the reactions of residents in the experimental areas to the measures: what did they think of them and how did they claim they behaved?

The behavioural survey comprised the following components.

1. Observation of traffic behaviour at points of access to residential zones. The three options as to the type of reconstruction were represented in the sample. Hyden's conflict observation technique was used (Lund Institute of Technology, 1983). This study led to the conclusion that there were no differences in conflict behaviour between the options or between the options and the control situations. It should be remembered that this conclusion relates only to the points where residential and traffic zones meet. The number and seriousness of the conflicts observed was found to increase the more complex the layout of the junction and the more traffic there was, especially motorized traffic. Bicycles and mopeds increased in number while decreasing as a proportion of total traffic. The result is that cyclists especially are exposed to greater risk. It was also found that where access was narrow there were conflicts between cars entering and leaving the residential zones.
2. Observations of the traffic behaviour of pedestrians on access roads to the residential zones already selected. Here Güttinger's conflict observation technique was used (Advisie, 1983). It was concluded that the danger to young pedestrians in these roads was not significantly different between the three options. It is possible that adult pedestrians run somewhat more risk in option 3 than in the other options.
3. Measurements of vehicle speeds on the access roads mentioned. In general the results corresponded to expectation: cars drive more slowly in zones with option 3 measures than in other types of residential zone. The measures had little effect on the speed of mopeds.
4. Observations of traffic behaviour at a small number of junctions in the traffic zones. Observations were made, using video, of vehicle movements at locations where facilities had been installed for pedestrians

and cyclists to cross the road. Conflict behaviour was measured using Van der Horst's time-to-collision method (Van der Horst, 1983). The only conclusion that can be drawn from the small number of conflicts during the 'before'- and 'after'-period is that cyclists from the reconstructed residential zones seem to take slightly more risk when crossing the road. The waiting times for cyclists and pedestrians crossing became shorter at a number of locations, especially where the carriageway was made narrower.

Otherwise the measures in the traffic zones did not remove the nuisance to cyclists and pedestrians from motorized traffic; in a few cases it even increased. The polls also showed that the measures did not always remove the nuisance from traffic. There were high percentages of respondents who still regarded their neighbourhoods as unsafe. These feelings related to a large extent to situatons in traffic zones. As regards the measures in the residential zones, the residents had the highest opinion of option 2 when it came to improving road safety. Reductions in the amount of through-traffic and lowering of speeds in the residential zones and improvements in living conditions could not be inferred directly from the residents' responses to the polls. In fact high percentages of respondents did not know which measures had been taken in their neighbourhood. This is remarkable, since a good deal of attention was paid to publicity and public participation procedures.

CONCLUSIONS ON THE EFFECTS OF THE MEASURES

In the brief period following the implementation of the experimental measures there has not yet been any major change in the number of accidents involving injury on the main traffic arteries in and around the areas involved. The change has however been in the right direction, also as regards the number of accidents involving injury per vehicle-kilometre. Within the residential zones where measures were taken the number of accidents involving injury dropped, even taking account of the drop in the amount of traffic, especially motorized. The actual number of accidents involving injury in these zones was 50-60% lower than expected on the basis of developments in the control areas.
These conclusions are based on the hypothesis that the control areas in Rijswijk and Eindhoven combined are representative of the urban areas of the Netherlands. The experimental areas of the two municipalities were also combined. No allowance has been made, then, for differences between the areas under scrutiny in Rijswijk and Eindhoven. If it is found after a longer period (phase 2 of the accident survey) that the hypothesis is invalid, the conclusions will be revised. The pronouncements made here are thus provisional.

The favourable effect of the experimental measures in the residential zones is attributable mainly to the reduction in the amount of through-traffic. The number of accidents involving injury per vehicle-kilometre in residential streets dropped considerably. But, even in the 'after'-period, the experimental areas scored far worse on this criterion than the control areas. A relation can be posited between the high relative level of danger in the residential zones of the experimental areas and the road structure in the traffic zones. The experimental areas contain a relatively large number of main traffic arteries, consequently the residential districts are small (11.2 hectares on average) and the traffic load on the area is heavy (a lot of through-traffic and possibly some unwanted through-traffic passing through the residential zones). The number of residents per hectare is also relatively high (105). The likelihood of the same effects occurring is assumed to be greater if the measures are applied in areas more like the experimental areas as regards the local characteristics mentioned.

The results of the accident survey do not enable pronouncements to be made on the effects of each set of measures (options). Every option includes the objective of keeping through-traffic out of the residential zones, which did indeed produce lower densities of motorized vehicles. According to the residents, however, through-traffic did not disappear entirely. A favourable effect on vehicle speeds was demonstrated in the case of the most radical measure, option 3, although moped speeds remained high. The behavioural survey does not enable any marked difference in danger to be inferred from a comparison of different measures in the residential zones.

Measures at junctions in the traffic zone have a favourable effect on waiting times for cyclists and pedestrians crossing. At exits from reconstructed residential zones cyclists, however, seem to take slightly more risk when crossing the carriageway. Otherwise the measures in the traffic zones did not always remove the nuisance to cyclists and pedestrians from motorized traffic. This was also found from the opinion polls: high percentages of respondents still regarded their neighbourhoods (including the traffic zones) as unsafe. Thus, although in general the measures produced a drop in the number of accidents involving injury (per vehicle-kilometre) in the residential zones, and possibly in the traffic zones as well, they did not fulfil all their objectives.

GENERAL CONCLUSIONS

The pilot schemes have shown that reclassification and reconstruction can improve road safety in urban areas. If measures are taken only in residential zones the improvement is not likely to be radical: 10-20% of all accidents involving injury are recorded as taking place in residential streets. The measures taken in the traffic zones also have a favourable effect on the number of accidents per vehicle-kilometre. In terms of the absolute number of accidents involving injury saved the latter effect, albeit not significant, is easily twice that on residential streets. The total effect is around 20% (during a 14-month 'after'-period 109 accidents involving injury were recorded; about 9 accidents were saved in residential zones and about 20 in traffic zones). It is assumed that the effect on residential streets is due mainly to keeping out through traffic (or most of it) - a feature of all three options. It is the number of accidents per vehicle-kilometre to which this effect relates. Whether supplementary measures to influence the behaviour of the remaining local traffic will increase the effect can only be established in the next phase of the posttest, after a follow-up period of about two years. What measures produce the greatest effect in the traffic zones is also something which can only be discovered in the second phase. It seems, however, that a substantial effect for the better can be expected on 'main access roads' (see below) if through-traffic is diverted to the main traffic arteries. If this does not work, measures to influence behaviour on the former could have an adverse effect. 'Main access roads' are roads which provide access to residential zones and attract traffic from the adjoining residential streets. Reclassification and reconstruction of traffic zones considerably reduces their original traffic function. The pilot schemes did not involve much reclassification where a traffic artery becomes a residential street: only 1.3 km of original traffic artery was reclassified in this way.

Thus the problem of road safety in urban areas to a large extent relates to unwanted through-traffic in typical residential streets and on main access roads. This, however, is estimated to account for only 30% at most of all accidents involving injury. The remaining 70% are recorded on main traffic arteries, the roads on which through-traffic is permitted, or

desired. The opinion poll showed that locations regarded as unsafe in residential areas were rarely residential streets. Opinions on danger are thus determined mainly by the traffic processes occurring in the traffic zones.
Research into road safety in urban areas should therefore not be restricted to residential streets; attention should also be paid to the problems of traffic zones and particularly the transitions from residential to traffic zones.

More use should be made of conflict methods when evaluating local measures. Accident surveys are more productive the larger the area covered by the measures and the longer the 'after'-period. It is difficult to ascertain from opinion polls what factors influence the behaviour and opinions of road users: research in this fields is urgently needed.

REFERENCES

ADVISIE (1983). Verschil van optie(k)? Konfliktobservaties in het kader van het na-onderzoek demonstratieprojekt herindeling stedelijk gebied. 's-Gravenhage.

ADVISIE (1983). Verschil van optie(k)? Snelheidsmetingen in het kader van het na-onderzoek demonstratieprojekt herindeling stedelijke gebied. 's-Gravenhage.

DE LEEUW, J. & OPPE, S. (1976). The analysis of contingency tables; Log-linear Poisson models for weighted numbers. R-76-31. SWOV, Voorburg.

JANSSEN, S.T.M.C. (1984). Demonstratieproject Herindeling en herinrichting van stedelijke gebieden (in de gemeenten Eindhoven en Rijswijk). Een evaluatie van de effecten van maatregelen in de eerste fase van de na-periode van het ongevallenonderzoek. R-84-28. SWOV, Leidschendam.

KRAAY, J.H. (1984). Beleving van de verkeersonveiligheid voor en na de invoering van verkeersmaatregelen. Resultaten van een enquête in het kader van het demonstratieproject Herindeling en herinrichting van stedelijke gebieden (in de gemeenten Eindhoven en Rijswijk). R-84-27. SWOV, Leidschendam.

LUND INSTITUTE OF TECHNOLOGY (1983). An evaluation study of the replanning and redesigning of urban areas: conflict-studies in the Netherlands at intersections along the border of some areas in the cities of Eindhoven and Rijswijk. University of Lund (Sweden).

VAN DER HORST, A.R.A. (1983). Gedragsobservaties ten behoeve van (brom)-fietsers; demonstratieprojekt Herindeling en herinrichting van stedelijke gebieden (in de gemeenten Eindhoven en Rijswijk). IZF-TNO, Soesterberg.

FIGURES 1-6

Figure 1. Development of the number of injury accidents inside and outside built-up areas in the Netherlands from 1972 to 1983.

Figure 2. Index of the number of injury accidents inside built-up areas of the Netherlands and Rijswijk and Eindhoven from 1972 (=100) to 1982.

Figure 3. Index of the number of injury accidents inside built-up areas of Rijswijk and Eindhoven from 1972 (=100) to 1982.

Figure 4. Development of the number of injury accidents inside built-up areas and in control areas of Rijswijk and Eindhoven from 1972 to 1982.

Figure 5. Index of the number of injury accidents in traffic zones of the experimental and control areas from 1972 (=100) to 1982.

Figure 6. Index of the number of injury accidents in residential zones of the experimental and control areas from 1972 (=100) to 1982.

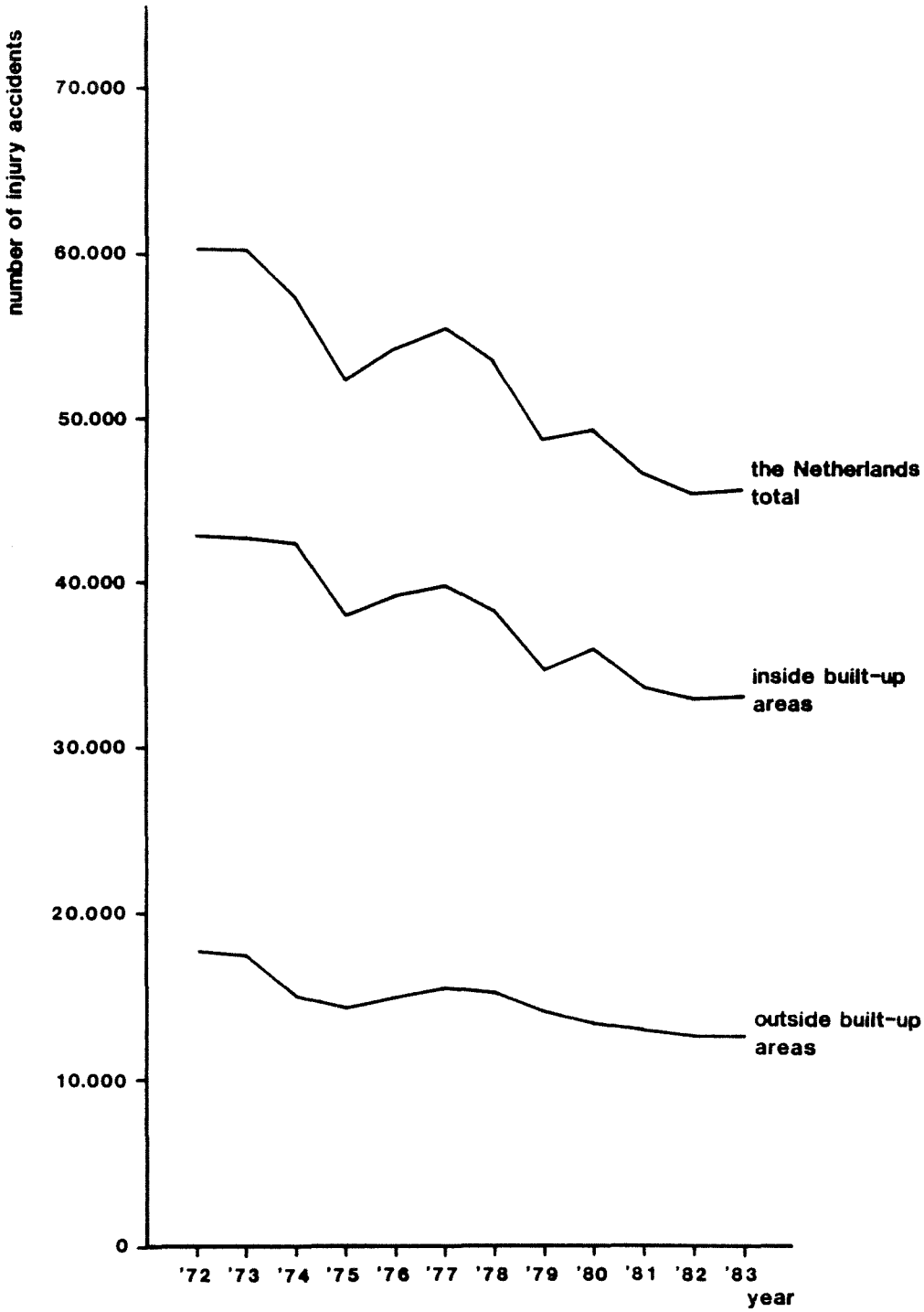

Figure 1. Development of the number of injury accidents inside and outside built-up areas in the Netherlands from 1972 to 1983.

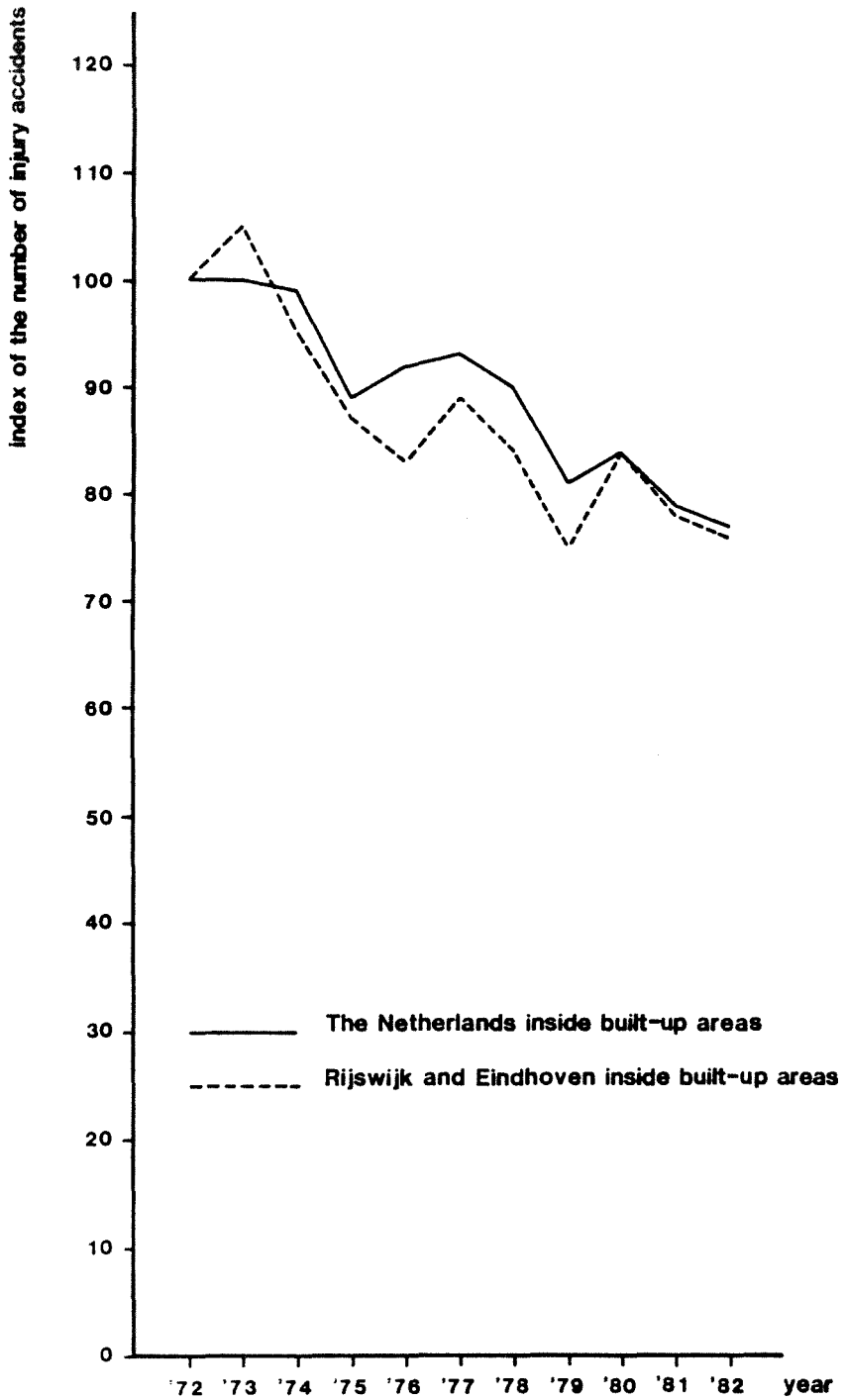

Figure 2. Index of the number of injury accidents inside built-up areas of the Netherlands and Rijswijk and Eindhoven from 1972 (=100) to 1982.

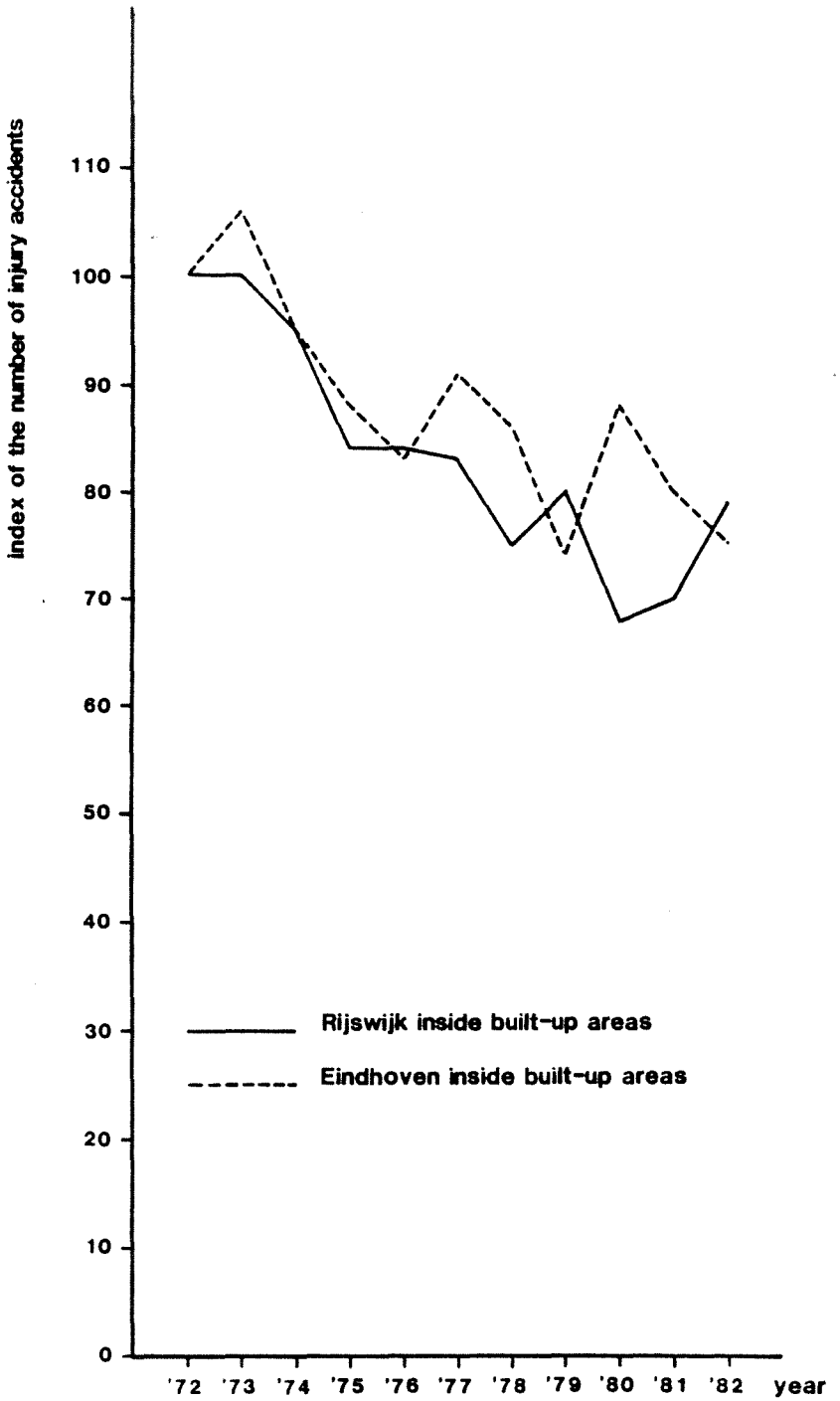

Figure 3. Index of the number of injury accidents inside built-up areas of Rijswijk and Eindhoven from 1972 (=100) to 1982.

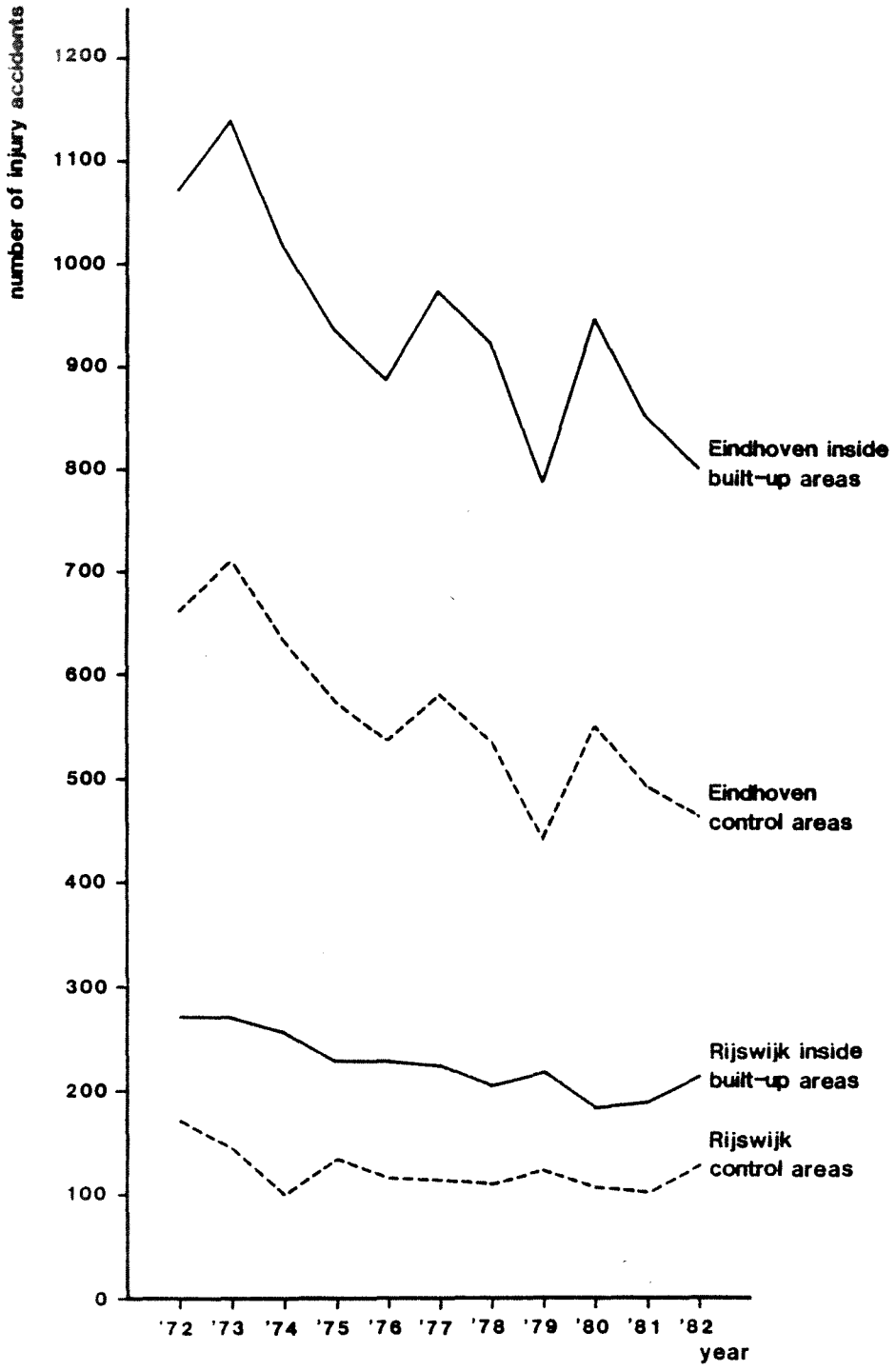

Figure 4. Development of the number of injury accidents inside built-up areas and in control areas of Rijswijk and Eindhoven from 1972 to 1982.

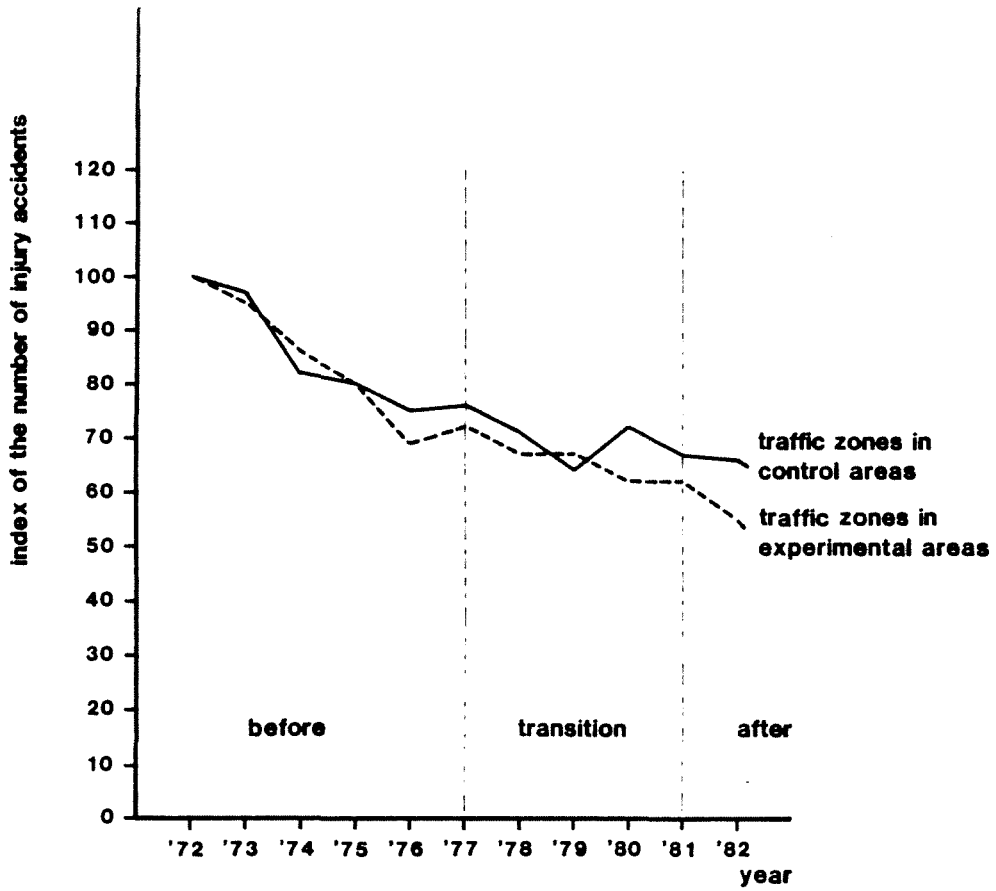

Figure 5. Index of the number of injury accidents in traffic zones of the experimental and control areas from 1972 (=100) to 1982.

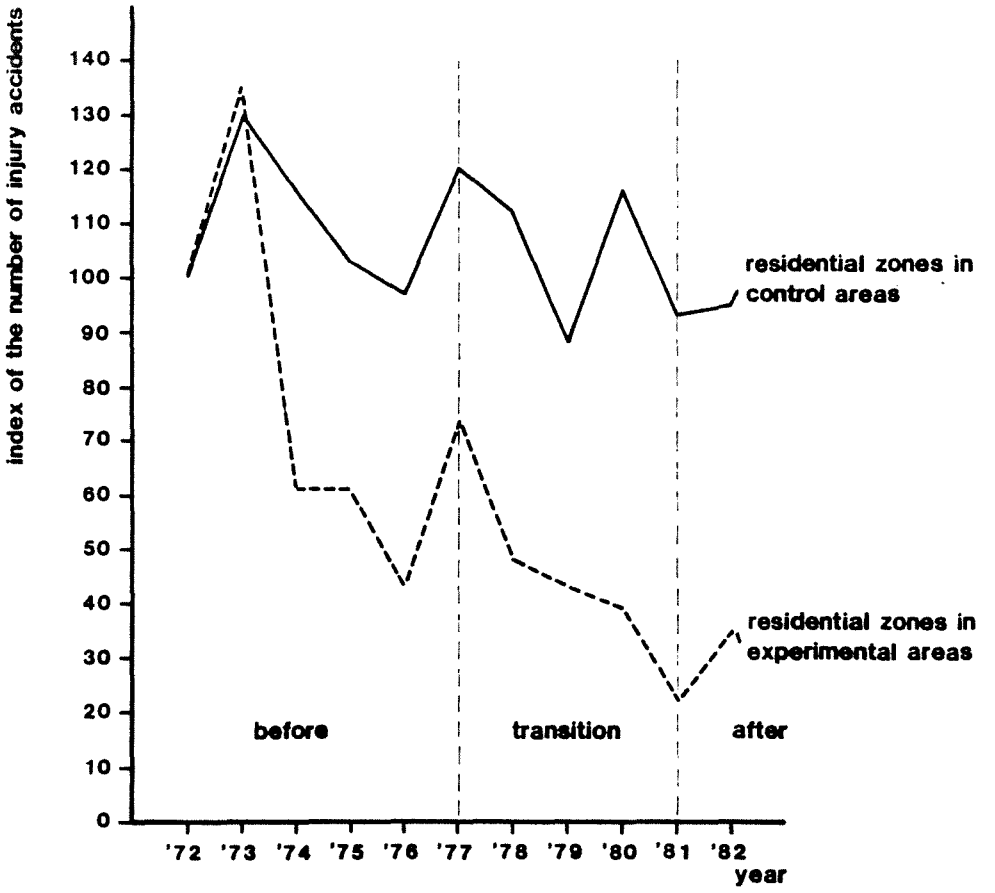

Figure 6. Index of the number of injury accidents in residential zones of the experimental and control areas from 1972 (=100) to 1982.