INTEGRATION OF MIXED TRAFFIC IN RESIDENTIAL AREAS

General principles and strategies

Contribution to OECD Special Research Group on Pedestrian Safety

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1. INTRODUCTION

For logical reasons and on the basis of research it has become clear that urban planning can greatly influence the reduction of the number and nature of conflicts between pedestrians and wheeled traffic.

The most obvious urban planning measure is the physical segregation of traffic categories, the environment being designed so that conflicts between pedestrians and other traffic are practically elimated. No law enforcement is needed; it is a clear, comprehensible system determined by its design. In other words, physical (urban) design determines and encourages certain traffic behaviour patterns.

The SCAFT Group in Sweden (SCAFT, 1968) recognise the principle that pedestrian "errors" are of secondary importance in studying pedestrian safety. The main reason why pedestrians are not safe is the traffic environment, which creates situations with a given risk of "errors". The environment should be such that a pedestrian's "error" does not promptly lead to a conflict or accident.

But such measures have a number of drawbacks:
(a) the high absolute costs;
(b) lack of space or the structural impossibility of carrying out specific plans;
(c) the difficulty of harmonising the various networks for pedestrians, moped riders, cyclists and motorised traffic.

2. INTEGRATION OF MIXED TRAFFIC

In view of the residential environment's many social functions, it may be asked whether physical segregation of traffic is really desirable.
Since strict segregation can impose many limitations on the numerous kinds of activities and contacts for which these environments are normally used, the need has arisen for a new approach to road safety within residential areas, based on integration of mixed traffic. The benefits of physical segregation as mentioned above can also be built into such an integrated system.

A number of cities have made small-scale attempts to integrate traffic in a limited number of residential streets. For application in larger areas, the Dutch examples of Delft and Emmen, among others, may be mentioned. These relate both to newly planned residential areas and to the renovation of old ones.

The planners' objective in Delft and other towns in the Netherlands was to create a residential environment for overall and varied use, especially by children, without causing conflicts with its other users or, should such conflicts occur, to reduce their severity to a minimum.

2.1. Residential areas as residential yards (VNG, 1975)

Residential yards are areas where the space open to the public should first of all do justice to its function as a place of sojourn for walking and playing; and only local traffic is allowed in them. In contrast to incidential facilities (such as a simple threshold, a localised narrowing of the carriageway etc.), this involves a systematic approach in which areas are integrally designed or redesigned as residential yards. They involve a system of physical facilities in and upon the area open to the public. The function of a residential yard differs especially from that of a traditional street in that the same paved area can be and is also (partly) used for various activities such as driving, playing, cycling, walking and parking. In a conven-

tional street design even the carriageway is often used for walking and playing, while this is not allowed by law. Primarily, the residential yard is a place of sojourn, a meeting point, a playground and pedestrian walk (its yard function). And, of course, this area accessible to the public opens up the yard for wheeled traffic too. But it does not provide for through traffic.

In concrete terms, the following aspects are involved:
(a) It is an area open to public traffic (hence the road traffic regulations apply to it).
(b) It is mostly paved (though it may contain small planted areas open to the public).
(c) It is located in neighbourhoods with mainly a residential function.
(d) Local traffic may comprise several categories for, say, services and school traffic.
(e) It is sometimes a single street or a single square or court, but it is mostly a connected group of streets or courts.
(f) Walking and playing is allowed everywhere, or at least it is not prohibited.
(g) It is also accessible to motorists, cyclists and moped users.
(h) It is not intended to be used by motorised through traffic.
(i) It comprises mixed traffic.
(j) There are not conventional, straight kerbed pavements.
(k) Physical facilities (narrowed routes, trees, elevations, posts, varied paving) are provided for slowing down motorised road users, especially motorists, when entering and traversing the area so as to protect pedestrians and children at play.

The basis idea is that the design of the residential environment should make wheeled traffic move at the proper speed. The introduction of special regulations and the placing of signs on the borders indicating these regulations are the legal finalisation of the work of urban planners and traffic experts.

Shops, supermarkets, social and cultural facilities, offices and business firms do not belong in or near a residential yard if they would attract or cause excessive motorised traffic. They would also be likely to bring too many parked vehicles to it. Too many moving and parked cars - and too many mopeds riding round - would spoil the idea of the residential yard, which is to provide a place to sojourn there pleasantly.

As the above indicates, one or more primary schools, an ordinary shop or a pub in the residential yard is not, however, likely to be a drawback. Further research will have to show what is or is not advisable in practice.

These newly evolved ideas on designing the residential environment involve several peripheral conditions.

If the traffic density is very high and if there is excessive parking, residential yards will not provide the answer. For such neighbourhoods other solutions will have to be found.

From the viewpoint of recognisability and psychological load upon road users, it seems preferable for a residential yard to comprise more than a single street or street section.

The optimum size and form of such residential yards in general cannot, of course, be indicated, nor how many entrances and exits belong to residential yards of a given size. An important point is the (maximum) distance motorists and moped users are prepared to go on driving at a low enough speed during the day and at night time. The walking distance to tram and bus stops (500 metres would seem to be about the maximum) is also an important factor.
An objection to setting up very big residential yards may also be that the traffic density in the area will be too great.

It is also advisable when planning to design or redesign a street or complex of streets, to consider the effects a residential yard

will have upon the surrounding area because through traffic is kept out of it. A large-scale project has the additional advantage of providing a framework for consultation with the (future) residents.

2.2. Legal regulations

Special behavioural codes will apply to traffic in the residential yard. In The Netherlands, the most notable new regulations applying to residential yards are the following:

(a) Roads within a residential yard designated as such may be used over their entire width by pedestrians and children at play.

(b) Drivers must drive with great caution in a residential yard. In particular, they must allow for the presence of pedestrian and children, for unmarked objects and for irregularities in the road surface and its route. In any case, they must not drive faster than walking pace.

(c) Drivers must not inconvenience pedestrians and children playing in the yard. Pedestrians and children must not unnecessarily obstruct the drivers' progress.

(d) Motor vehicles with more than two wheels may be parked in residential yards only at places marked with a board or with a letter "P" on the road surface in a parking space.

A new traffic sign indicated residential areas designated as residential yards.

3. NEED FOR FURTHER RESEARCH

3.1. Introduction

The need for further research can be subdivided into:
(a) subjects intended for investigation;
(b) the mode of investigation.

As regards subjects intended for investigation, pedestrian research priorities are being increasingly concentrated on urban areas. The emphasis is on the effects of various urban planning projects on pedestrian behaviour and safety.

As regards the mode of investigation, one can firstly concentrate on direct evaluations of specific residential areas. After this, it is advisable to compare the yard solution and its effects on traffic behaviour and road safety with other urban planning solutions.

The following can be said as regards research methods.
Since very few traffic accidents occur in residential areas in a short period of time, it is impossible to use this criterion for short-term road safety research.
Another indicator used in the concept of road safety is the near-miss, or serious conflict behaviour between two road users.
As regards the validity of this method as an alternative criterion for accidents in statistical road safety research, the following can be stated. Literature on this subject shows that the correlation between conflicts and accidents is not close. Better results are obtainable by considering serious conflicts only. But so far research on this has been on a limited scale only.

This Chapter will briefly summarise a number of advantages and disadvantages of both accident analyses and conflict analyses. The intention is to obtain greater insight into what can be done with both analyses as regards road safety and what problems they involve.

3.2. Drawbacks of accident analysis

1. Accident statistics only contain information on recorded accidents and not, therefore, on the unrecorded ones. But only part of all accidents are recorded.
2. Since accidents are relatively rare, it is often impossible to obtain reliable accident data. The time needed to collect adequate numbers of accidents for statistical processing is too long in many cases. Furthermore, different conditions and circumstances may occur during a lengthy period of collecting accident data.
3. The present standard records do not comprise any detailed information about manoeuvres.

3.3. Possibilities of analysis with conflict techniques

1. Many measurements can be made in a short time.
2. Conflicts can be classified numerically according to manoeuvring behaviour.
3. Conflicts can often be scored accurately by training observers and/or using film and video material.
4. Measures for improving road safety can be taken quicker on the basis of information from conflict techniques.
5. Conflict techniques are applicable particularly with low traffic densities where the accident level is likewise low.
6. Reduction of conflicts as the consequence of measures can be demonstrated quickly by means of before and after studies.
7. They can facilitate and improve thorough research into black spots.
8. The supply of information both to the authorities (police, traffic experts) and to road users themselves; it often happens that residents in a given area ask for action to be taken and the authorities cannot evaluate the traffic situation.
9. The conflict technique allows specific information to be obtained by vehicle categories, vehicle flows, etc.; in other words as sub-classifications.

3.4. Drawbacks of conflict techniques

1. The most useful techniques are often still strongly subjective as regards conflict scoring, especially as regards the severity of the conflict.
2. All techniques still have too little correlation with accidents to be used as an alternative criterion to these. It is advisable to limit their use to situations where there are few, if any, accident statistics available or where an initial impression is required.

3.5. Some problems in the conflict/accident relationship

1. From the results of a number of studies it can be said that conflicts are significantly related to accidents. The problem is that, although this relationship is significant, it is too slight to substitute conflicts for accidents, and that the correlation can largely be explained by the relationship of conflicts and accidents to traffic densities.
2. The validity of the conflict technique as an alternative to accident research can be verified only with recorded accidents; but accident records are incomplete.
3. For verifying this validity, knowledge of the actual flow is needed. Usually the average traffic flow is taken instead of the traffic flow at the moment of the measured conflicts. There may be a substantial difference between both measurements. The same problem may apply to accidents.
4. How many accidents are needed in order to obtain a representative picture of, say, an intersection, such that every type of accident that many happen at such an intersection has occurred? The same problem applies to conflicts.
5. If accident data are collected for a number of years and conflict data are collected at this moment, to what extent are the traffic situations then still comparable as regards density, traffic structure etc.?

6. In cases in which only serious conflicts are taken, the statistical techniques have been simple, especially rank correlations with only a limited number of observations.
7. Can conflicts be used to make an accurate estimate of expected accidents?
8. Is a statistically reliable estimate of when conflicts will occur a better indication of the number of expected accidents than a statistically less reliable estimate obtained from accidents themselves?
9. Can an estimate of expected accidents be made from actual accidents?
10. Most conflict techniques relate to vehicle relationships, while PLANFOR covers all road-user categories. Do pedestrian/other traffic relationships demand a different conflict technique from vehicle/vehicle?

Further research is advisable into the questions raised in this section.

3.6. Summary

Since validity in the various investigations is still not very great, it would seem advisable firstly to make a given technique reliable enough (because this is the primary requirement for a measuring instrument) so that it will ultimately improve validity (Oppe, 1975).
The foregoing implies that no opinions can yet be expressed regarding road safety if urban planning projects are to be evaluated by means of a conflict technique. By using a conflict technique, reliable information can, however, be obtained on certain kinds of encounters that occur, for instance, in a residential yard. Since the various conflict techniques have not so far proved reliable or valid in most cases, it is advisable to use them in situations where very few, if any, accident statistics are available or where an initial impression of the situation is required.

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