CHAPTER 3

STRATEGIES FOR IMPLEMENTING CHANGE

IMPROVING SAFETY AND THE ENVIRONMENT

Two main reasons for adapting the design of traditional residential streets have been discussed, firstly environmental improvement and secondly greater safety for pedestrians, and child pedestrians in particular.

Traditional road design served neither objective effectively, and to some extent designers seeking to improve the road network believed that the two objectives were incompatible. Safe traffic movement meant larger kerb radii, more generous sightlines, bolder lane and priority markings, and more signs, none of which contributed positively to the convenience of pedestrians or cyclists, nor to the appearance of the street. Conversely, environmental improvements meant more planting, non-standard lighting and paving materials, and other features not usually regarded as helping the safe flow of motor traffic. As a consequence, traffic segregation became the main answer to the conflict: the segregation of pedestrians from vehicles, and the segregation of through traffic from traffic seeking access. This approach is described in Buchanan's "Traffic in Towns".

The incompatibility of environment and road safety, however, is largely a product of the unquestioned assumption that motor traffic should have the legal right to travel at up to 30 mph on any street, regardless of its other functions, and that on the carriageway this traffic should have absolute priority in both legal and practical terms. Now that these assumptions are being discarded in favour of a more sensitive and varied approach to street design, the incompatibility between environment and safety objectives begins to melt away.

This section illustrates strategies that have been adopted, both in the UK and in other countries.

It is a major tenet of this paper that as this change in emphasis is implemented, many of the features desirable for improved pedestrian safety also offer opportunities for improving the environment of residential streets.

Speed reduction measures and road closures offer opportunities for introducing extra hard and soft landscaping into residential streets, while regulation of on-street parking can also improve the appearance of residential streets.

Unlike design for safety, aesthetic improvements cannot rely on a single set of standards or criteria. Variety, innovation and originality are important if residential streets are to become less monotonous. For this reason design guidance for environmental improvements should deal with general requirements rather than specific forms. Thus in the following discussion of the implementation of safety and environmental measures, this chapter focusses on the adaptations required for safety. The case studies in the following chapter 4 therefore show a range of possible environmental improvements as well as safety features, but avoid making specific recommendations on the precise form that such improvements should take.

STRATEGIES FOR SAFER RESIDENTIAL ROADS

This chapter explores the six "strategies" defined by Silcock and Walker (1982; 430) in their discussion of measures for area-wide accident prevention in residential areas. These are:

1. control of vehicle routes and volumes
2. control of vehicle speeds
3. modification of road user behaviour
4. restrictions on stationary vehicles
5. segregation of pedestrians and vehicles
6. warning devices

For the purposes of this study, strategy 6 is combined with strategy 3 but otherwise these strategies are considered in turn. Measures discussed within these strategies differ somewhat from those dealt with by Silcock and Walker because they were concerned only with safety measures on residential roads being used as through roads.

Adaptations already made to traditional residential roads in this country have often been designed to suit the specific location, without the conscious influence of sources external to the local authority (see survey results in chapter 5). Although Design Bulletin 32 has sometimes been an acknowledged influence, and more rarely the Dutch Woonerf schemes, the most directly relevant Government publication to date is the Area Improvement Note No. 9 (DOE 1974). This latter publication is, however, somewhat out of date, for it does not deal with more recent techniques such as footway crossovers. Some measures described below are therefore culled from actual examples rather than any of these publications. (More recently, schemes may have been influenced by a series of leaflets published by the Department of Transport's Traffic Advisory Unit, particularly 1-3/87.)

STRATEGY 1: KEEPING THROUGH TRAFFIC OUT OF RESIDENTIAL AREAS

In order to reduce the amount of traffic on residential roads there is a general move to follow Buchanan's (1963; 44) concept of environmental areas, and to divert traffic out of defined "environmental areas" onto bordering distributor roads (Figure 5).

Conventional means of discouraging through traffic are road closures, one-way systems, and banned turns, or a combination of these.

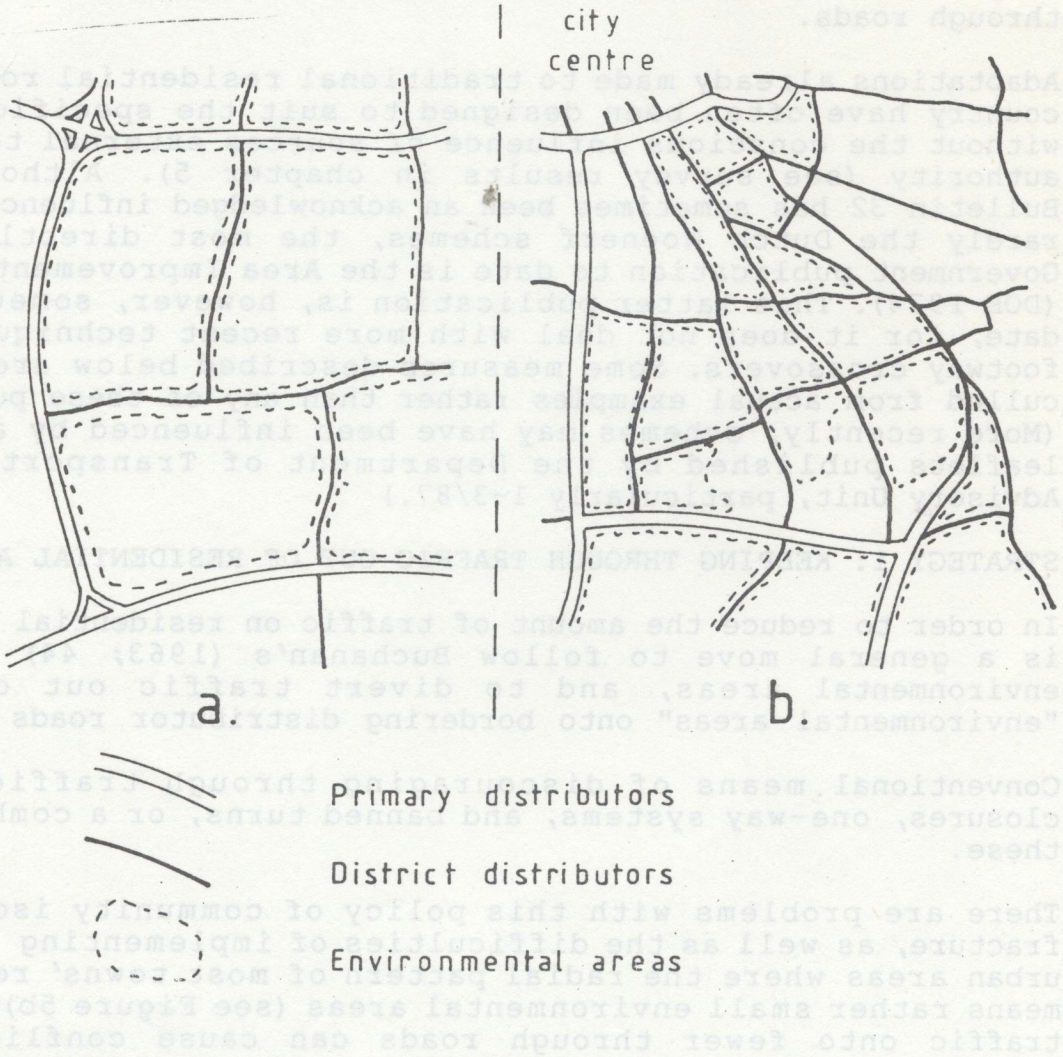
There are problems with this policy of community isolation and fracture, as well as the difficulties of implementing it in inner urban areas where the radial pattern of most towns' road systems means rather small environmental areas (see Figure 5b). Diverting traffic onto fewer through roads can cause conflict between residents if the chosen through routes are also residential, though there are many examples where such conflict has not arisen. It may sometimes be difficult to entirely prevent rat-running without serious curtailment of residents' access, as shown in the Broomhall case study (chapter 4).

Residents within environmental areas usually benefit from the resulting smaller volumes of traffic, but even so may resent

measures which impose more roundabout routes to their front doors. Moreover, the removal of through traffic does not in itself reduce traffic speeds, indeed reduced traffic volumes can encourage even higher speeds of the traffic that remains.

Nevertheless, the removal of through traffic from a residential area will usually make it easier to introduce other measures designed to reduce speeds and improve the environment.

FIGURE 5 The Buchanan concept of environmental areas.
a) shows the theoretical definition of environmental areas within a hierarchy of bordering distributor roads.
b) based on an inner urban area of Manchester shows how small these areas are likely to become in practice near the centre of large cities.



STRATEGY 2: REDUCING SPEEDS ON RESIDENTIAL ROADS

There is an accepted link between vehicle speed and accident severity, especially the fatality rate (Amundsen 1984; 92, Adams 1981; 100). However, on residential roads it is difficult to prove that reduced speeds lowers the overall accident rate. Due to the relatively small incidence of injury accidents, and their diffuse distribution, changes have to be large, and observed consistently over a long period to have statistical significance. Nevertheless, the authors of Design Bulletin 32 assumed that access roads would be safer if "low speeds" of motor vehicles were achieved.

One problem, and one which could be solved with greater experimentation and research, is that speed reduction measures have not been implemented widely enough in the UK to enable proper evaluation. Furthermore, the evaluation of safety measures should include not only the "accident rate" but also the "activity rate" or "conflict rate" in the streets concerned. Successful speed reduction schemes may well increase the extent of children's play, the incidence of local walking trips and other street activity, in which case residents may be "consuming" safety benefits by enjoying their streets to a greater degree. Accident monitoring by itself is therefore inadequate to judge the success of a speed reduction policy. Equally, measures designed to achieve only accident reduction are likely to fall short of the best solution.

Despite these difficulties, excessive speed is often perceived by residents to be the most serious problem, or as the main reason for their street being dangerous. Speed reduction schemes are therefore usually popular with residents.

Speed reduction schemes may be advisory only, legal speed limits, or self enforcing. As a general rule, speed reduction on residential roads must be self-enforcing, as adequate policing is not feasible, while advisory signs can too easily be ignored. Experimental 30 kmph speed limit signs on residential roads in Norway were obeyed only partially, and less frequently obeyed the longer they were in place (Amundsen 1984;95). Experience in Nuremburg, West Germany, was more positive, however, where all but one of 38 streets with a 30kmph limit still had lower traffic speeds after one year's operation (Stadt Nuremburg 1987).

Self enforcing speed reduction measures in the UK have to date been modifications either of the road surface or of the horizontal alignment of the carriageway, such as road and junction narrowing, chicanes and shared surfaces (see Figures 6 and 7). Some new residential estates have been designed with reduced visibility in order to slow vehicles down, though this has proved unsuccessful unless combined with other measures. Drivers are not legally bound nor physically compelled to reduce speed when there are poor sightlines, and if they do not reduce speed the poor visibility makes them more dangerous. There is evidence, however, that long sightlines encourage higher speeds (Jenks 1983; 46), so restricting these will help to reduce speeds safely, as long as short-length visibility is not impaired.

Road surface modifications in the UK include speed control humps, rumble strips, footway crossovers and areas of paving and other changes of surface within the carriageway. Rumble strips will work

FIGURE 6: Self-enforcing speed reduction measures - horizontal alignment modifications

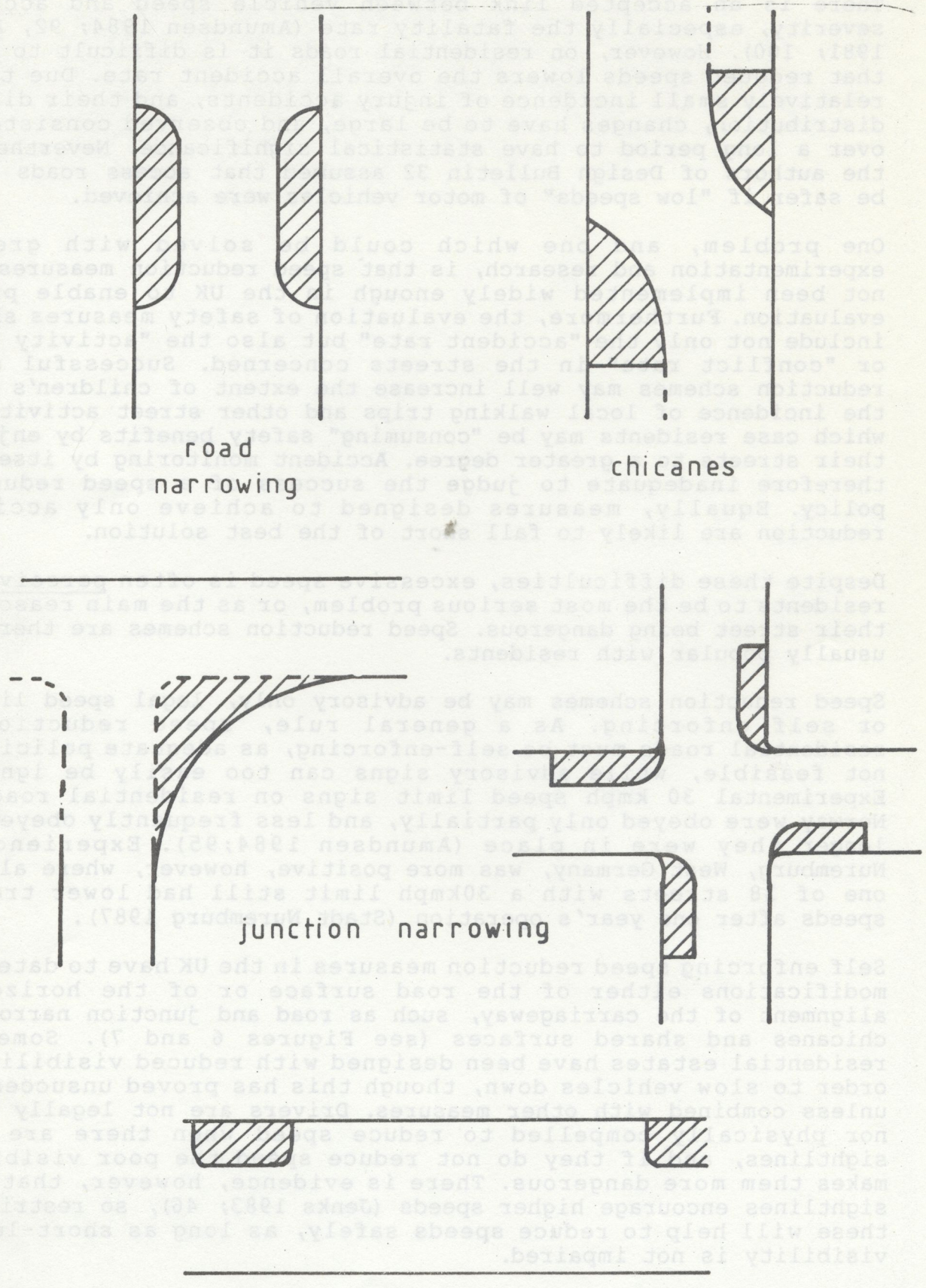
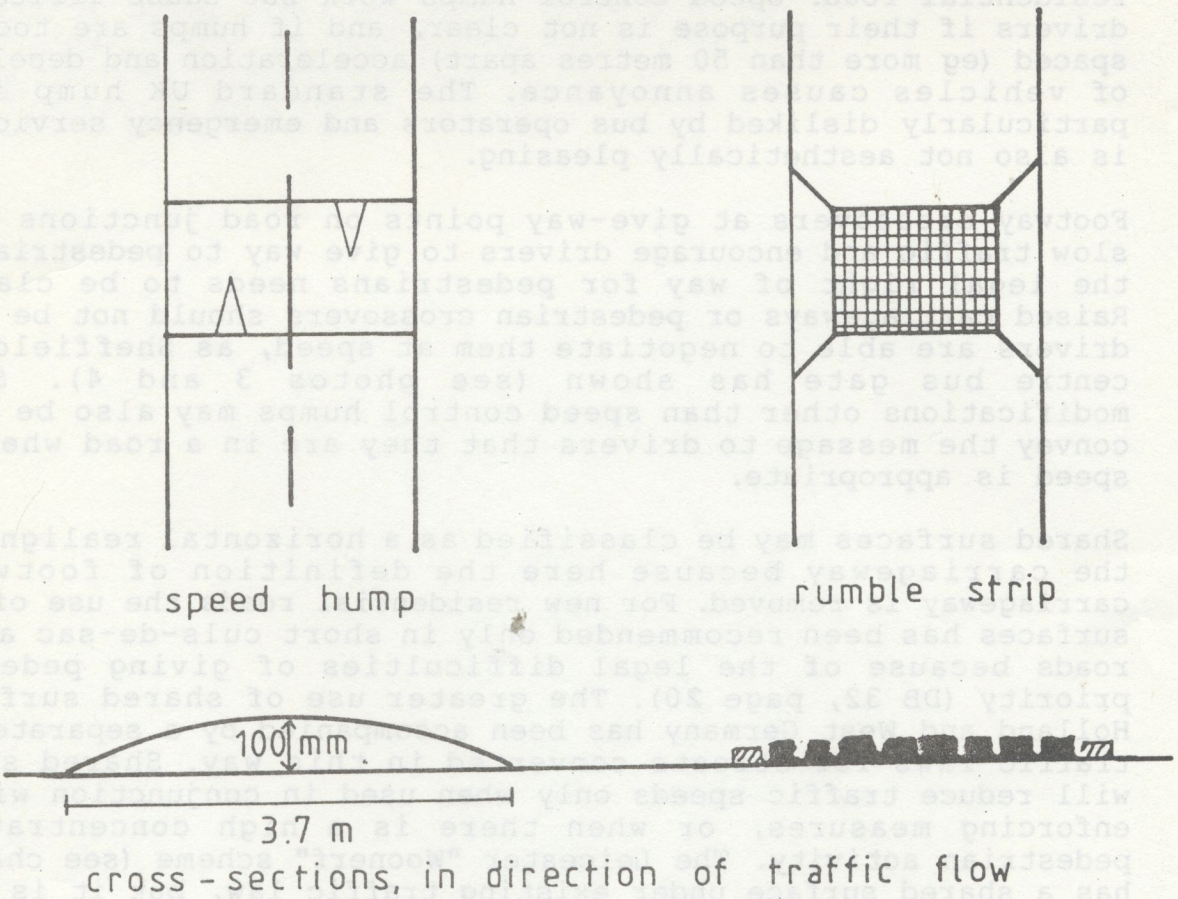


FIGURE 7: Self-enforcing speed reduction measures - road surface modifications



to slow vehicles if the surface is uneven enough to cause discomfort to drivers crossing it at high speed, but they increase traffic noise. The Bradford case study (chapter 4) shows an interesting use of a series of rumble strips to reduce speeds on a residential road. Speed control humps work but cause irritation to drivers if their purpose is not clear, and if humps are too widely spaced (eg more than 50 metres apart) acceleration and deceleration of vehicles causes annoyance. The standard UK hump is also particularly disliked by bus operators and emergency services, and is also not aesthetically pleasing.

Footway crossovers at give-way points on road junctions work to slow traffic and encourage drivers to give way to pedestrians, but the legal right of way for pedestrians needs to be clarified. Raised carriageways or pedestrian crossovers should not be used if drivers are able to negotiate them at speed, as Sheffield's city centre bus gate has shown (see photos 3 and 4). Surface modifications other than speed control humps may also be used to convey the message to drivers that they are in a road where slow speed is appropriate.

Shared surfaces may be classified as a horizontal realignment of the carriageway because here the definition of footway and carriageway is removed. For new residential roads the use of shared surfaces has been recommended only in short culs-de-sac and loop roads because of the legal difficulties of giving pedestrians priority (DB 32, page 20). The greater use of shared surfaces in Holland and West Germany has been accompanied by a separate set of traffic laws for streets converted in this way. Shared surfaces will reduce traffic speeds only when used in conjunction with self enforcing measures, or when there is a high concentration of pedestrian activity. The Leicester "Woonerf" scheme (see chapter 4) has a shared surface under existing traffic law, but it is unclear whether a pedestrian right of way exists on the road. Implementing such measures without changes in the traffic law could produce legal problems if accidents occur.

Other horizontal alignment modifications work as speed control devices as long as certain principles are adhered to. For chicanes this means forcing traffic to turn through at least 45 degrees, which is the Dutch recommended standard, implemented successfully in Southall but rarely elsewhere in Britain (chapter 4). Road narrowing will slow traffic if a HGV exclusion gate is used (see photo 2), or if the narrowing is sufficiently severe to generate a perceived risk of collision. Junction narrowing and corner radii tightening both work by forcing vehicles to slow right down when turning. Carriageway narrowing along the entire length of a street is best done in conjunction with providing sheltered parking, otherwise the narrowing effect varies according to the presence or otherwise of parked vehicles. Where traffic volumes are light, narrowing has to be severe to have a speed reduction effect, but is nevertheless important to ensure the effectiveness of other measures such as chicanes.

All speed reduction measures on residential roads must be carefully planned so that traffic is not merely transferred onto other equally unsuitable roads. Speed humps for example can cause such problems, though where a rat-run is particularly beneficial to drivers, humps are more effective in reducing speeds than reducing

traffic volumes (Sumner and Baguley 1979; 12). Speed reduction measures must also allow emergency and refuse collection vehicles to pass through routes normally closed by barriers, if not through the actual feature (see photo 2).

In West Germany considerable data have been gathered on the effectiveness of various speed reduction measures. For example, a major study in Nordrhein-Westfalen drew conclusions about the speed reducing effects of different types of measure, or rather combinations of measures. These are summarised in Table 8.

TABLE 8: Typical values of speeds achievable by various traffic calming measures.

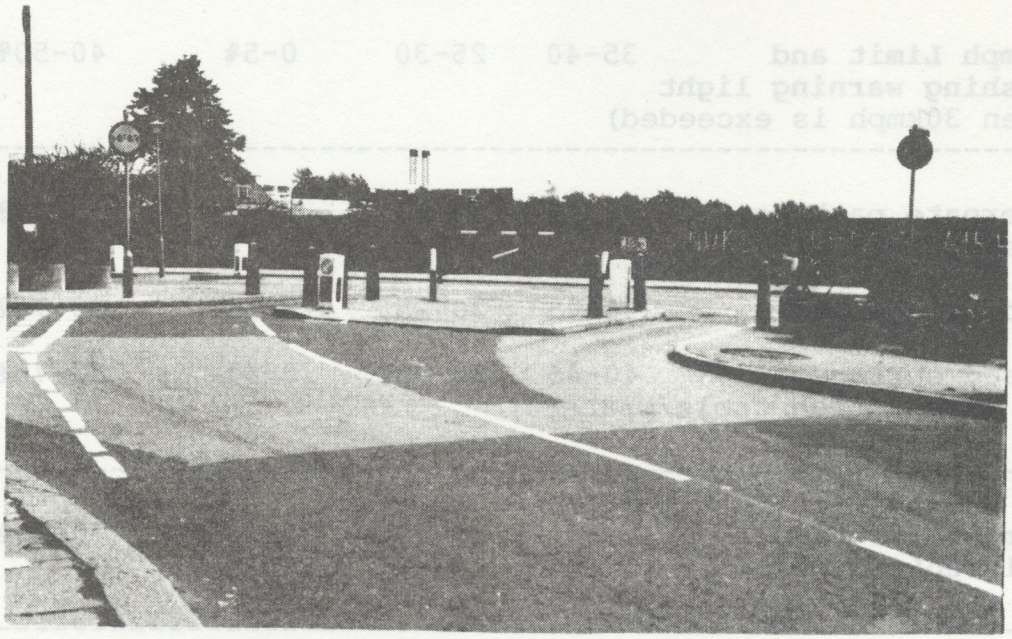
Type of Measure	**Speed Behaviour**				
	Max speed of this % of cars		**% of unrestricted cars going faster than**		
	V85% km/h	**V50% km/h**	**50km/h**	**30km/h**	**20km/h**
"Frohnhauser Model" *	35	27	0%	30-40%	75-85%
Mixed precinct (ie. shared surface)	35	27	0%	30-40%	75-85%
30kmph Limit and flashing warning light (when 30kmph is exceeded)	35-40	25-30	0-5%	40-50%	90-100%
Alternate parking (creating chicanes)	40-45	30-35	0-5%	50-70%	90-100%
Road narrowing	40-45	30-35	0-5%	50-70%	90-100%
Raised surface (eg. ramp/speed table/plateau)	40-45	30-35	0-5%	50-70%	90-100%
30kmph Limit and children's sign	50	35-40	5-15%	70-90%	100%

* **"Frohnhauser model":** Alternate side parking with speed tables at junctions and certain other places, visually reinforced by planting

Source: Der Minister fur Wirtschaft, Mittelstand und Verkehr des Landes Nordrhein-Westfalen. "Grossversuch Verkehrsberuhigung in Wohngebeiten" Final report 1979.

PHOTO 1: Junction narrowing, Bedford

PHOTO 2: HGV exclusion gate, with emergency access barrier, Camden, London



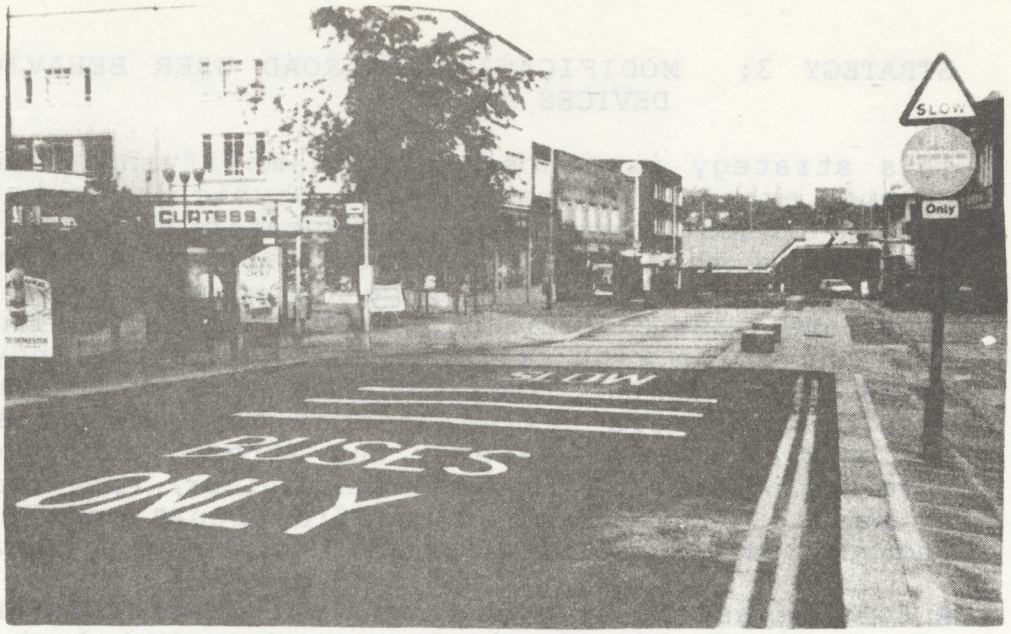


PHOTO 3 (above) and PHOTO 4 (below):
This Sheffield bus gate was intended to slow the speed of buses on a road crossing a pedestrianised shopping street. Unfortunately, as the later addition of "Beware of Buses" signs show - PHOTO 4 - the design encouraged people to see the pedestrianised area as continuous while failing to adequately slow passing buses. To be effective, speed reduction measures have to present drivers with a situation where their safety or comfort is at risk. The low kerbs and widely spaced bollards (shown in PHOTO 3) don't achieve that.

STRATEGY 3: MODIFICATION OF ROAD USER BEHAVIOUR AND WARNING DEVICES

This strategy is concerned with modifying road user behaviour through exhortation rather than physical adaptation of streets. This includes advertising and educational campaigns and advisory signing in residential areas. Warning devices include road markings, surface colour change and warning signs of various types. They have a low effectiveness especially in the long term, although in conjunction with self-enforcing measures they may be a useful extra reinforcement. They may have some beneficial effect if they result in drivers taking greater care when travelling fast in residential areas. Whatever the effectiveness of campaigns and advertising in promoting safer behaviour, they cannot be targetted at particular streets or traffic situations, and so cannot be regarded as a substitute for self-enforcing physical measures.

A further aspect of behaviour modification is the psychological effect of certain physical or environmental characteristics of streets. For example, research in West Germany has found that traffic is slower in streets where the height of buildings is greater than the width of the street. The proximity of trees and other planting to the carriageway also seems to influence driving behaviour. Putting such information to practical use, however, is probably best considered as visual reinforcement of the self-enforcing measures already discused.

STRATEGY 4: RESTRICTIONS ON STATIONARY VEHICLES

In order that the most common road accidents involving children are diminished, drivers' short length visibility (braking distance at least) must be good enough to allow him or her to observe children trying to cross a road or playing by it. The most serious obstructions to good short length visibility on traditional residential roads are vehicles parked at the side of the road. 31% of accidents to child pedestrians are blamed on the child being masked by a stationary vehicle (Crompton 1982; 18), while for adults the figure is 11.5%. In most traditional residential roads there are few other obstructions to short-length visibility.

On-street parking cannot just be legislated away. In many existing residential areas there is no provision for off-street parking and the streets are lined on both sides with the parked cars of residents and visitors. In some areas parking on the street is exacerbated by non-residents using the street as a parking facility for a variety of non-residential activities. Even where dwellings have off-street parking spaces, there is no guarantee that residents will use them. "Residents only" parking schemes which operate in many British towns and cities help to reduce on-street parking and thus make it easier to introduce other measures such as road narrowing and planting. However, redesign of residential streets for safety and environmental benefits can often be achieved with no loss of on-street parking space.

At present most residential roads have no parking restrictions, so that kerbside parking occurs randomly along the length of the road. One way to make streets safer is to regulate the parking, so that certain points are always free of parked cars, and become

preferentially used crossing points for pedestrians. The use of sheltered parking bays built onto the carriageway, which are also footway widenings, is one example of this treatment. Road narrowing features are often used as unofficial parking bays, however, unless this is prevented by the use of high kerbs, bollards or other features.

Another safety measure might involve regulating the parking of cars so that either side of the road is used, but not both. This makes it easier for drivers to notice pedestrians by improving their short-length visibility. In order that this doesn't restrict the amount of parking space too severely, cars may be encouraged to park nose to kerb or diagonally in chevron parking arrangements. Such parking arrangements may be used to create a chicane effect on the carriageway and thus reduce speeds (as discussed in the Woonerf case study).

STRATEGY 5: SEGREGATION OF PEDESTRIANS AND VEHICLES

On traditional residential roads the segregation of pedestrians from vehicles is achieved by the use of footways and carriageways defined by a change of level (kerb), but segregation for pedestrians crossing the carriageway is rarely feasible, and it is in crossing the road that pedestrians are mainly at risk. Complete physical segregation can be achieved (eg. as in the Radburn layouts discussed in chapter 1) but tends to be expensive or unpopular or both. There was a move in some early urban renewal schemes in older terraced housing with back lanes, to widen the back lane and provide garage parking along it, often in conjunction with pedestrianisation of the front street. The usual loss of garden or yard space seemed a high price to pay for traffic segregation, however, and such schemes were not popular.

Occasionally a pedestrianised residential street for children's play or general residents' enjoyment may be appropriate and requested by residents. But more usually finding alternative parking space is difficult, and concentrations of children at play can also cause a nuisance to adult residents. A street chosen for this provision should be short and have little or no housing fronting onto it without alternative vehicle access.

The range of techniques discussed in this chapter is by no means comprehensive, especially if practice in other European countries is considered, but it does include the principal features of practice in England and Wales as represented by the survey reported in Chapter 5 and the case studies described in Chapter 4.