Measure No.22: Inclusive Urban Design

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Enhancements and alterations to the public realm to help to 'manage' the presence of motorised traffic

Cities can encourage greater use of more sustainable means of transport (such as walking and cycling), by reducing the impact of motorised transport through changes in the streets themselves.

22.1 Context and background

This is a heterogeneous measure, encompassing schemes where motor traffic is not eliminated but is managed through design.

There is some overlap between the three approaches named above, as well as with other measures in the EVIDENCE review, particularly No:4 Access Restrictions, No:6 Environmental Zones, and No:19 Walking. Whilst traffic calming does have a definition (as is noted), there is no single agreed view on 'home zones' or 'shared space' – with the definition of the latter being contested in the literature. Broadly speaking, shared space is a design approach which aims to calm traffic and encourage pedestrians to make more use of the carriageway through the removal of demarcations such as kerbs, barriers, signage and traffic signals. Many shared spaces are flat surfaces, with no distinction between the pavement and carriageway, although the approach does not necessarily imply such a radical solution. Home zones are residential streets which have been designed (new streets) or redesigned (existing streets) with similar aims. The designs of home zones vary, but they tend to use a mixture of shared space techniques (e.g. removing kerbs and creating a flat surface) and traffic calming techniques (e.g. build-outs which narrow the carriageway).

Key messages:

- These measures can reduce vehicle speeds, fatalities and collisions.
- Traffic calming coupled with public realm improvements in mixed use shopping streets increases pedestrian flows on those streets. There are some indications that this might also benefit retailers in those streets.
- 'Home zones' also promote increased pedestrian use of streets, although that finding might vary according to national cultures and specific local contexts. The high cost of some interventions may have limited their wider application to date.
- 'Shared space' is likely to work best (i.e. favourable public perceptions and greater pedestrian use of road space) when vehicle flows and speeds are relatively low and pedestrian flows are relatively high.
- The review found insufficient source material to confirm claims made about effects of any of the interventions on economic activity or modal choice.

Potential interventions

- Traffic calming. (Interventions designed to reduce vehicle speeds through physical changes to roads. E.g. speed bumps or carriageway narrowing).
- Shared space
- Home zones

22.2 Extent and Sources of Evidence

Given the wide scope of this measure, the amount of readily-available evidence is rather limited. The nature, source and age of the evidence varies between the different measures. The concepts of home zones (woonerven in Dutch) and shared space both originated in the Netherlands and have been adopted to varying extents in other European countries. Shared space has, in recent years, been promoted through Government guidance in the UK, published in 2011. This has stimulated research interest in shared space in the UK, in recent years. A review (including primary research based on ten case studies) which informed that guidance has provided an important element of the evidence summarised here. Some of the academic studies have been used to critique that review and provide some different perspectives on shared space.

Following practice in the Netherlands, the UK Government also funded a programme of new and retro-fitted home zones between 2000 and 2002. Evaluations of these and other home zones in the UK provided much of the evidence reviewed below. The main sources cited were a review conducted for a UK NGO and an academic study of 7 case studies in the UK.

For both shared space and home zones, a search was also performed in the international literature and Dutch sources for evidence from the Netherlands. This produced relatively little evidence appropriate for this review.

Semi-pedestrianised streets (rues semi-piétonnes) have existed for some time in France. In 2008, the concept of the pedestrian priority zone ('zone de rencontre') was introduced in the national highway code. This gives greater legal priority to pedestrian in those zones (including most of the streets previously classified as semi-pedestrianised). These zones are often similar in character to shared spaces in the UK or the Netherlands. Certu, the national transport and planning research institute, has done several evaluations and case studies in France[1] and in Belgium and Switzerland[2]. These are mainly descriptive, however. Very little quantitative evidence was found in the French-language literature.

Traffic calming is an older concept, which has been widely adopted across many countries for several decades and research interest appears to have waned in recent years. This review encompasses an academic meta-study published in 2003 but drawing on international evidence (mainly from Germany, the UK and Australia) from 1972 to 1990. The underlying source documents are not readily available, so the analysis below relies on the findings of the meta-study. Ireland is one country where national traffic calming programmes have begun more recently. Two comprehensive reviews of the road safety impacts of those programmes written by consultants for the Irish government in 2002 and 2008 have also provided useful evidence for this review.

Revised national guidance in the UK in 2008 created a hybrid concept of 'mixed priority streets', which combine elements of traffic calming and some shared space to high streets with a mixture of retail and other uses. A road safety and economic evaluation of that programme, conducted by consultants for the UK Department of Transport, is also reviewed below.

22.3 What the Evidence Claims

22.3.1. Traffic Calming

Quantitative evaluations of traffic calming interventions have almost entirely focussed on road safety impacts. The evidence reviewed suggests that most traffic calming interventions have succeeded in reducing collisions, injuries and/or fatalities. As explained below, the broad conclusions about injuries and fatalities may be considered robust, whereas the findings about collisions are less clear.

One national study calculated that the annual rate of return from the Irish traffic calming programme produced a 46% annualised return on investment, using 'willingness to pay' measures for the value of collisions and fatalities avoided. Various qualitative case studies describe improvements to the urban environment, but these largely reflect the impressions of the

person or organisation writing the report. Other potential benefits such as increased rates of walking or cycling, or greater community cohesion, have not been systematically assessed.

International literature was searched by a meta-study looking for controlled before-and-after studies of traffic calming interventions[3]. This identified twelve such studies, reporting on sixteen interventions. Outcome data from the intervention areas were compared to the control areas for three outcome measures. The (statistically significant) reduction in road traffic injuries was 11% greater in the intervention areas. The fall in fatalities was 37% greater, although the authors recommend caution in interpreting that finding, as many of the studies reported no fatalities. The reduction in collisions was 5% greater in the intervention areas, but that small difference was not statistically significant. The meta-study did not report on traffic speeds, but concludes that speed reductions would explain the greater reduction in injuries and fatalities than in collisions.

An Irish study[4] evaluated a national programme of traffic calming implemented on major roads entering and traversing villages and small towns between 1997 and 2002. Here ninety-one schemes were evaluated using four years' pre-intervention and four years' post-intervention data from local authorities. This found a 13% reduction in collisions and a 52% reduction in fatalities, compared to the national trends, which were also downwards. From these reductions, using standard national methods and assumptions[5] the programme was estimated to have generated a 46% annualised return on initial investments. The pattern of reductions was highly variable; collisions fell more than the national average in just 53% of the sites. Different types of intervention achieved more success than others. The most successful interventions included a gateway at the entry to the settlements with side buildouts and a central island. Various types of changes were made on roads within the settlements. Signage and lines on the road made no difference on their own.

The study did not measure differences in speed or volumes of traffic but the fact that fatalities fell by more than collisions suggests (as in the meta-study) that lower speeds reduced the severity and consequences of collisions.

In 2002, the UK Government launched a pilot programme called the 'Mixed Priority Routes Demonstration Project' applied to ten high streets with retail and other uses. This was evaluated[6] and was used to inform new national guidance (Local Transport Note 03/08 Traffic Management and Streetscape). The elements of each individual scheme differed but they combined general improvements to the public realm with elements of traffic calming such as carriageway narrowing and improved pedestrian crossings using 'raised tables' to slow the traffic.

Collisions and casualty rates were compared ex-ante and ex-post. Benefit-to-cost ratios were calculated based on the casualty reductions only. All the thirteen individual cases (ten from the national pilot programme and three implemented by local authorities independently) were directly monitored for one to two years after implementation. Casualty rates were also compared over a three year period.

Overall, the schemes produced a 16% reduction in casualties over and above the national trend, which was also downwards. Using UK Government guidance rates for the value of lives saved and casualties avoided (Highways Economic Note1 2005) this produced a 24% return on investment. Other impacts, including increases (of between 2% and 22%) in the flow of pedestrians in those streets, reductions in vehicle speeds and a small reduction in vehicle flows. These impacts were not included in those calculations.

The 3 local authority schemes were implemented with lower budgets (and fewer physical improvements to the public realm). These were implemented slightly later and the available data was more limited, but the initial analysis suggested that they were generating comparable road safety advantages, so higher rates of return might be possible from lower cost schemes.

A theme in the technical literature suggests one potential disadvantage of physical traffic calming measures, relating to local air quality. Measures that cause vehicles to slow down and re-accelerate increase CO and NOx emissions. Most of this literature is based on hypothetical modelling. For example, a report on an experiment that measured variations in speed and then modelled the effect on emissions projected some significant increases in air pollution from measures such as speed humps[7]. However, an evaluation of a home zone programme, which included traffic calming measures, monitored the air quality in the intervention streets before and after the intervention. The interventions (which also reduced traffic volumes on most of the streets) made no statistically significant difference to air quality8. The intervention streets all had low traffic flows – the findings might be different on streets with higher traffic flows. Measures such as average speed cameras, which maintain more constant vehicle speeds, could avoid those potential problems on streets with higher traffic volumes.

Methodologies and Caveats

All of the evidence above was derived from before-and-after studies, which compared intervention areas to national trends (in the UK and Irish studies) or control areas (in the meta-study). This raises two caveats in interpreting the conclusions.

The first of these relates to the statistical phenomenon of 'regression to the mean'. The Irish study explains that one of the criteria for selecting sites for traffic calming was a high rate of collisions over a 5-year period. Some of the individual scheme evaluations of the UK Mixed Priority Routes programme also suggested that a poor casualty record was a factor influencing the selection of that street for the programme. Although this issue was not discussed in the meta-study, it is likely that similar considerations would have applied in at least some of the cases evaluated.

A ranking of 'the roads with the highest collision rate' will be partly influenced by natural variability. Thus, we would expect the roads with the highest collision rate to show an improvement even if no changes were made (just as world record-breakers usually record a slower time when they next compete – which does not mean their performance is deteriorating). This tendency of those at the extremes to converge over time is known as 'regression to the mean'. The Irish study acknowledges the problem, but makes no attempt to adjust for it. The meta-study does not mention it. In both cases, the rate of improvement is likely to be overstated because of regression to the mean. A 5-year collision record as used in the Irish programme would reduce (though not eliminate) the natural variation in collisions compared to the alternative of using a shorter time-period.

The second caveat (which also applies to some of the studies of home zones and shared spaces, discussed below) relates to traffic volumes and traffic displacement. Where an untreated alternative route exists, traffic-calming may displace some traffic onto the alternative route. In some residential areas, one objective of a traffic-calming scheme may be to displace traffic away from a residential street ('rat-running') onto roads with higher capacities and speeds. Even where displacement is not a deliberate objective, it may occur anyway. Any reduction in collisions on traffic-calmed streets might be partly due to falling traffic volumes – which might also increase collisions on alternative routes. Neither of the reports acknowledges this potential problem or provides any data on traffic volumes. The intervention sites in the Irish study were major roads entering, traversing and leaving small towns or villages so the opportunities for displacement are likely to be limited around most of those sites.

The finding that injuries and/or fatalities improved much more than collisions in both studies is unaffected by these caveats. Thus, the conclusion that traffic-calming significantly reduces injuries and fatalities may be considered robust, although the percentage reductions and the effect on collisions must both be treated with caution. The annualised rate of return in the Irish and UK studies should also be treated with some caution, although it would be reasonable to conclude that the

'true figures' would be strongly positive, particularly if benefits other than road safety were include in the calculations.

22.3 2. Home Zones

Home zones are designed to improve the street environment of residential areas. They may incorporate elements of traffic-calming, such as speed humps, chicanes and gateways, and elements of shared space such as flat surfaces with no kerbs. They may also include changes to parking arrangements, street furniture, tree planting and public art. Local residents are sometimes involved in their design. Between 1999 and 2004, the UK Department for Transport funded the conversion of conventional streets to home zones in nine pilot areas – each comprising a small cluster of residential streets. Seven of the pilot areas were evaluated[8] as were newly-built 'home zones' in six British towns / cities[9].

The evaluation in the pilot areas[8] involved before-and-after interview surveys of local residents and before-and-after measurements of: traffic speeds and volumes, air quality and collisions. The traffic data was measured by automatic counters over three weeks at various locations within each home zone. As far as possible the same locations were used in the 'before' and the 'after' measurements. Traffic volumes reduced in 6 of the 7 areas, by an average of 24%. In one case (a cul-de-sac) there was no change; at the other extreme, where a through road was closed, traffic levels halved. Average speeds fell in all seven areas, by an average of 24%, and 85th percentile speeds also fell in all seven areas, by an average of 25%. The researchers only had access to preliminary data covering varying periods post-intervention; only one collision was recorded, which suggested some improvement, but the data was insufficient to perform any statistical tests.

There was substantial support for the interventions amongst residents. Across the seven areas 64% were "in favour of the home zone now that it has been installed". 'Yes' answers exceeded 'nos' in all areas. The area with the least positive responses was the cul-de-sac where traffic volumes were unchanged. Some of the schemes reduced availability of on-street parking. 34% of respondents thought that parking problems had increased since the home zones were introduced, compared to 20% who thought they had reduced. Car ownership, which increased by 3% between the two surveys, may have partly influenced these perceptions.

The surveys asked about walking and cycling behaviour before and after the interventions. Although most residents thought the streets were now safer to walk or cycle, there was no significant change in the prevalence of walking or cycling. As each intervention only applied to a small area – and conditions outside those areas were largely unchanged – there would be no reason to expect any significant modal shift.

Post-implementation interviews were also conducted with local authority officers, who emphasised the importance of local community involvement in the schemes, as a factor contributing to their success.

The evaluation[9] of the six newly-built home zones (ex-post only), had a specific focus on the nature of pedestrian and social use of the streets. Using passive on-street observation (or time-lapse photography on one of the six streets), the researchers found that children in particular used the streets intensively for long periods, and that they engaged in a wide variety of play activities across the whole area of the street with relative freedom. Adults were also seen spending time in home zones, but the sense is that this was in response to the children playing there. These observations were more pronounced in streets with home zone treatments (which reduced traffic flows as well as speeds) compared to streets with just speed limit controls or traffic calming.

Methodologies and Caveats

The evaluation of the pilots[8] provides some information on scheme costs, but none of the sources reviewed attempted to calculate economic benefits. The high cost of some home zone treatments has limited their wider application (though no relationship was found between the cost of each

scheme and residents' satisfaction rates[8]). It is worth noting though that no attempt was made to measure traffic flows, nor to interview residents, on streets outside the home zone areas in this study[8]. The interventions would have caused some displacement onto surrounding streets but as traffic flows were relatively low beforehand, the scale of displacement would have been small. The responses to interview surveys in that study would partly reflect social influences amongst neighbours and could also be susceptible to 'the good subject effect' – where respondents unconsciously reflect what they believe the researchers want to hear. This did not prevent respondents from voicing dissatisfaction (with parking arrangements, for example), however.

22.3.3. Shared Space

Shared space is the most controversial of the sub-measures discussed in this review. It is a heterogeneous concept. Its most radical form is a flat surface across the full width of a street with no demarcations between pedestrians and vehicles. Elsewhere, more limited removal of demarcations such as traffic signals or pedestrian barriers may be described as 'shared space'. Evidence reviewed below[10], addresses this diversity with a scoring system designed to rank streets from the most shared to the least shared. Given the widespread implementation of the shared space approach across several European countries, the range and depth of evidence concerning its effectiveness is surprisingly limited. Many claims have been made about the benefits of shared space[11] several of which are unsupported by evidence. The claims that shared space causes modal shift (towards – or away from – active travel) have not been evaluated in any of the sources we have reviewed. As most shared space interventions are small in scale, like the home zones, there would be no reason to expect any significant impact on modal choice.

No economic evaluations of shared space programmes were found in the literature. There have been several evaluations of impacts on driver and pedestrian behaviours in shared space streets. The conclusions from these studies are less clear than for the other sub-measures. In some contexts – particularly streets with low traffic flows (like the home zones) – the approach appears to facilitate pedestrian use of carriageway space. In other contexts – particularly where vehicle flows are high – it appears to create environments hostile to pedestrians, particularly those from vulnerable groups, such as blind people, older people and women (more than men).

The depth of the evidence on shared space is limited by methodological concerns. The peer-reviewed academic studies have been limited in scope, whereas the more comprehensive review conducted for the UK Government[10, 12] used methods which leave some of its conclusions open to question. The claim that shared space reduces vehicle speeds (and if so, under what circumstances) remains unproven at present.

The UK Department for Transport commissioned research to inform national guidance on shared space (Local Transport Note 01/11). The resultant study[10] contains an ex-post evaluation of streets in ten UK towns and cities with a range of shared space interventions. On-site observations collected qualitative and categorical information about street design. This was used to score and rank each of the ten streets against a "shared space rating" – those with the fewest demarcations between vehicles and pedestrians (e.g. kerbs, bollards, traffic signals) achieved the highest score. Video cameras were installed at the ten sites, collecting information on pedestrian, driver and cyclist behaviour. Automatic traffic counters were installed at six of the ten sites - to capture vehicle speeds and flows.

A regression analysis found that traffic volumes and pedestrian flows predicted over 70% of the variation in the proportion of pedestrians using the carriageway (a key objective of shared space schemes). The propensity of drivers to give way to pedestrians was partly explained by vehicle flows (negative), pedestrian flows (positive) and the extent of demarcations (negative). A further analysis also suggested that these same factors also influenced vehicle speed, although that finding is contestable for the reasons explained below.

A literature review conducted at an earlier stage of the same review for the UK Government[11] concluded that the evidence on casualty impacts of shared space was unclear. Some evaluations (including 13 from the Netherlands) had shown reductions in collisions and/or casualties but one study suggested that at higher traffic volumes shared space resulted in increased casualties.

Further ex-post research[14] was conducted on one of the ten sites used for the DfT research, and findings from this were used to critique some of the conclusions of the earlier work[10]. The site was an inner-urban ring road with high traffic flows subject to a radical shared space solution with a flat surface and no demarcations between traffic and pedestrians. Video evidence showed that pedestrians made little use of the carriageway, apart from crossing the road, mostly using the informal 'courtesy crossings'. Many pedestrians were observed running across the road. Pedestrians gave way to vehicles more than vice versa. 80% of the pedestrians interviewed stated that they "felt safer under the previous scheme". The informal courtesy crossings were particularly unpopular – pedestrians felt that drivers were less likely to give way than they would on a more formal crossing. Older people and women were more negative about the scheme than younger people and men respectively.

Evaluations of other shared space streets, with lower traffic flows[15] produced more positive pedestrian evaluations, which is consistent with the finding of the DfT work[10] about the effect of vehicle flows.

Groups representing blind and partially-sighted people in the UK and the Netherlands have both opposed the spread of shared space schemes. As part of the previously described UK national study[10] qualitative research was conducted amongst different categories of street user[12]. People with a range of disabilities preferred "clearly defined areas for vehicles and pedestrians and designated crossing points". Kerbs were strongly valued by visually-impaired users both as a navigational aid and as a clear demarcation between the pavement and carriageway. Similar opinions were also strongly expressed by mobility-impaired participants, confounding the researchers' expectations that they would prefer flat surfaces.

Methodologies and Caveats

It is argued though[14] that some of the conclusions drawn by the DfT study[10] are based on speculative assumptions about the causal mechanisms behind statistical relationships. The ten case study sites, were evaluated ex-post only. The ones with the highest 'shared space ratings' tended to have lower traffic speeds. The authors concluded (and the UK Government repeated in Local Transport Note 01/11) that this demonstrates that shared space reduces traffic speeds. They did not consider the alternative explanation that local authorities might have gone further in removing demarcations on streets where vehicle speeds were already relatively low. The shared space rating was the only measure of urban design used in the analysis. In practice, many shared space conversions tend to comprise a package of measures, often including elements of traffic calming e.g. carriageway narrowing. This has led some to suggest that claims that shared space conversions reduce collisions or casualties may sometimes overlook the influence of other associated measures, which may reduce traffic volumes and/or speeds[16]. This review did not find any methodologically robust evaluations of the effect of shared space conversions on speed, collisions or casualties.

The conclusion that shared space encourages more pedestrian use of street space where traffic volumes are low and pedestrian volumes are high, though not proven, is plausible and supported by the balance of the available evidence. Although there is no specific evidence on this, increased sharing of the carriageway is likely to reduce vehicle speeds where pedestrian volumes are high, relative to the available space – which would be the case in many historic areas or shopping streets.

22.4 Lessons for Successful Deployment of this measure

Much of the evidence under all three sub-measures comes from the UK. The conclusions which are affirmed with greatest confidence, below, are likely to apply in most situations in all countries, however. The sources reviewed contain very few references to the process of implementation or the longer-term maintenance and continuation of schemes, so it is not generally possible to comment on how those might differ in other countries. One exception is the commentary in the review of UK pilot home zones8 on the benefits of involving local residents in the design of home zones. Although processes would differ between countries, that principle could be applied everywhere (at the possible cost of lengthening implementation timescales and requiring more staff time). To what extent home zones promote social interaction, or shared space changes the behaviour of drivers or pedestrians, would clearly depend on the social context of each country as well as characteristics of specific locations. Similarly the economic rate of return calculations for the UK and Irish national programmes would vary if performed in other countries.

Some of the interventions, particularly traffic calming can work as a single intervention on a small or a large scale. Attention should be paid to possible displacement effects, where traffic calming gives drivers an incentive to choose other routes. Home zones and shared space may require an appropriate legal framework to determine liability in the case of collisions or casualties. Depending upon the context in each country, measures to change driver perceptions and behaviour – to make drivers more aware of and ready to give way to – pedestrians and other vulnerable road users, could help to make home zones and shared space more successful.

22.5 Additional benefits

As well as the evidence of economic and financial benefits of interventions discussed above, there are a number of additional benefits that are claimed for these policies:

- Road Safety: Most traffic calming interventions have succeeded in reducing collisions, injuries and/or fatalities.
- Community benefits: Home zones can create a better living environment, particularly for children, depending upon how traffic and parking are handled within them. Residents may also perceive that streets are safer to walk or cycle on.

22.6 Summary

The following statements can be made with confidence:

- Traffic calming and home zones reduce vehicle speeds, fatalities and collisions.
- Traffic calming coupled with public realm improvements in mixed use shopping streets increases pedestrian use of those streets

Home zones also promote increased pedestrian use of streets, although that finding might vary according to national cultures and specific local contexts. The evidence around shared space is more ambiguous, but suggests that the approach is likely to work best (i.e. favourable public perceptions and greater pedestrian use of carriageway space) in circumstances where vehicle flows and speeds are relatively low and pedestrian flows are relatively high.

Some of the other claims made for these sub-measures cannot be confirmed or refuted by the available evidence. These relate to the impact of shared space on collisions or casualties and the effect of any of the sub-measures on modal choice or economic activity.

22.7 References for this Review

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