Traffic calming - Public attitude studies: a literature review

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Abstract 40
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Traffic calming using road humps has been successful in reducing the speeds of vehicles in residential roads and has resulted in a reduction in the number of injury accidents. Some local highway authorities have a backlog of schemes involving traffic calming which have been requested by residents, indicating that traffic calming is still popular.

Schemes exist where traffic calming measures have been installed and have subsequently been altered or removed due to adverse public comments. To minimise the likelihood of this occurring it is important to understand public reactions to schemes. Accordingly, the Department of the Environment, Transport and the Region’s (DETR) Driver Information and Traffic Management Division commissioned TRL to undertake a comprehensive review of public attitude surveys to traffic calming schemes.

Forty UK and five non-UK surveys have been reviewed; most were published since 1990. The report assesses the attitudes of respondents to traffic calming schemes in general and then examines the acceptability of different measures eg road humps, speed cushions, horizontal deflections, road closures and mini-roundabouts. The effectiveness of the various measures in terms of reducing vehicle speeds, traffic flows and injury accidents is compared with the perceived effectiveness, based on respondents’ attitudes. A limited amount of comparative data was available concerning noise, vibration and pollution.

Most of the schemes considered were on roads with 20 or 30 mph speed limits. The survey sample size in most studies was 50 - 500 respondents, with a maximum of 1000. The length and number of questions used in the questionnaires varied considerably, as did the type of survey and types of respondent. Most surveys were carried out between 3 months and 2 years after scheme installation.

The overall percentage of respondents who approved of the schemes, across all the reviewed studies, was 65%. This varied according to the types of measures in the schemes: it was 72% for schemes including road humps; 53% for schemes including speed cushions; 59% (but particularly variable) for schemes including horizontal deflections.

Surveys which provided direct information on the relative popularity of different measures indicated that round-top road humps were the most popular measure, followed by flat-top road humps, speed cushions, chicanes and mini-roundabouts in descending order.

The cost of the schemes varied greatly but this did not seem to influence respondents’ views on whether the locality had improved as a result of a scheme. This result suggests that schemes with high implementation costs per metre may not be justified unless general environmental improvements are required as part of the scheme objectives.

Comparisons between objective measures of the effectiveness of schemes (where they were made) and public reactions to those schemes indicated that:

i Vehicle mean speeds were reduced by an average of 8.5 mph, but the average proportion of respondents who thought speeds had been reduced was only 65%.

ii Speed reductions of more than 10 mph were, in all cases, perceived as a reduction by over half of the respondents questioned.

iii Traffic flow levels were reduced by an average of 23%, but the average proportion of respondents who thought flows had been reduced was only 33%.

iv Personal injury accident frequencies were reduced by an average of 63%, but the average proportion of respondents who thought that safety had improved was only 53%.

v There was no linear relationship between changes in mean speeds, traffic flows or accidents and the percentage of people who thought these things had improved.

vi For the few schemes where changes in noise, vibration or pollution levels were monitored, improvements were generally reported. Respondents’ views, however, did not generally reflect this.

The usefulness of the results of a questionnaire is determined by the questionnaire design (including the number and type of questions). As each scheme is different, a standard questionnaire is not considered appropriate, but examples of questionnaires considered to be good starting points have been included.

It is important that a questionnaire includes a balance between types of questions, includes the opportunity for comment, and avoids jargon. The wording and order of questions is important, as is the use of prompts.

The main conclusions can be summarised as follows:

- Public attitude surveys to traffic calming schemes are useful in establishing overall approval levels and in identifying the relative popularity of individual measures and any problems associated with them.
- Public attitude surveys cannot be a substitute for objective measures of the effectiveness of a scheme. Perceptions of changes in speeds, flow and safety, which might appear on the face of it to be easy to judge, are relatively poor.
- Changes in the environmental measures ground vibration, noise and air pollution are even more difficult to assess subjectively.
- These differences between objective and subjective assessments suggest that the methods of objective measurement should perhaps be reviewed to determine measures that more accurately reflect peoples’ concerns. For example, if measured noise levels have been reduced but people think they have increased, it may be because the noise characteristics have changed.
- Careful survey and questionnaire design are vital in eliciting the information required from respondents. A checklist of issues to consider in questionnaire compilation is given in Appendix C.
1 Introduction

TRL is undertaking research for the Department of the Environment, Transport and the Region’s (DETR) Driver Information and Traffic Management Division on the effectiveness of innovative traffic calming measures. The aims are:

- to investigate and evaluate new traffic calming measures for their effectiveness in controlling traffic speeds and enhancing the local environment
- to develop advice on their design, performance and application.

Traffic calming is an important tool for Highway Authorities because it is well established that it can be used to reduce speeds and consequently accidents (see, for example, Webster, 1993; Webster & Mackie, 1996). However, it is increasingly clear that the success of such schemes is not determined only by objective measures of their effect (on speed, flows and accidents) but that subjective assessment is also important. If measures are introduced which the local public do not like then they soon become discredited (IHT, 1990). Indeed, some examples of situations exist where pressure from local communities (resulting, for example, from noise being generated by vehicles crossing measures) has led to the removal of measures (Webster and Layfield, 1993). Clearly this is not a cost-effective way to proceed; it is far better to be able to estimate the likely public reaction to the scheme before it is installed. Design advice can then be provided so that schemes have a better chance of acceptance and situations likely to prove unpopular can be avoided. Pharoah and Russell (1989) have also commented that attitude studies can be important at some schemes because ‘the few who oppose it (traffic calming) make a lot of noise and some press media create the impression that this minority is the majority’ whereas an attitude study reflects a more balanced view of the popularity of the scheme.

It is important that local authorities consult the emergency services and bus operators (Department of Transport, 1994 and 1996a) over new traffic calming schemes, but this is outside the scope of the present review.

This report reviews the published literature describing 45 studies (40 UK, 5 Non-UK) of public attitudes to traffic calming schemes. These represent all of the relevant UK studies identified through a search of the TRL Library’s International Road Research Documentation (IRRD) database, a selection of the English-language non-UK studies and Local Authority information obtained by the Author.

Section 2 outlines the studies covered, together with the survey techniques and the types of questions used in them. Section 3 presents the results reported and Section 4 compares the measured (objective) effectiveness of the calming schemes with the public (subjective) assessments, to determine to what extent there is agreement between them. In Section 5, issues concerning questionnaire design are discussed. The report is concerned specifically with surveys that took place after scheme implementation and not with the consultation process which occurs before scheme implementation. However, Section 5 also includes some discussion of that process. Overall conclusions are presented in Section 6. It has been assumed throughout that the views of respondents were not unduly influenced by any press coverage of the success or failure of the scheme reviewed.

2 The studies covered

The number of traffic calming schemes installed in the UK has increased since the introduction of the 1990 Highways (Road Humps) Regulations (DOT, 1990) which allowed greater flexibility in the siting and shape of road humps. The vast majority of the studies considered in the present review were published in the early 1990’s. Only five UK references were found to public attitude surveys at traffic calming schemes before 1990. The earliest publication dated back to 1975.

2.1 Traffic calming measures used

Most of the public attitude surveys were concerned with traffic calming schemes in villages or on urban roads within 20 or 30 mph speed limits. A few schemes were on rural roads including trunk roads with higher speed limits of 40 or 60 mph.

A variety of measures were used in the traffic calming schemes including: round-top and flat-top road humps (Figure 1), speed cushions (Figure 2), gateways, chicanes and narrowings (Figure 3), rumble devices, islands, thermoplastic humps (‘thumps’) and mini-roundabouts. Road humps were by far the most common measure employed, featuring in 30 of the studies.

2.2 Survey techniques

The length of time between the installation of the schemes and the attitude surveys varied greatly; most of the surveys were carried out between 3 months and 2 years after the traffic calming schemes were installed.

The number of respondents in the surveys was typically between 50 and 500. Some surveys had larger samples (in one case, 1000) but this was usually because they consisted of a combination of a number of surveys at different schemes. The lower limit of 50 is similar to that used by Grigg (1981) when assessing the use of rating scale results. The target groups of interviewees varied between the surveys and included residents, local people, visitors, drivers and drivers of heavy goods vehicles (HGVs).

The type of survey used in the 40 UK studies were as follows:

- 14 personal interview
- 16 postal (self-completion) questionnaire
- 4 mixture of personal interview/postal questionnaire
- 6 consisted of feedback from residents to local authorities where no specific questions were asked.

Non-english speaking residents (Walker et al, 1989) were catered for in areas where this was likely to be a problem.
Figure 1a Example of round-top humps, Worcester Park (Survey 6d)

Figure 1b Example of a flat-top hump, Worcester Park (Survey 6d)
Figure 2a Example of speed cushions, York (Survey 27)

Figure 2b Example of speed cushions, York (Survey 27)
Figure 3a Example of a gateway, West Haddon (Survey 28)

Figure 3b Example of a chicane and a narrowing, Watford (Survey 29)
2.3 The questionnaires

The length and number of questions used in the questionnaires varied considerably from 20 questions (with subsidiaries) to just 3 questions (with Yes/No/Don’t know format). The techniques used in the questionnaires also varied: for example, in some surveys prompts were used; some contained ‘open’ questions and some ‘closed’ questions; some contained ‘multiple choice questions’ and some contained combinations of these types of questions.

In the vast majority of cases, the scope of the questions covered the key issues of traffic speeds and safety. Some included questions on environmental factors and some on traffic flows along the traffic calmed roads.

In many of the surveys, scheme-specific questions were a feature. For example, for a scheme in the New Forest there were questions relating to animals; other schemes had specific questions relating to parking, to pedestrians, to bus passenger comfort, to agricultural vehicles, etc.

In some surveys of schemes incorporating different types of measure, questions were designed so that the relative effectiveness of the measures was assessed.

3 Opinion survey results

Details of the results obtained in each survey reviewed are given in Appendix A (UK studies) and Appendix B (non-UK studies), along with descriptions of the schemes and the surveys carried out. The information is summarised in Table 1.

Some of the attitude surveys reviewed were concerned with individual schemes while others covered a variety of schemes. Generally, the percentage approvals given in Table 1 relate to the combined effect of the traffic calming measures within a scheme or schemes.

3.1 The overall level of approval

Most of the surveys indicated that the majority of the respondents approved of the traffic calming schemes. Overall, the average percentage of respondents expressing approval across all of the UK surveys was 65 per cent; this varied from 18 per cent for a one-way chicane scheme in Leatherhead (Survey 21d) to 93 per cent for a residential scheme in Stockport (Survey 20a).

Sections 3.2 to 3.6 concentrate on the UK results relating to schemes with different types of measures: humps; cushions; gateways/chicanes/narrowings; road closures; mini-roundabouts. The relevant results are summarised in tables where appropriate; schemes involving a variety of measures feature in more than one of these tables.

3.2 Attitudes towards schemes with round-top and flat-top humps

As already indicated, humps were the most common traffic calming measure with 30 out of the 45 surveys relating to schemes which contained some humps, either round-top or flat-top, or both.

Table 2 summarises the results from surveys which contained appreciable numbers of road humps. The average percentage of respondents expressing approval for the hump schemes was 72 per cent; this varied from 47 per cent to 93 per cent.

There was little difference between public perception of schemes in 20 mph zones and those in 30 mph zones as they had 71 and 72 per cent of respondents approving respectively.

There was an indication that round-top humps may be slightly more popular than flat-top humps. In those schemes where only round-top or only flat-top humps were used, the average percentage of respondents approving was 78 per cent for schemes with round-top humps compared to 64 per cent for those with flat-top humps.

The percentage of respondents expressing approval can depend on whether the respondents themselves benefit from the traffic calming measures. Data from two UK surveys assessing a variety of hump schemes (Surveys 3 and 4) indicated that, on average, non-resident drivers were likely to be slightly less in favour of keeping the humps (66%) than residents (78%).

In Survey 41a (Australia), 75 per cent of residents living on the roads with the humps approved of the scheme but 80 per cent of residents living in the surrounding streets were opposed to the scheme. In Survey 41c, tight road layout configurations and flat-top humps were used and the level of acceptance of the scheme by residents was 89%. This could have been influenced by the fact that heavy vehicles were eliminated from the road. In Survey 41d, road humps which were spaced at 200 metres were removed because residents were unhappy that drivers chose to use severe acceleration and braking, indicating a lack of acceptance by drivers.

The five 75 mm high round-top humps considered in Survey 19y (Egerton Road) were subsequently removed at the request of the residents, who were unduly concerned by noise from HGVs crossing the humps as early as 5 am. The effect of noise generated by humps has been investigated by Abbott et al., (1995).

3.3 Attitudes towards schemes including speed cushions

Six surveys assessed traffic calming schemes that used speed cushions (Surveys 13, 17, 24, 27, 30 and 37). Survey 30 (Craven Arms) was of a trunk road traffic calming scheme through a village using narrow (1500 mm wide) cushions as one of the measures.

The percentage of respondents expressing overall approval for the schemes is 53% as given in Table 3. The degree of approval varied from 31 per cent in Survey 30 (a trunk road scheme at Craven Arms) to 80 per cent in Survey 13 (Greenwich). The average value for respondents expressing approval of schemes including cushions (53 per cent) was less than the average value for hump schemes (72 per cent). This difference may be because speed cushions are regarded as less effective at reducing speeds than road humps.

In Survey 17 (Leicester), about half the respondents thought the speed cushions worked less well than the road humps, while a third thought they worked equally well. In Survey 27 (York), respondents thought that speed cushions were less effective than road humps (see section 3.7). Respondents in Survey 37 (Wrexham) were generally
## Table 1 Summary of opinion survey results

<table>
<thead>
<tr>
<th>Survey No.</th>
<th>Location</th>
<th>Limit (mph)</th>
<th>Type of traffic(^1) calming measures</th>
<th>Ref year</th>
<th>Survey(^2) carried out after (months)</th>
<th>Survey(^1) type &amp; people surveyed</th>
<th>Number of people surveyed</th>
<th>Respondents(^4) approving of scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UK Surveys</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>New Forest</td>
<td>40</td>
<td>Gateway, rumble, roundels</td>
<td>1993</td>
<td>27</td>
<td>I DN</td>
<td>422</td>
<td>89%</td>
</tr>
<tr>
<td>2</td>
<td>Tavistock</td>
<td>40</td>
<td>Village gateway, islands</td>
<td>1993</td>
<td>12</td>
<td>I RADN</td>
<td>100</td>
<td>50%</td>
</tr>
<tr>
<td>3a-e</td>
<td>national</td>
<td>30</td>
<td>Round-top humps</td>
<td>1979</td>
<td>3</td>
<td>I RDN</td>
<td>899</td>
<td>71%</td>
</tr>
<tr>
<td>4a-c</td>
<td>national</td>
<td>30</td>
<td>Round-top humps</td>
<td>1981</td>
<td>3+</td>
<td>I RDN</td>
<td>624</td>
<td>73%</td>
</tr>
<tr>
<td>5</td>
<td>national</td>
<td>30</td>
<td>Humps</td>
<td>1990</td>
<td>-</td>
<td>P RADN</td>
<td>753</td>
<td>50%</td>
</tr>
<tr>
<td>6a-d</td>
<td>various</td>
<td>30</td>
<td>Humps, chicanes, narrowings</td>
<td>1992</td>
<td>12-24</td>
<td>I RA</td>
<td>652</td>
<td>76%</td>
</tr>
<tr>
<td>7</td>
<td>Gateshead</td>
<td>30</td>
<td>Thermoplastic humps</td>
<td>1994</td>
<td>15</td>
<td>P R</td>
<td>8</td>
<td>88%</td>
</tr>
<tr>
<td>8</td>
<td>Ashridge Park</td>
<td>30</td>
<td>Round-top humps</td>
<td>1975</td>
<td>24</td>
<td>I N</td>
<td>84</td>
<td>73%</td>
</tr>
<tr>
<td>9</td>
<td>Milton Keynes</td>
<td>30</td>
<td>Flat-top humps</td>
<td>1993</td>
<td>12</td>
<td>I AN</td>
<td>612</td>
<td>47%</td>
</tr>
<tr>
<td>10</td>
<td>Windsor</td>
<td>30</td>
<td>Round-top humps</td>
<td>1996</td>
<td>39</td>
<td>P RA</td>
<td>150</td>
<td>50%</td>
</tr>
<tr>
<td>11</td>
<td>Gamlingay</td>
<td>30</td>
<td>Humps, chicanes, narrowings</td>
<td>1991</td>
<td>3</td>
<td>P RA</td>
<td>100</td>
<td>87%</td>
</tr>
<tr>
<td>12a</td>
<td>Southend</td>
<td>30</td>
<td>Flat-top humps</td>
<td>1992</td>
<td>6</td>
<td>I RA</td>
<td>748</td>
<td>approve</td>
</tr>
<tr>
<td>12b</td>
<td>Hadleigh</td>
<td>30</td>
<td>Round-top humps</td>
<td>1991</td>
<td>11</td>
<td>I RADN</td>
<td>726</td>
<td>74%</td>
</tr>
<tr>
<td>13</td>
<td>Greenwich</td>
<td>30</td>
<td>Cushions, raised junction</td>
<td>1995</td>
<td>6</td>
<td>P RA</td>
<td>256</td>
<td>61%</td>
</tr>
<tr>
<td>14</td>
<td>Borehamwood</td>
<td>30</td>
<td>Long flat-top humps</td>
<td>1990</td>
<td>8</td>
<td>I A</td>
<td>-</td>
<td>approve</td>
</tr>
<tr>
<td>15</td>
<td>Newport (IoW)</td>
<td>30</td>
<td>Flat-top humps, narrow</td>
<td>1994</td>
<td>6</td>
<td>P R</td>
<td>-</td>
<td>approve</td>
</tr>
<tr>
<td>16</td>
<td>Sittingbourne</td>
<td>30</td>
<td>Flat-top humps, narrow</td>
<td>1992</td>
<td>18</td>
<td>P R</td>
<td>223</td>
<td>68%</td>
</tr>
<tr>
<td>17</td>
<td>Leicester</td>
<td>30</td>
<td>Speed cushions</td>
<td>1994</td>
<td>6</td>
<td>P R</td>
<td>-</td>
<td>49%</td>
</tr>
<tr>
<td>18a-c</td>
<td>Oxfordshire</td>
<td>30</td>
<td>Round/flat-top humps</td>
<td>1991</td>
<td>12-15</td>
<td>P RA</td>
<td>1041</td>
<td>59%</td>
</tr>
<tr>
<td>19a-y</td>
<td>Richmond</td>
<td>30</td>
<td>Round-top humps</td>
<td>1990</td>
<td>4-15</td>
<td>P R</td>
<td>-</td>
<td>91%</td>
</tr>
<tr>
<td>20a</td>
<td>Stockport</td>
<td>30</td>
<td>Round-top humps</td>
<td>1995</td>
<td>17</td>
<td>P R</td>
<td>61</td>
<td>93%</td>
</tr>
<tr>
<td>20b</td>
<td>Stockport</td>
<td>30</td>
<td>Flat-top humps</td>
<td>1995</td>
<td>2</td>
<td>P R</td>
<td>65</td>
<td>66%</td>
</tr>
<tr>
<td>20c</td>
<td>Stockport</td>
<td>30</td>
<td>Humps, pinches, priority</td>
<td>1995</td>
<td>34</td>
<td>P R</td>
<td>104</td>
<td>56%</td>
</tr>
<tr>
<td>20d</td>
<td>Stockport</td>
<td>30</td>
<td>Humps, chicanes, rumbles</td>
<td>1995</td>
<td>8</td>
<td>P R</td>
<td>94</td>
<td>33%</td>
</tr>
<tr>
<td>21a</td>
<td>Guildford</td>
<td>30</td>
<td>Round-top humps</td>
<td>1995</td>
<td>23</td>
<td>P RA</td>
<td>-</td>
<td>83%(^3)</td>
</tr>
<tr>
<td>21b</td>
<td>Ashford</td>
<td>30</td>
<td>Flat-top humps</td>
<td>1995</td>
<td>16</td>
<td>P RA</td>
<td>-</td>
<td>69%(^3)</td>
</tr>
<tr>
<td>21c</td>
<td>Woking</td>
<td>30</td>
<td>Chicanes/2-way</td>
<td>1995</td>
<td>16</td>
<td>P RA</td>
<td>-</td>
<td>39%(^3)</td>
</tr>
<tr>
<td>21d</td>
<td>Leatherhead</td>
<td>30</td>
<td>Chicanes/1-way</td>
<td>1995</td>
<td>22</td>
<td>P RA</td>
<td>220</td>
<td>18%(^3)</td>
</tr>
<tr>
<td>22a-d</td>
<td>Bypassed towns</td>
<td>20</td>
<td>Flat-top humps, environ.</td>
<td>1995</td>
<td>3</td>
<td>IP RADN</td>
<td>39-360</td>
<td>65%</td>
</tr>
<tr>
<td>22e-f</td>
<td>Bypassed towns</td>
<td>30</td>
<td>Flat-top humps, environ.</td>
<td>1995</td>
<td>3</td>
<td>IP RADN</td>
<td>42-370</td>
<td>66%</td>
</tr>
<tr>
<td>23a-c</td>
<td>Brighton, Sheffield</td>
<td>20</td>
<td>Round/flat-top humps, gates</td>
<td>1995</td>
<td>4</td>
<td>IP R</td>
<td>437</td>
<td>86%</td>
</tr>
<tr>
<td>23b-d</td>
<td>Leicester, York</td>
<td>30</td>
<td>Humps, chicanes, cushions</td>
<td>1995</td>
<td>4</td>
<td>IP R</td>
<td>592</td>
<td>79%</td>
</tr>
<tr>
<td>24a-b</td>
<td>Sheffield, York</td>
<td>30</td>
<td>Cushions, flat/round humps</td>
<td>1995</td>
<td>4</td>
<td>P R</td>
<td>72, 360</td>
<td>variable</td>
</tr>
<tr>
<td>25a-d</td>
<td>various 20mph zones</td>
<td>20</td>
<td>Round/flat-top humps</td>
<td>1993</td>
<td>15-43</td>
<td>P R</td>
<td>-</td>
<td>75%</td>
</tr>
<tr>
<td>26a-e</td>
<td>various villages</td>
<td>30</td>
<td>Gateways, islands, rumbles</td>
<td>1995</td>
<td>1-6</td>
<td>I RA</td>
<td>72-100</td>
<td>50%</td>
</tr>
<tr>
<td>26f</td>
<td>Tunstall</td>
<td>60</td>
<td>Gateways, rumble bars</td>
<td>1994</td>
<td>12</td>
<td>P RA</td>
<td>25</td>
<td>50%</td>
</tr>
<tr>
<td>27</td>
<td>York</td>
<td>20/30</td>
<td>Humps, chicanes</td>
<td>1994</td>
<td>3+</td>
<td>I RA</td>
<td>750</td>
<td>52%</td>
</tr>
<tr>
<td>28</td>
<td>national</td>
<td>30-60</td>
<td>Rumble strips</td>
<td>1993</td>
<td>-</td>
<td>LA</td>
<td>-</td>
<td>variable</td>
</tr>
<tr>
<td>29a-d</td>
<td>distributor roads</td>
<td>30</td>
<td>Flat-top humps, chicanes</td>
<td>1995</td>
<td>-</td>
<td>-</td>
<td>LA</td>
<td>-</td>
</tr>
<tr>
<td>30</td>
<td>Craven Arms</td>
<td>30 (T)(^6)</td>
<td>Gateway, red surface</td>
<td>1996</td>
<td>3</td>
<td>I RA</td>
<td>200</td>
<td>approve</td>
</tr>
<tr>
<td>30</td>
<td>Craven Arms</td>
<td>30 (T)(^6)</td>
<td>Mini-roundabouts</td>
<td>1996</td>
<td>3</td>
<td>I RA</td>
<td>200</td>
<td>dislike</td>
</tr>
<tr>
<td>30</td>
<td>Craven Arms</td>
<td>30 (T)(^6)</td>
<td>Narrow cushions</td>
<td>1996</td>
<td>3</td>
<td>I RA</td>
<td>200</td>
<td>approve</td>
</tr>
<tr>
<td>31</td>
<td>Thorney</td>
<td>20/30 (T)(^7)</td>
<td>Gateway, chicanes, mini-rbt</td>
<td>1995</td>
<td>6</td>
<td>I RA</td>
<td>199</td>
<td>26%</td>
</tr>
<tr>
<td>32a</td>
<td>Oxford</td>
<td>30</td>
<td>Narrowing, bypass</td>
<td>1996</td>
<td>90</td>
<td>I C</td>
<td>61</td>
<td>57%</td>
</tr>
<tr>
<td>32b</td>
<td>Wandsworth</td>
<td>30</td>
<td>Chicanes, bypass</td>
<td>1996</td>
<td>20</td>
<td>I C</td>
<td>41</td>
<td>85%</td>
</tr>
<tr>
<td>32c</td>
<td>Oxford</td>
<td>20</td>
<td>Narrowing</td>
<td>1996</td>
<td>19</td>
<td>I C</td>
<td>54</td>
<td>51%</td>
</tr>
<tr>
<td>33b-d</td>
<td>Plymouth, Sheerwater</td>
<td>30</td>
<td>Chicanes/2-way</td>
<td>1994</td>
<td>-</td>
<td>LA</td>
<td>-</td>
<td>acceptable</td>
</tr>
<tr>
<td>33a-c</td>
<td>Gosport, Leatherhead</td>
<td>30</td>
<td>Chicanes/1-way</td>
<td>1994</td>
<td>-</td>
<td>LA</td>
<td>-</td>
<td>dislike</td>
</tr>
<tr>
<td>34</td>
<td>national</td>
<td>30</td>
<td>Chicanes</td>
<td>1996</td>
<td>-</td>
<td>LA</td>
<td>-</td>
<td>variable</td>
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<tr>
<td>35</td>
<td>national</td>
<td>20/30</td>
<td>Various including humps</td>
<td>1992</td>
<td>-</td>
<td>LA R</td>
<td>-</td>
<td>80%</td>
</tr>
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<td>national</td>
<td>20/30</td>
<td>Various including humps</td>
<td>1992</td>
<td>-</td>
<td>LA DN</td>
<td>-</td>
<td>66%</td>
</tr>
<tr>
<td>35</td>
<td>national</td>
<td>20/30</td>
<td>Various including humps</td>
<td>1992</td>
<td>-</td>
<td>LA B</td>
<td>-</td>
<td>68%</td>
</tr>
<tr>
<td>36</td>
<td>Nelson</td>
<td>30</td>
<td>Area wide, safety project</td>
<td>1989</td>
<td>1</td>
<td>I R</td>
<td>160</td>
<td>65%</td>
</tr>
<tr>
<td>36</td>
<td>Nelson</td>
<td>30</td>
<td>Area wide, safety project</td>
<td>1989</td>
<td>15</td>
<td>I R</td>
<td>189</td>
<td>74%</td>
</tr>
<tr>
<td>37</td>
<td>Wrexham</td>
<td>20</td>
<td>Humps, narrowings, mini-rbt</td>
<td>1996</td>
<td>-</td>
<td>LA</td>
<td>-</td>
<td>approve</td>
</tr>
<tr>
<td>37</td>
<td>Wrexham</td>
<td>20</td>
<td>Cushions</td>
<td>1996</td>
<td>-</td>
<td>LA</td>
<td>-</td>
<td>dislike(^7)</td>
</tr>
<tr>
<td>38</td>
<td>Camden</td>
<td>20</td>
<td>Humps, road closures</td>
<td>1996</td>
<td>6</td>
<td>P RA</td>
<td>58</td>
<td>52%</td>
</tr>
<tr>
<td>39</td>
<td>Huyton</td>
<td>20</td>
<td>Humps, road closures</td>
<td>1994</td>
<td>-</td>
<td>P R</td>
<td>-</td>
<td>64%</td>
</tr>
<tr>
<td>40</td>
<td>various estates</td>
<td>30</td>
<td>Narrow, rumble, pinches</td>
<td>1983</td>
<td>12+</td>
<td>P R</td>
<td>601</td>
<td>63%</td>
</tr>
</tbody>
</table>

Overall surveys (data available for 45 surveys or sub-surveys) 65%
Table 1 (Continued)

<table>
<thead>
<tr>
<th>Survey No.</th>
<th>Location</th>
<th>Limit (mph)</th>
<th>Type of traffic calming measures</th>
<th>Ref year</th>
<th>Survey2 type &amp; people surveyed</th>
<th>Number of people surveyed</th>
<th>Respondents% approving of scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>Non UK Surveys</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>41a</td>
<td>Australia</td>
<td>37</td>
<td>Round-top humps</td>
<td>1993</td>
<td>-</td>
<td>-</td>
<td>75%</td>
</tr>
<tr>
<td>41a</td>
<td>Australia</td>
<td>37</td>
<td>Round-top humps</td>
<td>1993</td>
<td>-</td>
<td>AD</td>
<td>20%</td>
</tr>
<tr>
<td>41b</td>
<td>Australia</td>
<td>25</td>
<td>Offset carriageway + parking</td>
<td>1993</td>
<td>24</td>
<td>P R</td>
<td>17%</td>
</tr>
<tr>
<td>41c</td>
<td>Australia</td>
<td>-</td>
<td>Chicanes and flat-top humps</td>
<td>1993</td>
<td>-</td>
<td>R</td>
<td>89%</td>
</tr>
<tr>
<td>41d</td>
<td>Australia</td>
<td>-</td>
<td>Road humps at 200 m spacing</td>
<td>1993</td>
<td>-</td>
<td>R</td>
<td>removed</td>
</tr>
<tr>
<td>41e</td>
<td>Australia</td>
<td>-</td>
<td>Road closures</td>
<td>1993</td>
<td>-</td>
<td>R</td>
<td>oppose</td>
</tr>
<tr>
<td>41f</td>
<td>Australia</td>
<td>-</td>
<td>Angled slow points</td>
<td>1993</td>
<td>-</td>
<td>R</td>
<td>approve</td>
</tr>
<tr>
<td>41f</td>
<td>Australia</td>
<td>-</td>
<td>Angled slow points</td>
<td>1993</td>
<td>-</td>
<td>N</td>
<td>object strongly</td>
</tr>
<tr>
<td>41g</td>
<td>Australia</td>
<td>-</td>
<td>Roundabouts</td>
<td>1993</td>
<td>-</td>
<td>R</td>
<td>variable</td>
</tr>
<tr>
<td>42</td>
<td>Denmark</td>
<td>25</td>
<td>Gateways,chicanes,rumbles</td>
<td>1992</td>
<td>I</td>
<td>N</td>
<td>52%</td>
</tr>
<tr>
<td>42</td>
<td>Denmark</td>
<td>25</td>
<td>Gateways,chicanes,rumbles</td>
<td>1992</td>
<td>P</td>
<td>R</td>
<td>approve</td>
</tr>
<tr>
<td>43</td>
<td>Israel</td>
<td>30</td>
<td>Humps,urban area</td>
<td>1989</td>
<td>-</td>
<td>R</td>
<td>17%</td>
</tr>
<tr>
<td>44</td>
<td>USA</td>
<td>25</td>
<td>Humps,urban area</td>
<td>1989</td>
<td>P</td>
<td>R</td>
<td>147</td>
</tr>
<tr>
<td>45</td>
<td>Austria</td>
<td>19/31</td>
<td>Gateway, 30 kph on road</td>
<td>1995</td>
<td>1.6,18</td>
<td>T R</td>
<td>77%</td>
</tr>
</tbody>
</table>

1 Major measures are included, see Appendix A for more details
2 Time interval between installation of scheme and opinion survey if specified
3 I = Interview, P = Postal, IP = Interview + postal, T = Telephone, LA = Local Authority, (-) = Type of survey or people surveyed not specified
4 R = Resident on road, A = Resident on adjacent road, D = Driver (resident of road), N = Driver (non resident of road), C = Cyclist, B = Business
5 Overall value of all respondents for all road users considered
6 Per cent of residents who thought measures were ‘beneficial’
7 Trunk road schemes
8 Cushions were subsequently replaced with humps
9 Attitudes can vary with time

Table 2 Hump schemes opinion survey results

<table>
<thead>
<tr>
<th>Survey No.</th>
<th>Limit (mph)</th>
<th>Type of measures</th>
<th>Residents (%)</th>
<th>Non resident drivers (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3a-e</td>
<td>30</td>
<td>Round-top humps</td>
<td>83</td>
<td>58</td>
</tr>
<tr>
<td>4a-c</td>
<td>30</td>
<td>Round-top humps</td>
<td>73</td>
<td>73</td>
</tr>
<tr>
<td>5</td>
<td>30</td>
<td>Humps</td>
<td>50</td>
<td>-</td>
</tr>
<tr>
<td>6a-d</td>
<td>30</td>
<td>Humps,chicanes,narrowings</td>
<td>76</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>30</td>
<td>Thermoplastic humps</td>
<td>88</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>30</td>
<td>Round-top humps</td>
<td>-</td>
<td>73</td>
</tr>
<tr>
<td>9</td>
<td>30</td>
<td>Flat-top humps</td>
<td>471</td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td>30</td>
<td>Round-top humps</td>
<td>502</td>
<td>-</td>
</tr>
<tr>
<td>11</td>
<td>30</td>
<td>Humps,chicanes,narrowings</td>
<td>87</td>
<td>-</td>
</tr>
<tr>
<td>16</td>
<td>30</td>
<td>Flat-top humps/narrow</td>
<td>70</td>
<td>-</td>
</tr>
<tr>
<td>18a-c</td>
<td>30</td>
<td>Round/flat top humps</td>
<td>59</td>
<td>-</td>
</tr>
<tr>
<td>19a-l</td>
<td>30</td>
<td>Round-top humps</td>
<td>91</td>
<td>-</td>
</tr>
<tr>
<td>19m-y</td>
<td>30</td>
<td>Round-top humps</td>
<td>753</td>
<td>-</td>
</tr>
<tr>
<td>20a</td>
<td>30</td>
<td>Round-top humps</td>
<td>93</td>
<td>-</td>
</tr>
<tr>
<td>20b</td>
<td>30</td>
<td>Flat-top humps</td>
<td>66</td>
<td>-</td>
</tr>
<tr>
<td>21</td>
<td>30</td>
<td>Round-top humps</td>
<td>83</td>
<td>-</td>
</tr>
<tr>
<td>21</td>
<td>30</td>
<td>Flat-top humps</td>
<td>69</td>
<td>-</td>
</tr>
<tr>
<td>22a-d</td>
<td>20</td>
<td>Flat-top humps, environ.</td>
<td>65</td>
<td>-</td>
</tr>
<tr>
<td>22e-f</td>
<td>30</td>
<td>Flat-top humps, environ.</td>
<td>66</td>
<td>-</td>
</tr>
<tr>
<td>23a-c</td>
<td>20</td>
<td>Round/flat-top humps, gates</td>
<td>86</td>
<td>-</td>
</tr>
<tr>
<td>23b-d</td>
<td>30</td>
<td>Humps, chicanes</td>
<td>79</td>
<td>-</td>
</tr>
<tr>
<td>25a-d</td>
<td>20</td>
<td>Round/flat-top humps</td>
<td>70</td>
<td>-</td>
</tr>
<tr>
<td>39</td>
<td>20</td>
<td>Humps,road closures</td>
<td>64</td>
<td>-</td>
</tr>
</tbody>
</table>

Average 20 surveys or sub-surveys 72 3 surveys 68
Overall 22 surveys or sub-surveys 72

1 The ramp gradients which were originally (1:6) were made shallower after the survey had been carried out
2 42% of residents wanted the humps removed and 7% wanted other measures to be investigated
3 Included result for Survey 19y where only 11% of residents approved due to noise problems

Table 3 Speed cushion schemes opinion survey results

<table>
<thead>
<tr>
<th>Survey No.</th>
<th>Limit (mph)</th>
<th>Type of measures</th>
<th>Approval in survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>30</td>
<td>Cushions,raised junction</td>
<td>80%1</td>
</tr>
<tr>
<td>13</td>
<td>30</td>
<td>Cushions,raised junction</td>
<td>51%2</td>
</tr>
<tr>
<td>17</td>
<td>30</td>
<td>Cushions</td>
<td>variable1</td>
</tr>
<tr>
<td>24a,b</td>
<td>30</td>
<td>Cushions, flat/round humps</td>
<td>Variable</td>
</tr>
<tr>
<td>27</td>
<td>20/30</td>
<td>Humps, cushions, chicanes</td>
<td>52%</td>
</tr>
<tr>
<td>30</td>
<td>30</td>
<td>Narrow cushions</td>
<td>31%</td>
</tr>
<tr>
<td>37</td>
<td>20</td>
<td>Cushions</td>
<td>No3</td>
</tr>
</tbody>
</table>

Overall 5 surveys or sub-surveys 53%

1 Residents of road with cushions
2 Residents of surrounding roads without cushions
3 Cushions replaced with flat-top humps
supportive of the scheme but opposed (reasons not given) to the use of speed cushions, which were subsequently replaced with flat-top humps. It has been reported Webster (1994) that cushions were preferred by the bus company in Bradford but the residents preferred thermoplastic humps because they perceived cushions to be less effective at moderating bus speeds.

The dimensions of closures on several roads in York were modified following off-road ‘public acceptability’ trials by York City Council (Layfield and Parry, 1998) to determine suitable cushion dimensions that would reduce discomfort for passengers in minibuses, ambulances and small cars and also eliminate any grounding problems. Opinion surveys carried out in the areas affected found that about 60% of respondents thought that the modified cushions were acceptable. The off-road trials also indicated that, over the range of cushion dimensions tested, cushion width had a much stronger influence on public acceptability than cushion spacing.

3.4 Attitudes towards schemes including horizontal deflections

There were 17 surveys which included gateways, chicanes, narrowings and other horizontal deflections. An advantage of horizontal deflections, compared with road humps, is that they can be used on roads which have speed limits above 30 mph.

The results are given in Table 4, which shows overall approval rates varying from 18% to 89% of respondents. Attitudes towards chicanes in particular were very variable (see Surveys 33 and 34). The one-way priority chicane in Survey 25f (Nuneaton) were subsequently removed because of complaints about congestion which at peak times caused queues of approximately 25 cars at the chicane (County Surveyor’s Society, 1994).

A disadvantage of chicane in residential areas can be the loss of parking spaces as noted in Survey 33b.

A review of traffic calming in Northamptonshire reported by Kendrick (1995) showed that the acceptability results were very variable but generally favourable for urban schemes, which included chicane and one-way throttles. However, horizontal measures on main roads (A and B class) through villages were considered to be less successful on average.

In Australia (Survey 41b) a scheme which consisted of an offset carriageway and recessed parking had an approval rate of only 17%. This may have been partly due to the speeds being reduced by 14 mph but no reduction in traffic flow. Residents approved of angled slow points (Survey 41f) but non-resident drivers, not surprisingly, objected strongly to them.

3.5 Attitudes towards schemes containing road closures

Four of the surveys (Nos. 36, 38, 39 and 41) included road closures but generally these were not assessed separately. In Survey 36, Mackie et al (1990) and Walker et al (1989) found that total road closures caused most public opposition. In Survey 41e (Australia) it was noted that road closures should not be scattered ‘randomly’ around an area unless they are overwhelmingly supported. Residents are not able to understand random closures and they can split a community. A road closure in a 20 mph zone outside the local school in Valpy Avenue, Norwich was popular with 70% of residents (Norwich City Council, 1996) who wanted the closure to be retained. However, road closures may be less popular with residents on adjacent roads which through traffic may divert to. Clearly the popularity of road closures is very dependent on the area and the degree of access required.

3.6 Attitudes towards schemes including mini-roundabouts

Mini-roundabouts were used at a number of sites but specific opinions of the mini-roundabouts were only available for Surveys 30, 31, 37 and 41g. The mini-roundabout at Wrexham (Survey 37) was described as unpopular. In Surveys 30 and 31 a rating system was used and mini-roundabouts received a very low rating.

At sites in Australia (Survey 41g), high acceptance was reported for roundabouts generally but it was less so in smaller rural townships. There was sometimes confusion at mini-roundabouts by elderly drivers and also by drivers who drove in the wrong direction or over the roundabout.

3.7 Ranking of the effectiveness of measures

The surveys which provide information on particular measures indicate that there are some of these measures which are perceived as less effective than others. For example, in Survey 27 (York) respondents were asked to rate the various measures in terms of how effective they

<table>
<thead>
<tr>
<th>Survey No.</th>
<th>Limit (mph)</th>
<th>Type of devices</th>
<th>Approval in survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>40</td>
<td>Gateway, rumble, roundels</td>
<td>89%</td>
</tr>
<tr>
<td>2</td>
<td>40</td>
<td>Village gateway, islands</td>
<td>50%</td>
</tr>
<tr>
<td>6a-d</td>
<td>30</td>
<td>Humps, chicane, narrowings</td>
<td>76%</td>
</tr>
<tr>
<td>11</td>
<td>30</td>
<td>Humps, chicane, narrowings</td>
<td>87%</td>
</tr>
<tr>
<td>20c</td>
<td>30</td>
<td>Humps, pinchers, priority</td>
<td>56%</td>
</tr>
<tr>
<td>20d</td>
<td>30</td>
<td>Humps, chicane, rumbles</td>
<td>33%</td>
</tr>
<tr>
<td>21</td>
<td>30</td>
<td>2-way chicane</td>
<td>39%</td>
</tr>
<tr>
<td>21</td>
<td>30</td>
<td>1-way chicane</td>
<td>18%</td>
</tr>
<tr>
<td>23b-p</td>
<td>30</td>
<td>Humps, chicanes</td>
<td>70%</td>
</tr>
<tr>
<td>26a-e</td>
<td>30</td>
<td>Gateways, islands, rumbles</td>
<td>50%</td>
</tr>
<tr>
<td>26f</td>
<td>60</td>
<td>Gateways, rumble bars</td>
<td>50%</td>
</tr>
<tr>
<td>27</td>
<td>20/30</td>
<td>Humps, chicane, narrowings</td>
<td>52%</td>
</tr>
<tr>
<td>30</td>
<td>30</td>
<td>Gateways, red surface</td>
<td>66%</td>
</tr>
<tr>
<td>31</td>
<td>20/30</td>
<td>Gateway, chicane, mini-rbt</td>
<td>speed camera, part time 20</td>
</tr>
<tr>
<td>32a</td>
<td>30</td>
<td>Narrowing/bypass</td>
<td>57%</td>
</tr>
<tr>
<td>32b</td>
<td>30</td>
<td>Chicane, bypass</td>
<td>85%</td>
</tr>
<tr>
<td>32c</td>
<td>20</td>
<td>Narrowing</td>
<td>51%</td>
</tr>
<tr>
<td>33a-p</td>
<td>30</td>
<td>Chicane/2-way</td>
<td>acceptable</td>
</tr>
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<td>33a-c</td>
<td>30</td>
<td>Chicane/1-way</td>
<td>dislike</td>
</tr>
<tr>
<td>34</td>
<td>30</td>
<td>Chicanes</td>
<td>variable</td>
</tr>
<tr>
<td>36</td>
<td>30</td>
<td>Area wide, safety project</td>
<td>65%</td>
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<td>36</td>
<td>30</td>
<td>Area wide, safety project</td>
<td>74%</td>
</tr>
<tr>
<td>40</td>
<td>30</td>
<td>Narrow, rumble, pinchers</td>
<td>63%</td>
</tr>
<tr>
<td>41c</td>
<td>-</td>
<td>Chicane and flat-top humps</td>
<td>89%</td>
</tr>
</tbody>
</table>

Overall     | 21 surveys or sub-surveys | 59%                |
considered them to be in reducing traffic speed and improving road safety. The most effective measures were perceived to be round-top road humps (75% effective), which although criticised on a number of issues, were felt to be more acceptable than other forms of traffic calming. Speed cushions and flat-top road humps were felt to be next best (50%) in terms of effectiveness, followed by chicanes (45%) and mini-roundabouts (41%) in descending order.

Table 5 shows the comparative rating of different measures in Surveys 30 (Craven Arms) and 31 (Thorney). Of all the features in these trunk road schemes (including others not shown here in the Table), the mini-roundabouts had the lowest rating - that is, they were the least popular.

Table 5 Comparative rating of mini-roundabouts in Surveys 30 and 31

<table>
<thead>
<tr>
<th>Survey No</th>
<th>Gateway Islands</th>
<th>Hatching</th>
<th>Speed cushion</th>
<th>Mini-rbt</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>2.94</td>
<td>2.74</td>
<td>2.60</td>
<td>2.28</td>
</tr>
<tr>
<td>31</td>
<td>Gateway Narrowing</td>
<td>Chicanes</td>
<td>Mini-rbt</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.61</td>
<td>2.31</td>
<td>2.06</td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>2.78</td>
<td>-</td>
<td>-</td>
<td>1.53</td>
</tr>
</tbody>
</table>

1 = Causes concern, 2 = of little use, 3 = fairly useful, 4 = very useful

Boyd and Noon (1997) described a survey in Edinburgh which showed that round-top road humps and flat-top road humps were regarded as acceptable by 51% and 47% of respondents respectively, but that chicanes were the least popular measure with 74% of residents living close to one being dissatisfied with them. Chicanes were disliked because they were said ‘to make driving conditions difficult and to encourage bad driving’.

3.8 Scheme costs and attitudes to aesthetic impact

The cost of schemes varies greatly, depending on the number and type of measures installed and whether additional lighting is installed as part of the scheme. The costs of a sub-set of schemes are given in Table 6 alongside the percentages of respondents who perceived the quality/appearance of the area to have improved.

The results demonstrate the wide range of scheme costs, even when considering costs per metre. For example, even the similar schemes, 6a,b,d, vary from £13 to £366 per metre. Despite the high cost of scheme 6a, only 37% of respondents thought the area was better and 50% thought it was the same. It is interesting to note that 56% of respondents thought the area was the same at scheme 6d. Overall, the percentage of respondents thinking the area had improved ranged from 9% to 90%, with an average of 48%, or just under a half. Mackie, (1989) reported that “a more integrated approach combining safety, environmental and land use planning objectives could gain better public support and provide more financial justification for schemes which may not be viable in either safety or environmental objectives separately”.

Surveys 22a - 22f relate to the Bypass Demonstration Project sites, for which the environmental and traffic calming cost was approximately £10 million. This makes the unit cost very high indeed and unrepresentative because considerable environmental work was also included with the humps. These surveys have therefore been omitted from Table 6. Overall 65% of respondents thought that the Bypass Demonstration Project sites were an improvement.

The Leicester scheme (Survey 23b), which used high quality block paving, was regarded as aesthetically pleasing by 38% compared with only 10% at Brighton (Survey 23a). The latter consisted of asphalt round-top humps and gateways at the entrances to the scheme.

Table 6 Perceived effect on environment against cost of scheme

<table>
<thead>
<tr>
<th>Scheme No</th>
<th>Type of measures</th>
<th>Estimated cost for the complete scheme</th>
<th>Respondents who thought that the area was better</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Total (£)</td>
<td>Per metre</td>
</tr>
<tr>
<td>2</td>
<td>Gateway,islands</td>
<td>£6500</td>
<td>£6.5</td>
</tr>
<tr>
<td>6a</td>
<td>Humps,chicanes</td>
<td>£220000</td>
<td>£366</td>
</tr>
<tr>
<td>6b</td>
<td>Humps,narrowings</td>
<td>£198000</td>
<td>£29</td>
</tr>
<tr>
<td>6d</td>
<td>Humps,narrowings</td>
<td>£168000</td>
<td>£13</td>
</tr>
<tr>
<td>13</td>
<td>Cushions,raised junction</td>
<td>£35500</td>
<td>£39</td>
</tr>
<tr>
<td>19a-l</td>
<td>Round-top humps</td>
<td>£94000</td>
<td>£13</td>
</tr>
<tr>
<td>20a</td>
<td>Round-top humps</td>
<td>£4800</td>
<td>£7</td>
</tr>
<tr>
<td>20b</td>
<td>Flat-top humps</td>
<td>£9700</td>
<td>£9</td>
</tr>
<tr>
<td>20c</td>
<td>Humps,pinches etc</td>
<td>£70000</td>
<td>£100</td>
</tr>
<tr>
<td>20d</td>
<td>Humps,chicanes,rumbles</td>
<td>£50000</td>
<td>£56</td>
</tr>
<tr>
<td>23a</td>
<td>Round-top humps, gates</td>
<td>£60000</td>
<td>£12</td>
</tr>
<tr>
<td>23b(Phase 1)</td>
<td>Flat-top humps, gates</td>
<td>£165000</td>
<td>£49</td>
</tr>
<tr>
<td>23c(Phase 1)</td>
<td>Flat-top humps, gates</td>
<td>£245000</td>
<td>£47</td>
</tr>
<tr>
<td>26a-f</td>
<td>Gateways,islands,hatching</td>
<td>£104000</td>
<td>£15</td>
</tr>
</tbody>
</table>

1 The Phase 1 area surrounded Worthington Street which is 167 metres long and cost £180,000 when it was built (£1078/metre) using the 'Woonerf' style of traffic calming. The influence of Worthington Street on attitudes to the Phase 1 area could not be separated.
3.9 Other considerations

The approval rate does not appear to be dependent on the timing of the survey in relation to installation of the measures.

In Survey 23, there was some evidence that calming was less popular with increasing length of residence. These ‘long-term’ residents wanted to have a greater say in designing the schemes.

Public opinions may alter with time (Zaidel et al, 1992) as countries install more traffic calming. This was shown to some extent at Richmond (Survey 19 in Table 1) where the earlier (19a-1) and later (19m-y) schemes had approval rates of 91% and 75% respectively. However, it should be noted that the later schemes contained a site (Survey 19y) which had to be removed because of complaints about noise. Modifications to schemes after installation can be carried out, if required, to improve the public acceptability (Taylor and Tight, 1996) and (Layfield and Parry, 1998).

In Graz, Survey 45, the approval rate varied from a low of 44% during the public discussion period to 77% 18 months after implementation. This long term improvement is similar to the Urban Safety Project (Mackie, 1989) where “the overall response to the schemes were mixed...and the general opinion of the Urban Safety schemes had improved over time”.

4 Effectiveness of measures compared with public reactions to the measures

It has been suggested (Hawley et al, 1993) that ‘where the speed and/or through traffic problem is perceived as critical, there is greater acceptance of speed humps’. Therefore, this section compares public reactions with objective measures of the effectiveness of schemes. The objective measures considered are the changes in speeds, traffic flows, and accidents and in the environmental factors noise, vibration and pollution.

4.1 Changes in vehicle speeds

Table 7 shows, for each survey, where actual speed changes were measured, the measured change, together with the percentage of respondents who thought that speeds had reduced. The changes in mean vehicle speeds for each site are based on approximately 200 radar measurements or at least 1,000 automatic measurements both before and after scheme installation. The speed reductions for the hump sites were averages of the ‘between’ hump and ‘on’ hump reductions; the gateway speed reductions relate to ‘inbound’ vehicles. The speed reductions at the schemes which contained a mixture of measures (Surveys 6, 11, 16, 26, 30 and 31) were overall average speed reductions for the whole scheme. In some surveys respondents were also asked whether speeds had been reduced enough and the percentages who thought that they had are also shown.

The results given in Table 7 show that mean vehicle speeds were reduced at all sites, by an average of 8.5 mph. However, on average, only 65% of people questioned thought that speeds had in fact been reduced. The value ranged from 18% at a 1-way chicane site (Survey 21d) to 90% at a site (Survey 20a) with humps. In Surveys 2, 26a-e, 30 and 31 respondents were asked whether speeds had been reduced enough. An average of 39% of the respondents thought that speeds had been reduced enough, the value ranging from 14% to 62%. It should be noted that the speed measurements are average reductions and may not necessarily have been measured at exactly the same position within the scheme as considered by the respondent. There are many factors which might influence respondents’ views - for example, the time of day or time of year considered may be significant. A single speeding car may be remembered by one respondent but the same vehicle may not be remembered by, or be a problem to, another respondent.

### Table 7 Comparison of measured mean speed changes and perceived effect

<table>
<thead>
<tr>
<th>Types of survey measures installed</th>
<th>Measured speed reduction (mph)</th>
<th>Respondents who thought that speed reduced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survey No.</td>
<td></td>
<td>%</td>
</tr>
<tr>
<td>1 Gateway and rumble area</td>
<td>2</td>
<td>69</td>
</tr>
<tr>
<td>1 Roundel, slogan</td>
<td>7</td>
<td>67</td>
</tr>
<tr>
<td>1 Undulations1</td>
<td>181</td>
<td>68</td>
</tr>
<tr>
<td>2 Gateway, islands</td>
<td>4</td>
<td>50</td>
</tr>
<tr>
<td>3 Round-top humps</td>
<td>12</td>
<td>58</td>
</tr>
<tr>
<td>4 Round-top humps</td>
<td>5</td>
<td>46</td>
</tr>
<tr>
<td>6a Humps, chicanes</td>
<td>10</td>
<td>62</td>
</tr>
<tr>
<td>6b Humps, narrowings</td>
<td>9</td>
<td>52</td>
</tr>
<tr>
<td>6c Humps</td>
<td>17</td>
<td>56</td>
</tr>
<tr>
<td>6d Humps, narrowings</td>
<td>12</td>
<td>64</td>
</tr>
<tr>
<td>7 Thermoplastic humps</td>
<td>9</td>
<td>88</td>
</tr>
<tr>
<td>11 Humps, narrow, chicanes</td>
<td>6</td>
<td>87</td>
</tr>
<tr>
<td>16 Flat-top hump, narrow</td>
<td>5</td>
<td>70</td>
</tr>
<tr>
<td>17 Cushions</td>
<td>12</td>
<td>71</td>
</tr>
<tr>
<td>19a Round-top humps</td>
<td>10</td>
<td>84</td>
</tr>
<tr>
<td>20a Round-top humps</td>
<td>41</td>
<td>90</td>
</tr>
<tr>
<td>20b Flat-top humps</td>
<td>101</td>
<td>80</td>
</tr>
<tr>
<td>20c Humps, pinch, priority</td>
<td>161</td>
<td>71</td>
</tr>
<tr>
<td>21a Round-top humps</td>
<td>14</td>
<td>85</td>
</tr>
<tr>
<td>21b Flat-top humps</td>
<td>15</td>
<td>64</td>
</tr>
<tr>
<td>21c 2-way chicane</td>
<td>7</td>
<td>27</td>
</tr>
<tr>
<td>21d 1-way chicane</td>
<td>4</td>
<td>18</td>
</tr>
<tr>
<td>24a Cushions</td>
<td>5</td>
<td>29</td>
</tr>
<tr>
<td>24b Cushions</td>
<td>11</td>
<td>73</td>
</tr>
<tr>
<td>25a Humps</td>
<td>7</td>
<td>66</td>
</tr>
<tr>
<td>25b Humps</td>
<td>9</td>
<td>56</td>
</tr>
<tr>
<td>25d Humps</td>
<td>11</td>
<td>81</td>
</tr>
<tr>
<td>26a Gateway, pinch</td>
<td>7</td>
<td>42</td>
</tr>
<tr>
<td>26b Gateway, narrow</td>
<td>3</td>
<td>66</td>
</tr>
<tr>
<td>26c Gateway, narrow</td>
<td>8</td>
<td>72</td>
</tr>
<tr>
<td>26d Rumbles, 30 mph on road</td>
<td>4</td>
<td>82</td>
</tr>
<tr>
<td>26e Gateway, rumbles, roundels</td>
<td>3</td>
<td>64</td>
</tr>
<tr>
<td>26f Gateways, rumbles</td>
<td>101</td>
<td>48</td>
</tr>
<tr>
<td>30 Gateways, red, rbts, cushions</td>
<td>8</td>
<td>74</td>
</tr>
<tr>
<td>31 Gateway, chicane, mini-rbt</td>
<td>9</td>
<td>61</td>
</tr>
<tr>
<td>44 Humps</td>
<td>2</td>
<td>82</td>
</tr>
<tr>
<td>Average all surveys</td>
<td>8.5</td>
<td>65</td>
</tr>
<tr>
<td>Surveys with humps</td>
<td>10.1</td>
<td>71</td>
</tr>
<tr>
<td>Surveys without humps</td>
<td>6.5</td>
<td>57</td>
</tr>
<tr>
<td>Surveys 2 &amp; 26a-26c, 30 &amp; 31</td>
<td>5.8</td>
<td>64</td>
</tr>
</tbody>
</table>

1 Included in humps (removed after fatal accident)
2 85th percentile speeds
3 85th percentile speed in village
Considering schemes with and without humps shows that there was a higher average speed reduction at the hump schemes (10.1 mph) than the non-hump schemes (6.5 mph), but the percentages of respondents believing speeds had been reduced were similar, at 71% and 57% respectively.

Figure 4 shows the percentage of respondents who believed speeds had been reduced, plotted against the measured reduction in mean speed. No relationship is discernible. Indeed, a linear regression line fitted to the data was not statistically significant \((r = 0.13, n = 36)\). This perhaps suggests that respondents are more strongly influenced by prejudice or by what they think is the ‘right’ answer to give, than reality. Figure 4 does show that speed reductions of over 10 mph appear to be consistently perceived by over half of the respondents questioned. It is likely that smaller changes in speed are quite difficult to identify reliably with the ‘naked eye’, particularly if lower gears and higher engine speeds are used, possibly ‘masking’ the actual speed reduction obtained.

### 4.2 Changes in traffic flows

Table 8 shows percentage changes in vehicle flow for surveys where this was measured. Alongside are the percentages of respondents who thought that flows had reduced or had stayed the same. Changes in vehicle flows are notoriously difficult to measure reliably due to the large day-to-day and seasonal variability. The results should therefore only be used as a guide. All of the flows were based on a minimum of a 12 hour count in both the ‘before’ and ‘after’ periods. Survey 25d relates to an area scheme and therefore the flow change was estimated for the whole area.

The results show that vehicle flows were reduced at all schemes in Table 8. The average reduction was 23%, ranging from 9% to 43%. On average, approximately 33% of the public thought that vehicle flows had been reduced, ranging from 12% to 86%. An average of 56% thought that they were unchanged at the 11 sites where this information was available. It should be noted that the flow measurements are average reductions over the whole area and therefore the best estimate which can be made. They are unlikely to relate directly to the position in the scheme considered by the respondent. Again there are many other issues that might influence respondents views.

Figure 5 shows the percentage of respondents who thought that the vehicle flows had been reduced after the traffic calming had been installed, plotted against the measured flow reductions. A linear regression analysis was carried out but the relationship was not statistically significant \((r = 0.21, n = 17)\).

In Survey 13, Greenwich, the flows on the surrounding roads, which were not treated, increased by 35% and 69% of the residents of these roads thought that flows had increased.

![Figure 4](image-url) Relationship between measured and perceived speed reduction
4.3 Changes in accidents

Table 9 shows percentage changes observed in personal injury accident frequency for surveys where this was examined. Alongside are the percentages of respondents who thought that safety had improved or was unchanged. All of the schemes showed a reduction in accident frequency. The accident reduction range was 13 - 100% with an average of 63%. On average for these surveys, 53% of respondents believed that safety had improved. In some surveys, respondents were asked whether safety had improved, stayed the same or got worse. An average of 40% thought that it was improved and a further 40% thought that it was unchanged at the 5 sites where this information was available.

Figure 6 shows the percentage of respondents who thought that the safety of the traffic calmed road had been improved after the measures had been installed, plotted against the measured accident reduction. A linear regression analysis was carried out but the relationship was not statistically significant (r = 0.21, n = 17). In most cases the accident reduction will have been measured over a longer period than the interval between scheme installation and the opinion survey. However, the result emphasises the difficulty of subjective determination of safety.

The accident figures given in the surveys all relate to the part of the road network on which the traffic calming scheme actually lies. If, as a result of a scheme, traffic

---

**Table 8 Comparison of observed changes in vehicle flows and perceived effect**

<table>
<thead>
<tr>
<th>Survey No</th>
<th>Type of measures installed</th>
<th>Measured reduction in vehicle flow (%)</th>
<th>Respondents who thought that flows reduced (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Humps</td>
<td>34</td>
<td>34 (%)</td>
</tr>
<tr>
<td>4</td>
<td>Humps</td>
<td>25</td>
<td>20 (%)</td>
</tr>
<tr>
<td>6a</td>
<td>Humps, chicanes</td>
<td>12</td>
<td>25 (%) 60%</td>
</tr>
<tr>
<td>6b</td>
<td>Humps, narrowings</td>
<td>36</td>
<td>23 (%) 54%</td>
</tr>
<tr>
<td>6c</td>
<td>Humps</td>
<td>11</td>
<td>18 (%) 60%</td>
</tr>
<tr>
<td>6d</td>
<td>Humps, narrowings</td>
<td>12</td>
<td>27 (%) 46%</td>
</tr>
<tr>
<td>11</td>
<td>Humps, narrow, chicanes</td>
<td>13</td>
<td>30% -</td>
</tr>
<tr>
<td>13</td>
<td>Cushions, raised junction</td>
<td>22</td>
<td>86 % -</td>
</tr>
<tr>
<td>16</td>
<td>Hump, narrow</td>
<td>27</td>
<td>16 % 58%</td>
</tr>
<tr>
<td>17</td>
<td>Cushions</td>
<td>16</td>
<td>50 % -</td>
</tr>
<tr>
<td>20a</td>
<td>Humps, pinch, priority</td>
<td>43</td>
<td>28 % -</td>
</tr>
<tr>
<td>21a</td>
<td>Round-top humps</td>
<td>40</td>
<td>63 % 36%</td>
</tr>
<tr>
<td>21b</td>
<td>Flat-top humps</td>
<td>37</td>
<td>44 % 40%</td>
</tr>
<tr>
<td>21c</td>
<td>2-way chicane</td>
<td>9</td>
<td>12 % 75%</td>
</tr>
<tr>
<td>24a</td>
<td>Cushions</td>
<td>13</td>
<td>13 % 78%</td>
</tr>
<tr>
<td>24b</td>
<td>Cushions</td>
<td>21</td>
<td>20 % 70%</td>
</tr>
<tr>
<td>25d</td>
<td>Humps</td>
<td>12</td>
<td>58 % 40%</td>
</tr>
</tbody>
</table>

Average all surveys: 23 % 33 % -
Surveys 6, 16, 21, 24 & 25: 21 % 29 % 56 %

1 Based on difference between ‘before’ and ‘after’ attitude surveys of amount of traffic using the road
2 Based on difference between ‘before’ and ‘after’ attitude surveys of general traffic conditions on the traffic calmed road

![Figure 5 Relationship between measured and perceived flow change](image)
**Table 9** Comparison of changes in accident frequency at schemes and perceived effect

<table>
<thead>
<tr>
<th>Type of Survey measures installed</th>
<th>Reduction in accident frequency (%)</th>
<th>Respondents who thought that safety improved (%)</th>
<th>Respondents who thought that safety was the same (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Humps</td>
<td>61</td>
<td>43</td>
<td>-</td>
</tr>
<tr>
<td>4 Humps</td>
<td>100</td>
<td>22</td>
<td>-</td>
</tr>
<tr>
<td>6a Humps, chicanes</td>
<td>53</td>
<td>47</td>
<td>39</td>
</tr>
<tr>
<td>6b Humps, narrowings</td>
<td>61</td>
<td>37</td>
<td>39</td>
</tr>
<tr>
<td>6c Humps</td>
<td>50</td>
<td>48</td>
<td>31</td>
</tr>
<tr>
<td>6d Humps, narrowings</td>
<td>47</td>
<td>50</td>
<td>34</td>
</tr>
<tr>
<td>11 Humps, narrow, chicanes</td>
<td>100</td>
<td>82</td>
<td>-</td>
</tr>
<tr>
<td>13 Cushions, raised junction</td>
<td>100</td>
<td>74</td>
<td>-</td>
</tr>
<tr>
<td>18a Humps</td>
<td>56</td>
<td>67</td>
<td>-</td>
</tr>
<tr>
<td>18b Humps</td>
<td>56</td>
<td>52</td>
<td>-</td>
</tr>
<tr>
<td>18c Humps</td>
<td>70</td>
<td>62</td>
<td>-</td>
</tr>
<tr>
<td>21a Round-top humps</td>
<td>73</td>
<td>85</td>
<td>-</td>
</tr>
<tr>
<td>21b Flat-top humps</td>
<td>84</td>
<td>69</td>
<td>-</td>
</tr>
<tr>
<td>21c 2-way chicane</td>
<td>74</td>
<td>46</td>
<td>-</td>
</tr>
<tr>
<td>21d 1-way chicane</td>
<td>54</td>
<td>17</td>
<td>55</td>
</tr>
<tr>
<td>31 Gateway, chicane, mini-rbt</td>
<td>speed camera, part-time 20</td>
<td>20</td>
<td>40*</td>
</tr>
<tr>
<td>45 Gatesways, 30 kph on road</td>
<td>13</td>
<td>68</td>
<td>-</td>
</tr>
<tr>
<td>Average all surveys</td>
<td>63</td>
<td>53</td>
<td>-</td>
</tr>
<tr>
<td>Surveys 6 &amp; 21d</td>
<td>53</td>
<td>40</td>
<td>40</td>
</tr>
</tbody>
</table>

1 Based on difference between ‘before’ and ‘after’ attitude surveys
2 Based on pedestrian attitude surveys

<table>
<thead>
<tr>
<th>Type of Reduction</th>
<th>Respondents who thought it was safer (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measured change in accident frequency (%)</td>
<td></td>
</tr>
<tr>
<td>in other areas</td>
<td>-14 (decrease)</td>
</tr>
<tr>
<td>in other areas</td>
<td>-14 (decrease)</td>
</tr>
<tr>
<td>in other areas</td>
<td>-14 (decrease)</td>
</tr>
</tbody>
</table>

4.4 Changes in noise, vibration and pollution

Taylor and Tight (1996) showed that perceived changes in noise and pollution vary greatly between traffic calming schemes, with perceived increases at some schemes and decreases at others.

Traffic noise (DOT, 1996b) and vibration were explicitly measured at several sites and the results are given in Tables 11 (noise) and 12 (vibration). Table 11 indicates a measured reduction in noise at all sites. At 4 sites the percentage of respondents who were bothered by noise decreased but at 3 sites quite large percentages of respondents thought that noise had increased. Noise is complex to assess because nighttime noise can be more annoying than daytime noise, particularly loud noises. The degree of perceived noise in houses may vary between summer and winter, due to windows being open more in the summer. Double-glazing can reduce noise appreciably in houses in winter when windows are closed for longer periods so individuals’ perception of noise levels can depend on the characteristics of their home.

In Survey 16 in Kent, 82% of the residents living directly beside a hump thought that the noise had increased compared to 33% of residents who did not have a hump directly outside their house. It is interesting to note that 42% of residents who did not have a hump directly outside their house thought that there had been no change in the noise after installation of the humps along their road.

Ground vibration is often a function of the soil type and local conditions (Baguley, 1981). The results given in Table 12 are limited but they suggest that residents can be concerned about vibration even when the measured values are very low. In Survey 30, the ‘before’ and ‘after’ measured values were similar, as were the respondents’ ‘before’ and ‘after’ views.

In Survey 45 (Graz), the measured exhaust emissions were a 24% reduction in NOx, a 0.5% increase in HC and a 3.8% increase in CO. Several attitude surveys were carried out after scheme installation and the percentage of respondents who thought emissions had increased reduced from 52% to 24% between the first and last of these surveys.

Pollution can be very difficult for residents to assess because background pollution can influence their views (DOT, 1996c). Abbott et al (1995) reported that there was ‘no clear evidence that the amount of annoyance or concern is directly related to the measured amount of pollution’ and ‘the public tend to be much more concerned about smoke/fumes/odour when they are outdoors’. In recent years catalytic converters have reduced some emissions but they can produce some very pungent smells while warming up. Diesel-engined vehicles are now much cleaner than they used to be. Overall, the usefulness of pollution questions appears to be limited.
Table 11 Comparison of change in noise levels and perceived effect

<table>
<thead>
<tr>
<th>Survey measures</th>
<th>Measured reduction</th>
<th>Respondents attitude to noise after measures installed (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>dB(A)</td>
<td>before</td>
</tr>
<tr>
<td>3b</td>
<td>Humps</td>
<td>2</td>
</tr>
<tr>
<td>3d</td>
<td>Humps</td>
<td>6</td>
</tr>
<tr>
<td>3a</td>
<td>Humps</td>
<td>14</td>
</tr>
<tr>
<td>30</td>
<td>At cushions (Daytime)</td>
<td>4</td>
</tr>
<tr>
<td>31</td>
<td>In village (Daytime)</td>
<td>4</td>
</tr>
<tr>
<td>45</td>
<td>Gateway, 30 kph on road</td>
<td>1</td>
</tr>
<tr>
<td>Average all surveys</td>
<td>5</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 12 Comparison of change in vibration levels and perceived effect

<table>
<thead>
<tr>
<th>Survey measures</th>
<th>Measured vibration</th>
<th>Respondents attitude to vibration after measures installed (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4a</td>
<td>Humps</td>
<td>Low</td>
</tr>
<tr>
<td>30</td>
<td>Cushions</td>
<td>Very low</td>
</tr>
<tr>
<td>30</td>
<td>Cushions</td>
<td>Very low</td>
</tr>
<tr>
<td>31</td>
<td>Gateway</td>
<td>Quite high</td>
</tr>
<tr>
<td>Average all surveys</td>
<td>Variable</td>
<td>58% adverse comment</td>
</tr>
</tbody>
</table>

1 On a trunk road carrying a high traffic flow

---

Figure 6 Relationship between accident reduction and perceived safety improvement
5 Issues concerning questionnaire design and initial consultation

5.1 Questionnaire design

5.1.1 Structure

The aim of a traffic calming attitude survey is to establish whether the objectives of the scheme have been achieved and whether there are any concerns with the traffic calming measures that have been used. The usefulness of the results of a questionnaire is determined by the questionnaire design (including the number and type of questions). The depth to which a questionnaire should go will be influenced by whether the calming features are new or novel. Novel features can have problems associated with them because they are untried, so it is important that public reaction is sought after a few months when residents have had experience of them (Walker et al, 1989).

The main purposes of questionnaires, carried out after the scheme has been installed, vary depending on the type and location of the scheme but this review shows that the following objectives should be considered when appropriate:

a. Are the residents, public, emergency services and bus operators satisfied with the measures which have been installed?
b. Have the measures assisted all road user groups?
c. Which measures are popular and effective?
d. Which measures are unpopular but effective?
e. Are the measures considered environmentally friendly? Noise? Pollution? Vibration?
f. Could the measures be improved?
g. Do the measures give value for money in terms of accident reductions and/or environmental improvements?
h. Are the materials used complimentary with the surroundings?

As each scheme is different a ‘standard’ questionnaire would not appear to be appropriate but it is suggested by the author that Davies and Ryley (1996), May and Hopkinson (1992), Windle and Mackie (1992), Windle and Hodge (1993) and Wheeler et al (1993, 1994 & 1996) include questionnaires which provide good starting points. These questionnaires can then be customised to give a questionnaire which covers all of the road users and residents affected by the scheme. The type of survey will therefore be determined more by local considerations such as, the number of people affected, who the scheme is designed to benefit most and the cost of the surveys to be carried out.

Appendix C provides a useful checklist for issues to consider when compiling questionnaires for assessing reactions to traffic calming schemes, based on information from this review.

5.1.2 Types of questions

The type and phrasing of a question asked may affect the response which is given (Taylor and Tight, 1996) because the respondent may assume that a particular answer is expected. Jargon such as ‘speed cushions’ and ‘pinch points’ should be avoided unless a photograph of the measure is supplied, otherwise respondents may misunderstand the question and give an unintended answer. It is therefore important that the questionnaire has a balance between:

1. Open questions
2. Yes/No questions
3. Multiple choice questions
4. Opportunity for general comments.

Open questions

An open question allows the respondent to give their view or may also be used to see if they understand or know a particular fact. Examples of questions from this review are:

- Can you describe what was done to slow traffic?
- What do you think of the speeds of vehicles along this road?
- Why do you think the humps were installed?

However, the answers can be varied and lengthy and are therefore costly to code up and analyse. Such questions are often used in pilot surveys to establish a set of responses for closed questions.

Closed questions

The following are examples of questions from Stockport, Survey 20.

- Do you feel the scheme has reduced a) vehicle speeds? Y/N b) numbers of vehicles? Y/N
- Do you feel the scheme is successful? Y/N

These questions are easy to understand and answer but they do not allow the respondent to say that speeds or vehicle numbers have not been altered, or to indicate the degree of change. In this case, it was possible for respondents to add brief comments at the end of the questionnaire.

Multiple choice questions

A seven box system was used in a questionnaire in Camden, Survey 38 which had ‘positive’ or ‘good’ values on the right (eg safe, clean) and ‘negative’ or ‘bad’ values on the left (eg unsafe, filthy) as follows:

- What do you feel about Air Quality in your Neighbourhood? Filthy ☐ ☐ ☐ ☐ ☐ ☐ Clean
- The following is an example of a question from Craven Arms, Survey 30.

Can you tell me, for the following groups of people whether the changes have been a good thing, bad thing or have had no effect?

<table>
<thead>
<tr>
<th>Group</th>
<th>Very good</th>
<th>Quite good</th>
<th>No effect</th>
<th>Quite bad</th>
<th>Very bad</th>
<th>Don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedestrians</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Drivers</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Children</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Cyclists</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Old people</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Residents on main road</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Shopkeepers</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>
This type of question contains a number of useful points such as the ‘no effect’ box and the ‘don’t know’ box. The words used are easy to understand to assist the respondent.

The following is an example of a question from the New Forest, Survey 1.

Please look at the following 7 photographs and give each a score between one and ten for how effective you think it would be at slowing vehicles down.

<table>
<thead>
<tr>
<th>Score</th>
<th>A. Gate</th>
<th>B. Rumble strip</th>
<th>C. Mini-gate</th>
<th>D. Sign with slogan</th>
<th>E. 40 mph marking on road</th>
<th>F. Pinch point</th>
<th>G. Undulations</th>
</tr>
</thead>
</table>

This question type allows respondents to rate the effect, which can be an advantage if the effects due to alterations have been quite small.

At Huyton, Survey 39, respondents were asked to grade their answer by marking on a horizontal line from zero to 100, where the zero value was ‘the bad’ value (eg increased vehicle speeds, decreased pedestrian safety, objectionable road network) and 100 was ‘the good’ value (eg decreased vehicle speeds, increased pedestrian safety, improved road network). The 50 value was the no change or tolerable state, as given in the following example:

MARK ON THE LINE YOUR OPINION

Question 1. VEHICLE SPEEDS

0-----------------------------50-----------------------------100
Increased | No change | Decreased

After an opinion survey has been carried out it may be apparent that some answers are not as expected. This could be due to respondents misunderstanding the question or assuming that an answer was required for every question. The following example is from Surrey, Survey 21:

Do you think the road humps have affected road safety in your road?

- Safer
- Less safe
- No change
- Not applicable

As a pedestrian ( ) ( ) ( ) ( )
As a pedal-cyclist ( ) ( ) ( ) ( )
As a motor-cyclist ( ) ( ) ( ) ( )
As a driver ( ) ( ) ( ) ( )

This question would appear to be straightforward but the responses showed that some people who were not motorcyclists had filled in the answer whereas others had used the ‘not applicable’ box. This shows that the ‘not applicable’ box would have been better placed as the first box rather than the last box. It is important that the respondents have clear questions and that they do not have to assume anything.

General comments

Many questionnaires invited general comments at the end. These comments may not be directly relevant; however, they could give additional information which was not considered to be important when the questionnaire was prepared but has subsequently become an important issue. It also allows respondents generally to ‘air their views’ and to suggest ways of improving the scheme.

5.1.3 Other issues

Order of questions

Quimby and Glendinning (1990) report that the order of the questions could be more important as the number increases because the respondents may become disinterested with too many questions, especially if the questions appear quite similar.

Prompts

Prompts are an important part of a questionnaire because they allow respondents to choose suitable answers, but it can also be useful to have some questions which are not prompted. These unprompted questions can then be followed up by a supplementary question after explaining certain aspects of the scheme. This type of approach is appropriate if the scheme is novel or likely not to be fully understood by respondents (Wheeler et al, 1994). Photographs of features (used for example in Surveys 30 and 31) can be a useful aid in face-to-face interview surveys.

Wording

Mackie (1989) reported that it may be advisable not to describe a new scheme as ‘experimental’ or as a ‘trial’ because communities may not like being guinea pigs for a scheme which is ‘novel’ or ‘innovative’ and is therefore not tried and tested.

Some questions, which appear to be similar, can often result in different responses. An example of two questions from York, Survey 27 is:

Do you find that your vehicle has suffered more than acceptable wear and tear due to traffic calming measures?
Result - Yes 53%.

Has your vehicle had to have any repairs as a result of traffic calming measures?
Result - Yes 28%.

It is probable that the ‘wear and tear’ items are suspension/dampers and tyre side walls whereas repairs are confined to exhausts striking the hump or cracked alloy wheels caused by excessive speed over the humps.

5.2 Initial consultation

So far, any consultation process with the public which occurred prior to the implementation of a scheme has not been considered. This sub-section presents findings concerning initial consultations reported in the reviewed literature.

The consultation process may have ‘political’ considerations which are specific to the scheme but these
are not dealt with here. In a review of public attitudes and consultation in traffic calming schemes, Taylor and Tight (1996) noted that the type and format of the public consultation can vary considerably and that the overall acceptability of a scheme ‘does not appear to be straightforward with the least successful consultation resulting in the highest satisfaction rating’. They also noted that the ability to adjust designs was very important if problems were encountered.

Kendrick (1995) reported that it is important that all sections of the local community are consulted, especially any minority groups which may be particularly affected by the measures proposed. The particular client population - pedestrians, children, non-car users - should be identified and their views sought by sample interviews both before and after introducing schemes. It is often possible to accommodate minor alterations without adversely affecting the effectiveness of the scheme.

Initial consultations with the police, emergency services and bus operators are generally constructive but the general public are sometimes very unresponsive to public meetings before the schemes are built. However, they can become very vociferous after the scheme has been built if the measures are regarded as too severe (Goddard, 1996). This sort of problem appears to vary across the country and therefore Local Authorities need to refine their own consultation procedures for the particular area under consideration.

It should be noted that very detailed drawings can be misunderstood by the general public who may assume that the details of the scheme have already been decided (Taylor and Tight, 1996). It is useful if the public are aware of schemes already installed in their local area so that they can make a considered response, especially if a postal consultation is used (York City, 1994).

6 Summary and conclusions

A total of 40 UK and 5 non-UK surveys of public attitudes to traffic calming schemes have been reviewed. Road humps have been installed in increasing numbers since the 1990 Highways (Road Humps) Regulations were introduced in the UK and all but five of the UK references date from 1990 onwards.

Most of the schemes considered were on roads with 20 or 30 mph speed limits. A variety of measures was used, humps being by far the most common, featuring in 30 of the studies.

The survey sample size in most studies was 50 - 500 respondents, with a maximum of 1000. The length and number of questions used in the questionnaires varied considerably, as did the type of survey and types of respondent. Most surveys were carried out within between 3 months and 2 years of scheme installation.

The results can be summarised as follows:

1 The overall percentage of respondents who approved of the schemes, across all the reviewed studies, was 65%. This varied according to the types of measures in the schemes: it was 72% for schemes including road humps; 53% for schemes including speed cushions; 59% (but particularly variable) for schemes including horizontal deflections. The timing of the survey in relation to installation of the measures appeared to have little, if any, effect on approval levels.

2 Surveys which provided direct information on the relative popularity of different measures indicated that round-top road humps were the most popular measure, followed by flat-top road humps, speed cushions, chicanes and mini-roundabouts in descending order.

3 The cost of the schemes varied greatly but this did not seem to influence respondents’ views on whether the locality had improved as a result of a scheme. Schemes with high implementation costs per metre may not be justified unless general environmental improvements are required as part of the works.

4 Comparisons between objective measures of the effectiveness of schemes (where they were made) and public reactions to those schemes indicated that:

i Vehicle speeds were reduced by an average of 8.5 mph, but the average proportion of respondents who thought speeds had been reduced was only 65%.

ii Speed reductions of more than 10 mph were, in all cases, perceived as a reduction by over half of the respondents questioned.

iii Traffic flow levels were reduced by an average of 23%, but the average proportion of respondents who thought flows had been reduced was only 33%.

iv Personal injury accident frequencies were reduced by an average of 63%, but the average proportion of respondents who thought that safety had improved was only 53%.

v There was no linear relationship between changes in mean speeds, traffic flows or accidents and the percentage of people who thought these things had improved.

vi For the few schemes where changes in noise, vibration or pollution levels were monitored, improvements were generally reported. Respondents’ views, however, did not generally reflect this.

5 The usefulness of the results of a questionnaire is determined by the questionnaire design (including the number and type of questions). As each scheme is different a standard questionnaire is not considered appropriate, but examples of questionnaires considered to be good starting points have been indicated.

6 It is important that a questionnaire includes a balance between types of questions, includes the opportunity for comment, and avoids jargon. The wording and order of questions is important, as is the use of prompts.

It should be noted that, for the purposes of the present report, all the surveys have been considered equally robust and the results given equal weighting in terms of scale and robustness.
The main conclusions can be summarised as follows:

- Public attitude surveys to traffic calming schemes are useful in establishing overall approval levels and in identifying the relative popularity of individual measures and any problems associated with them.
- Public attitude surveys cannot be a substitute for objective measures of the effectiveness of a scheme. Perceptions of changes in speeds, flow and safety, which might appear on the face of it to be easy to judge, are relatively poor. This is likely to be largely due to the difficulty in matching judgements to observations in terms of time and location, plus an inherent difficulty in judging vehicle speeds and flows.
- Changes in the environmental measures ground vibration, noise and air pollution are even more difficult to assess subjectively because they are influenced by a greater number of external factors.
- These differences between objective and subjective assessments suggest that the methods of objective measurement should perhaps be reviewed to determine measures that more accurately reflect peoples’ concerns. For example, if measured noise levels have been reduced but people think they have increased, it may be because the noise characteristics have changed.
- Careful survey and questionnaire design are vital in eliciting the information required from respondents. A checklist is given in Appendix C.

7 Acknowledgements

The author would like to thank Mrs M C Taylor, TRL and the officers in the local authorities and all those individuals who provided information given in Appendix A used in this report.

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Appendix A: Public attitude literature reviewed UK

   Location New Forest, Hampshire (B3078, B3079, B3080 and C31)
   Sample 121 residents, 150 local and 151 visitors interviewed
   Measures Gateways, 40 mph roundels, rumble strips/cattle grids
   Installed Spring 1990
   Survey Summer 1992
   Questions 20 questions to residents living in Forest, 18 questions to residents outside Forest & 11 questions to visitors.
   Reaction Overall very favourable. Residents are most enthusiastic (95% approve). Visitors think that it is a good idea (90% approve) but some residents outside the forest are less enthusiastic (84% approve).
   Results Effect on measured speed v perceived effectiveness:
   - Gateway. -2 mph v 6.90 (out of 10)
   - Roundel, sign & slogan. -12 mph (peak) -2 mph (off peak) v 6.71 overall
   - Undulations. -21 mph (peak) -16 mph (off peak) v 6.85
   - Pinch point. +1 mph (off peak) v 7.71
   Cost £300,000

   Location Tavistock village, Devon
   Sample 100 residents interviewed
   Measures Gateways, central islands, centre hatching, extra lighting
   Installed March 1992
   Survey Feb/March 1993
   Questions A total of 15 to ascertain:
   If the changes to the road were noticed
   Problems before calming
   Improvements noted
   Effect on road users
   Overall effects of measures
   Consultation procedure
   Reactions Overall: Nearly half looked on measures favourably.
   Results Mean speeds reduced by 4 mph to 39 mph. Half thought speeds were reduced, half thought not reduced. 86% thought not reduced enough. No before survey. 90% thought measures attractive.
   Cost £6500 = £6.5/metre

   Location 5 sites: 3a) Oxford, 3b) Norwich, 3c) Haringey, 3d) Kensington & 3e) Glasgow
   Sample 417 residents at sites 3a - 3e, 572 drivers at sites 3a, 3c & 3d interviewed
   Measures Round-top humps, 102 mm high
   Installed 1975 - 1977
   Survey 3 months after installation
   Questions Residents (5 sites, 14 questions on speed, safety, measures, traffic). Drivers (3 sites, 9 questions on measures, safety, whether resident or not).
   Reaction Residents, 83% thought the humps served a useful purpose and wanted to keep them. Of 551 non-resident drivers, 71% thought the humps were a good idea but only 58% were in favour of keeping the humps
   Results Measured effect v perceived effectiveness (before to after):
   - Speeds. Reduced 27 to 15 mph v 88% to 30% (thought speeds too fast)
   - Flow. 3866 to 2541 (-34%) v 69% to 35%
   - Noise. 64 dB(A) to 60 dB(A) v 32% to 17%
   - Accidents. 27.9 to 11/yr (-61%) v 67% to 24% (All residents)
   Cost £271 - £718 per hump.
Location 4a) Lytham, 4b) Ventnor, 4c) Rotherhithe & 4d) Winchester
Sample 107 residents (sites 4a - 4c), 473 car + light van drivers (sites 4c & 4d) & 44 HGV drivers (site 4c) interviewed
Measures Round-top humps (76 mm high at site 4a & 102 mm at sites 4b - 4d)
Installed 1977 - 1979
Survey At least 3 months after installation
Questions Residents (3 sites, Questions as Survey 3).
Non-resident drivers (2 sites, Questions as Survey 3 but additional question on whether driver still uses road after humps).
Reaction Residents 73% thought the humps served a useful purpose and wanted to keep them.
Non-resident drivers, 73% were in favour of keeping the humps.
Results Measured effect v perceived effectiveness (before to after):
Speeds. 19 to 14 mph v 77% to 31% (too fast)
Flow. 2412 to 1809 (-25%) v 59% to 39%
Noise. 60 dB(A) to 46 dB(A) v 33% to 20% (Only at 1 site)
Accidents. 5.0/yr to zero (-100%) v 44% to 22% (All residents)
Cost Not stated

Location National
Sample 753 residents postal questionnaires returned (63% of total sent out)
Measures Humps
Installed Not applicable
Survey 1989 approx
Questions National survey. One relevant question. “Should have more humps in built-up areas to discourage speeding”.
Reaction In favour 50%. Effective 38%
Results/Cost Not stated

Location 6a) Exeter, 6b) Maidstone, 6c) Bridgwater and 6d) Worcester Park
Sample 652 residents interviewed
Measures Round-top, flat-top humps, chicanes and narrowings
Installed 1989 - 1990
Survey January/February 1991
Questions Comprehensive questionnaire with 18 questions, on speed, safety, noise, pollution, traffic, benefits, measures.
Reaction Respondents 59% thought traffic was slower, 76% thought they were a good idea near schools and 55%
thought they reduce accidents.
Results Effectiveness v perceived:
Speeds 28 to 16 mph v 58% (Lower)
Flow. 5122 to 4200 (-18%) v 23% (lower) 55% (no change)
Accidents. -38% v 45% (improved) 36% (not changed)
Accident migration. ‘Only shift problem somewhere else’
Actual difference surrounding area a)-5/yr, c)-5/yr and d)+10/yr
v residents perception (problem shifted) a)27%, c)20% and d)40%
Cost 6a) £220,000 = £366/metre 6b) £198,000 = £29/metre 6c) N/A
6d) £168,000 = £13/metre which includes 47 humps + 8 throttles

Location Bowes Incline, Gateshead
Sample 8 residents along road. Postal questionnaire
Measures 21 thermoplastic humps, 57 mm high and 940 mm long
Installed February 1992
Survey May 1993
Questions Short questionnaire. Questions on speed, success of scheme, number of humps and proposed alterations.
Reaction Residents concerned about the close spacing (30 - 40 metres) of humps.
Results Measured effect v perceived effectiveness:
Speeds 29 mph to 20 mph, 88% residents agreed they were successful
Cost £4630 = £5.6/metre
- **Location**: Ashridge Park, Hertfordshire
- **Sample**: 84 non-resident drivers interviewed
- **Measures**: Round-top humps, 100 mm high at 350 metre average spacing
- **Installed**: 1972
- **Survey**: 1974
- **Questions**: Acceptability of the humps
- **Reaction**: In favour 73%, not in favour 17%
- **Results**: Low ground clearance sports car (e.g. Jaguar) drivers thought that humps were too high. Hump crossing speed of 4.3 mph compared with 9.0 mph for other cars. No accidents ‘after’ to deer or vehicles including damage only accidents.
- **Cost**: Not stated

- **Location**: Milton Keynes
- **Sample**: 612 interviews including 575 residents and 37 non-residents
- **Measures**: Six flat-top humps 100 mm high (with ramp gradients of 1:6) including pedestrian crossing points
- **Installed**: Summer 1988, modified in 1990 by making gradients shallower at 1:12
- **Survey**: July 1989
- **Questions**: (1) All respondents; attitude to humps, priority at humps. (2) Drivers/riders; damage to car, awareness of drivers to pedestrians. (3) Bus passengers; any problems and if so what? (4) Hump crossers and non-hump crossers
- **Reaction**: In favour of humps 47%, wanted changes 33%, wanted humps removed 20%. 60% of bus passengers had problems mainly with the bumpy ride. Found to be more acceptable to people who did not use regularly. Results were divided into age bands of 0-4, 5-12, 13-16, 17-20, 21-59 & 60+ which gave some age related effects regarding pedestrian crossing behaviour.
- **Results**: None applicable
- **Cost**: £30,000

- **Location**: Hatch Lane, Windsor.
- **Sample**: 150 residents returned postal questionnaire (38% of total sent out)
- **Measures**: Round-top humps.
- **Installed**: March 1993
- **Survey**: July 1996
- **Questions**: Please tick the box you prefer:
  - Road humps to be retained
  - Road humps to be removed
  - Investigate the introduction of alternative traffic calming measures
  - Additional comments
- **Reactions**: Retain humps 41%, retain humps & investigate other measures 9%, remove humps 19%, remove and investigate other measures 23%, investigate other measures 7%. Of the 42% who wanted the humps removed, 84% were side road residents.
- **Results**: None applicable
- **Cost**: Not stated
Location B1040 through Gamlingay.
Sample Before and after survey of returned questionnaires from 100 residents on the road and local residents affected by the road.
Measures Round and flat-top humps (50 to 100 mm high), narrowings & chicanes.
Installed November 1990
Survey February 1991
Questions (Q1) How do you consider vehicle speeds?
(Q2) How difficult is it to cross the road?
(Q3) How safe do you feel when using the footways?
(Q4) How do you regard traffic noise and pollution?
(Q5) How do you regard general traffic conditions?
(Q6) How difficult is it to find a parking space?
(Q7) How safe are conditions for cyclists?
Reaction (A1) Acceptable 87%
(A2) Not difficult/easy 84%
(A3) Safe/very safe 82%
(A4) Acceptable/not concerned 72%
(A5) Congested/occasionally congested 51% (81% before)
(A6) Difficult/very difficult 46%. (63% before)
(A7) Acceptable/safe 68%.
Results Speeds reduced (average of 4 sites) from 34.6 to 29.0 mph v Speeds were acceptable to residents 9% to 87%.
Flow reduced from 3235 to 2806 (13% reduction) v Traffic conditions 81% thought congested before compared to 51% thought congested after.
Cost Not stated

Location 12a) Southend, Marine Parade.
Sample 748 residents interviewed
Measures Flat-top humps, pelicans and road width reduced from dual to single lanes.
Installed March 1992
Survey September 1992
Questions (Q1) What form of transport do you use on Marine Parade?
(Q2) At what time of the day do you use this road?
(Q3) Did you use this road before the road improvements were made?
(Q4) Why do you think these tables have been put in this road?
(Q5) What changes have you noticed in activity since the speed tables were introduced?
(Q6) Have the speed tables made you change your route?
(Q7) Do you consider this to be a significant inconvenience?
(Q8) Interviewer to note the subjects Age group, sex and whether trader, resident or visitor
Reaction (A4) To reduce speed 84%, pedestrian safety 23%, road safety 14%, restrict traffic flow 3%, improve area 2%, Don’t know 2%
Results Speeds reduced from 28 to 26 mph
Cost £181,000

Location 12b) Hadleigh, Scrub Lane.
Sample 726 residents interviewed
Measures Round-top humps (4 x 50 mm & 13 x 100 mm high)
 Installed September 1991
Survey October 1992
Questions (Q1) Before road humps were introduced in this area, did you think that it was necessary to reduce the speed of vehicles in Scrub Lane?
(Q2) Did you think that it was necessary to reduce the amount of traffic using Scrub Lane?
(Q3) Have you ever been over the humps in Scrub Lane?
(Q4) Have the road humps made you slow down?
(Q5) Would you be happy to travel over road humps if you knew they reduced accidents?
(Q6) Do you think it acceptable to reduce vehicle speeds to improve the environment solely for residents by reducing vehicle speeds?
(Q7) What do you most like about the road humps?
(Q8) What do you dislike most about the road humps?
Reaction Residents like the scheme
Results Average speed decreased by 9 mph
Flow down from 8700 to 3580 (-59%) Accidents reduced from 3 in 11 months before to 0 in 11 months after.
Cost £23,000

Location Riefield Road.
Sample 256 residents. Postal questionnaire
Measures Speed cushions (80 mm high) and raised junction (75 mm high & 1:15 ramps)
Installed September 1994
Survey March 1995
Questions (Q1) Did you support original request for speed cushions in Riefield Road? (Q2) Do you support the scheme now or would you like to see it removed? (Q3) By how much do you feel this scheme has improved safety in your road? (Q4) Do you consider the heights of the speed cushions to be excessive? (Q5) Do you consider that traffic noise has increased due to this scheme? (Q6) Do you think traffic volumes have increased in your road because of the scheme? (Q7) Comments
Reactions Support (before and after calming).
Riefield Road, Before 80% After 80%
Non-treated Roads, Before 31% After 51% After (all roads) 61%
Results Flows.
Riefield Road, Measured -22%. Residents 14% thought increased.
Non-treated Roads, Measured 35%. Residents 69% thought increased. 31% thought that noise had increased. No accidents after installation.
Cost £35,500 = £39/metre

Location Borehamwood, Shenley Road.
Sample Shoppers
Measures Flat-top humps, narrowing of road and horizontal deflection.
Installed February 1990
Survey October 1990
Questions Various questions concerning safety and acceptability of scheme.
Reactions Overall shoppers approved of the scheme.
Results/Cost Not stated

Location Newport (I of W), Pan Estate.
Sample Residents, postal questionnaire
Measures Two-way block paved 75 mm high ramped (1:10 gradient) narrows
Installed June 1993
Survey December 1993
Questions (Q1) Vehicle speeds have been reduced by 18 mph, do you agree Yes/No? (Q2) Vehicle flows have been reduced by 30%, do you agree Yes/No?
Reactions Overall a successful scheme.
Results Speeds reduced from 35 mph to 17 mph, accidents reduced 50%.
Cost £40,000
Location Sittingbourne, Stanhope Avenue.
Sample 223 residents returned postal questionnaire (58% of total sent out)
Measures Two-way block paved, 100 mm high, ramped narrows
Installed August 1989
Survey February 1991
Questions (1) Speeds/flows/noise
(2) Do you drive? More or less than once a week?
(3) Effects of scheme on traffic for pedestrians, parents, cyclists, drivers
(4) Is there a hump DIRECTLY outside your house? Access to property
Results Speeds. Actual 28 to 23 mph, 70% thought reduced. Noise results variable.
Flows. Actual -27%, 16% thought decrease, 58% thought no change.
Pollution. 11% thought it was worse
Cost £43,000

17. Ref. Leicester City Council (1994).
Location Leicester, Eyres Monsell.
Sample 139 residents returned postal questionnaire (41% of total sent out)
Measures Sets of 2 or 3 cushions, 75 mm high, 1600 mm wide & 1:8 ramps
Installed May 1994
Survey November 1994
Questions (Q1) Do you think that the traffic calming has slowed the speed of most cars?
(Q2) Do you find it easier to cross the roads that have been traffic calmed?
(Q3) Do you think that less cars use the roads that have been traffic calmed?
(Q4) Has there been an increase in joy riders using these roads since the traffic calming was installed?
(Q5) Do you think the traffic calming looks reasonably attractive in the street scene (once repairs have been carried out)?
(Q6) Is the traffic calming what you were expecting? If not why?
(Q7) Do you think the traffic calming has been successful? If not why?
(Q8) Do you think the small cushions work as well as the humps which go straight across the road?
(Q9) Would you recommend traffic calming to other people as a way of solving problems of speed, accidents and rat running?
Reactions Residents answers to questions, percentage who agreed:
(A1) Speeds reduced, 71% (A2) Crossing road easier, 71% (A3) Flow reduced, 50% (A4) Joy riding increased, 17% (A5) Street attractive, 43% (A6) Expected humps, 6% (A7) Scheme successful, 46%; Unsuccessful, 43% (A8) Humps work better than cushions, 56%; cushions work as well as humps, 35%.
Results Measured results
Speeds. Mean speeds reduced from 38 mph to 26 mph.
Flows. Overall mean flows of two roads reduced by 16%.
Cost Not stated

Location 18a) Northcourt Road, Abingdon, 18b) The Moors, Kidlington, 18c) Kennington Road, Kennington
Sample Postal questionnaire (18a) Residents, (18b) 220 residents, (18c) 821 residents; Sample was (18a) 70%, (18b) 55%, (18c) 59% of total sent out respectively
Measures Round-top and flat-top humps/zebra crossings (75 - 100 mm high)
Installed 1991
Survey 1992 (1 year after installation)
Questions (Q1) Have speeds, decreased, not changed or increased (Scheme a, b, c)
(Q2) Is road safer, no change or less safe (Scheme a, b, c)
(Q3) Traffic volume (Q4) Traffic noise (Increase, decrease, no change)
(Q5) Safety of different road users (Car, bus, cycle, m/c, child, elderly)
(Q6) Frequency/mode of passing hump (Car, bus, cycle, walk, m/c, goods)
(Q7) Details of respondent (pupil, parent with children, retired, other)
Reactions Speeds (18a) N/A (18b) 32 to 27 mph (18c) 31 to 22 mph
Flows (18a) N/A (18b) -30%, -50% W/End (18c) -25%
Safety (18a) 67% think road is safer (18b) 52% think road is safer
(18c) 59% Satisfied with scheme. Perceived safety improved, elderly 73%, school children 68%.
Results Actual accident reductions 18a) 56%, 18b) 56% and 18c) 70%
At site 18c, 17% thought noise had increased.

Cost 18a & 18b not given. (18c) £65,000 (Mini-rbts, 13 round-top humps, 3 humped zebra crossings and additional humps on adjoining roads. (1.5 km = £43/metre)


Location 12 schemes (19a - 19l), 13 schemes (19m - 19y)
Sample All residents
Measures Round-top humps
19a - 19l (94 x 100 mm, 12 x 75 mm & 9 x 50 mm high)
19m - 19y (17 x 100 mm, 117 x 75 mm & 2 x 50 mm high)
Questions 14 Questions including:- Are you in favour of retaining scheme.
Reactions Residents were 83% to 97% (average of 91%) in favour 1990.
Residents were 11% to 97% (average of 75%) in favour 1994/95.
84% of residents at site 19n thought speeds were reduced.
Results Average mean speeds reduced from 30 to 20 mph at site 19n.
Cost Total £94,000 for 115 humps (7115 metres) £13/metre 1990 schemes.
Note Egerton Road, 19y, 5 humps were removed due to residents (89% were against retaining humps) concern of noise from Heavy Goods Vehicles.


Location 20a) Swann Lane, Cheadle, 20b) Cross Lane, Marple, 20c) Woodsmoor Lane, Woodsmoor, 20d) Regent Road, Heaviley.
Sample 20a) 61, 20b) 65, 20c) 104, 20d) 94 residents returned postal questionnaire which represented 20a) 68%, 20b) 54%, 20c) 47% & 20d) 52% of total sent out
Measures 20a) Round-top road humps (90 mm high)
20b) Flat-top road humps (80 mm high)
20c) Speed tables, flat-top humps, pinch points and priority changes
20d) Humps (90 mm high), chicanes and rumble devices
Survey April - June 1995
Questions (Q1) Do you feel that there was a need for traffic calming on your street?
(Q2) Do you feel that the scheme has reduced a) Vehicle speeds? b) number of vehicles?
(Q3) Do you feel that the scheme has improved the quality of your environment? (Q4) Do you feel the scheme is successful?
Reactions (A4) Overall scheme success 20a) 93%, 20b) 66%, 20c) 56%, 20d) 33%
Results Site Speed mph Residents Environ Scheme success:
20a 29 to 25 90% lower 84% better 93%
20b 38 to 28 80% lower 55% better 66%
20c 38 to 22 71% lower 52% better 56%
20d N/A 49% lower 33% better 33%
Flows. Survey (20c) decreased 2875 to 1650 vehicles/day but only 28% of residents thought the traffic volume had reduced.
Cost 20a) £4,800 = £7/metre 20b) £9,700 = £9/metre
20c) £70,000 = £100/metre 20d) £50,000 = £56/metre

Locations 21a) Cumberland Avenue, Guildford; 21b) Feltham Hill Road, Ashford; 21c) Albert Drive, Woking; 21d) Cleeve Road, Leatherhead

Sample 21a) Residents, 21b) Residents, 21c) Residents, 21d) 220 Residents; Returned postal questionnaires 21d) represented 49% of total sent out

Measures 21a) 75 mm round-top humps, 21b) 100 mm flat-top humps & 1:15 ramps 21c) Two-way chicanes 21d) One-way chicanes

Installed January - August 1991

Survey December 1992

Questions (Typical) (Q1) Do you live in Cumberland Avenue? Yes/No
(Q2) Do you think the road humps are beneficial? Yes/No/Unsure
(Q3) Do you think that vehicle speeds IN THAT PART OF ALBERT DRIVE have Increased/Decreased/not changed/unsure?
(Q4) Since the road tables were introduced do you think that the amount of traffic in YOUR road has Increased/Decreased/not changed/unsure?
(Q5) Do you think that the chicanes have affected road safety IN THAT PART OF ALBERT DRIVE as a pedestrian, parent, pedal-cyclist, motor-cyclist, driver? Safer, less safe, no change, not applicable?
(Q6) Further questions on Effect on car journeys, Effect on bus journeys, Access, parking and noise near tables and whether cyclists use the cycle track (always/sometimes/most times/never).

A short Questionnaire was sent to each business on Albert Drive.

Reactions Approval (beneficial) 21a) 83%, 21b 69%, 21c) 39%, 21d) 18%

Results Speeds
21a) 14.3 mph, reduction 85% thought speeds reduced 21b) 15 mph reduction, 64% thought reduced 21c) 7 mph reduction, 27% thought reduced (60% same) 21d) 3.7 mph reduction, 18% reduced (40% same)

Flows
21a) 40% lower 63% thought lower 36% same 21b) 37% lower 44% thought lower 40% same 21c) 9% lower 12% thought lower 75% same

Accidents
21a) 73% lower 85% thought lower 21b) 84% lower 69% thought lower 21c) 74% lower 46% thought lower 21d) 54% lower 17% thought lower 55% same

Cost 21a) £35,500 = £50/metre 21b) £80,000 = £61/metre 21c) £84,000 = £35/metre 21d) £6,000 = £40/metre


Location 6 bypass demonstration sites (a) Berkhamstead, (b) Dalton, (c) Market Harborough, (d) Whitchurch, (e) Petersfield, (f) Wadebridge

Sample 39 to 360 (22a - 22d) & 42 - 370 (22e -22f). Surveys of residents, businesses, pedestrians and cyclists. 90% of interviews successful but postal questionnaires represented 28% of those sent out.

Measures 22a) 20 mph zone, gateways, humps, chicanes 22b) 20 mph zone, humps 22c) 20 mph zone, humps, chicanes, cushions 22d) 20 mph zone, gateways, humps 22e) Narrowing, very shallow ramps 22f) Humps, segregated facilities

Installed 1993/1994

Survey 1994/1995

Questions Parking, noise, fumes, vibration, crossing, traffic speeds, pavement widths and conditions. Measures considered separately.

Reactions Overall: Changes were better than before, 22a) 53%, 22b) 63%, 22c) 67%, 22d) 78%, 22e) 67% & 22f) 64%

Results See full report for more details

Cost £1.2 - £2 million for complete schemes
Location 23a) Brighton, 23b) Leicester, 23c) Sheffield and 23d) York
Sample 23a) 244, 23b) 244, 23c) 193, 23d) 348. A total of 1029. Returned postal questionnaires represented 41% of total sent out
Measures 23a) Brighton, 20 mph zone, round and flat-top humps, chicanes and narrowings
23b) Leicester, flat-top humps
23c) Sheffield, Nether Edge & Sharrow 20 mph zone, flat-top humps
23d) York, humps, chicanes, cushions
Installed 1992 - 1994
Survey 1993 - 1994
Questions Comprehensive questionnaire. Below is a sample of the Questions.
(Q1) Do the streets have a better appearance?
(Q2) More people walking in the street?
(Q3) Stronger community feeling?
(Q4) Main purpose of your street?
(Q5) Have environmental problems got better?
(Q6) Feel safer crossing your street?
(Q7) Drivers changing route?
(Q8) Drivers more likely to let pedestrians cross?
(Q9) Do humps damage your car?
Some questions were split into age groups
Reaction Residents supported the principle of calming. 23a) 90%, 23b) 73%, 23c) 82%, 23d) 85%.
Results Only reactions stated
Cost 23a) £60,000 = £12/metre, 23b) Worthington Street £180,000 = £1078/metre, 23b) Phase 1, £165,000 = £49/metre, 23c) £245,000 = £47/metre

Location 24a) Sheffield and 24b) York: Foxwood Lane, Tang Hall, Muncaster.
Sample Residents, 72 in Sheffield, 360 in York
Measures Cushions, chicanes, narrowings and humps
Installed 24a) April 1993, 24b) April 1993
Survey 24a) July 1993, 24b) July 1993
Questions Short postal survey, traffic speeds/volumes, safety, noise etc
Reactions (24a) Half thought no change in speeds or safety.
(24b) Most thought speeds were reduced, some concern for cyclists
Results Speeds were reduced by 5 mph in Survey 24a and 11 mph in Survey 24b on average.
Cost £320 - £3400 per pair of cushions
Sample 25a) 759, 25b) 50, 25c) N/A, 25d) N/A, 25e) 262, 25f) Residents
Measures Round and flat-top humps, chicanes and narrowings
Questions 25a) Town centre survey carried out by Transport Executive for Barnsley MBC covering mode of travel, effect of measures, safety, effect on bus passengers, alternative measures 18 questions in total.
25b) Richmond. Acceptability, safety.
25c) Sheffield, Tinsley. Acceptability, safety to road users.
25f) Nuneaton, Camp Hill. Residents unhappy with chicanes.
Reaction Acceptability 25a) 58%, 25b) 96% & 25d) 57% (average 70%).
Results Overall 25a) Speeds reduced 21 to 14 mph, 66% said they were effective.
25b) Speeds reduced from 25 to 16 mph, 56% thought reduced and 42% same. 85% thought the 20 mph zone should be permanent.
25c) Majority views were favourable with pedestrians and children as main beneficiaries.
25d) Speeds reduced 27 to 16 mph, 81% thought reduced, volumes reduced by average of 12%, 58% thought reduced and 40% same.
25e) Speeds reduced 23 to 12 mph. Residents thought 60% (before) and 27% (after) that speeds were major problem. Flows reduced by 42% overall. Flows thought to be a major problem 72% (before) 37% (after). 76% of residents wanted a 20 mph speed limit.
(f) Chicanes removed due to chicanes causing congestion.
Cost Not stated

Location 26a) Crondall, 26b) Gisburn, 26c) Jersey Marine, 26d) Ludford, 26e) Sanquhar, 26f) Tunstall.
Sample 26a - 26c) 100, 26d) 72, 26e) 100 residents interviews, 26f) 25 residents postal questionnaire
Measures Gateways, central islands, centre hatching, rumbles, extra lighting
Average length of scheme 1182 metres.
Installed Various
Survey Various
Questions A total of 15 as Tavistock (Survey No. 2). Tunstall postal.
Reaction Overall: Nearly half looked on measures favourably.
Results Speeds reduced for 26a-f by 7, 3, 8, 4, 3, 10 mph respectively corresponding to respondents who thought speeds had reduced 42, 66, 72, 82, 64, 48% and for 26a-e who thought speeds had reduced enough 34, 36, 44, 62, 52%
Cost 26a) £8500 = £16/metre, 26b) £50800 = £40/metre, 26c) £17600 = £16/metre, 26d) £4300 = £2/metre, 26e) £17100 = £13/metre, 26f) £5700 = £8/metre
Total cost all sites = £104000 = £15/metre

Location York (Various locations)
Sample 750 face to face interviews with York residents
Measures Humps, cushions, speed tables, 20 mph zones, chicanes, mini-rbts
Installed All York schemes installed before 1994
Survey June/July 1994
Questions How often do you travel by car, m/c, bus, taxi, cycle (Choice of 7 answers)
( Abbreviated) Effect of road safety for pedestrians, cyclists, bus users, car users
Types of various measures used in York
Effectiveness of measures used
Locations/heights etc. of measures
Period during installation of measures
Satisfaction with schemes
Future schemes
Any damage to vehicle
Route changing
Reactions 52% satisfied with traffic calming in York
69% think traffic calming improves road safety
71% think it is now safer for pedestrians
Also see Surveys 23 & 24.

**Results**
Percentage believing measures to be effective

<table>
<thead>
<tr>
<th>Measures</th>
<th>Round-top humps</th>
<th>Cushions</th>
<th>Flat-top humps</th>
<th>Chicanes</th>
<th>Mini-rbts</th>
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</thead>
<tbody>
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<td><strong>Percentage</strong></td>
<td>75%</td>
<td>50%</td>
<td>50%</td>
<td>45%</td>
<td>41%</td>
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</tbody>
</table>

**Cost** Not stated

**28. Ref. Webster and Layfield (1993).**

**Location** 35 sites in UK, mainly approaching 30 mph areas
**Sample** Residents reactions given to Local Authority
**Measures** Rumble strips and rumble areas
**Installed** 1987 - 1992
**Survey** No specific surveys carried out
**Questions** None asked
**Reactions** Devices were modified or removed at 11 out of 35 sites due to objections. See also Bexley Site (Ref.Traffic calming in practice, County Surveyor’s Society, 1994).
**Results** Noise was dominant at many sites (see reactions)
**Cost** £500 - £1500 for thermoplastic strip sites and £2500 - £10000 for coarse aggregate sites.

**29. Ref. Webster (1995).**

**Location** Distributor roads at 4 locations: 29a) Woking, 29b) Farnborough, 29c) Windsor & 29d) Watford.
**Sample** Residents reactions given to Local Authority
**Measures** Flat-top humps, chicanes, pedestrian refuges, hatching.
**Survey** 29b) Short postal questionnaire to residents but few replies received by Local Authority
**Questions** None asked
**Reactions** These 4 schemes were generally well received with comments such as: Can the scheme be extended (residents), can we have humps like those in ...(non residents) Some of the public disliked the red colour of one set of humps used but the colour has toned down as it has weathered. Redistribution of traffic at one scheme was thought by the public to be problem but this could not be quantified. Noise and vibration was commented on but it was not found to be a problem at similar sites.
**Results** None stated
**Cost** 29a) £40,000, 29b - 29d) Not given

**30. Ref. Wheeler et al. (1996).**

**Location** A49 Craven Arms, Shropshire.
**Sample** 200 residents interviewed
**Measures** Gateways, painted roundels, speed cushions, pedestrian refuges, patches of red surface.
**Installed** May 1995
**Survey** September 1995
**Questions** Problems before installation Photographs of measures used to assist respondents Safety of road users, speeds, noise, vibration, fumes
**Reactions** Mini-roundabouts disliked by 80% (Priority unclear, vehicle speeds).
**Results** No accidents (5 months).
Noise and vibration. Considerably worse for people near cushions but not borne out by measurements. Isolated noise at night could be reason for discrepancy. Speeds reduced by about 8 mph, respondents agreed that speeds were reduced (74)% and 49% thought they were reduced enough.
**Cost** £80,000
Location A47 Thorney, Cambridgeshire.
Sample 199 residents interviewed
Measures Gateway, chicane, mini-rbt, speed camera, part-time 20 mph sign.
Installed May 1995
Survey November 1995
Questions Problems before installation
Photographs of measures used to assist respondents
Safety of road users, speeds, noise, vibration, fumes
Reactions 26% satisfied with scheme
Photos of measures used to assist respondents
Gateway 2.61, Narrowing 2.31, Chicanes 2.06, Mini-rbt 1.58 (out of 4)
Results Average speeds reduced by 9 mph, 61% thought reduced but 24% thought reduced enough. Noise reduced by 4 dB(A) in village (daytime), 82% thought there had been an increase. Vibration was ‘quite high’ and 82% said house shook when an HGV passed. Accidents reduced by 20% and 40% of respondents thought road safer.
Cost £486,000

Location 32a) Abingdon Road, Oxford; 32b) Burntwood Lane, L B of Wandsworth and 32c) Cricket Road, Oxford
Sample 32a) 61 cyclists, 32b) 41 cyclists and 32c) 54 cyclists
Measures 32a) A narrowing with bypass, 32b) Chicane with bypass, 32c) Narrowing
Installed 32a) April 1988, 32b) March 1994, 32c) April 1994
Survey November 1994
Questions Purpose and estimated distance of journey
Likes/dislikes of section of road
Behaviour of motor vehicles
Safety/cyclist behaviour at narrowing
Whether measures were an improvement
Reactions Cycle lane was popular, 32a) 33%, 32b) 59% and 32c) N/A.
Threat at narrowing was a concern 32a) 57%, 32b) 24% and 32c) 46%.
Nearest vehicle in narrowing causes no problem, 32a) 72%, 32b) N/A and 32c) 75%.
Road improved 32a) 57%, 32b) 85%, 32c) 51%
Results/Cost Not stated

Discussion at TRL chicanes seminar 16/3/94.
Surveys in which public opinion was mentioned were:
Location 33a) Braemer Road, Gosport; 33b) Budshad Road, Plymouth; 33c) Cleeve Road, Leatherhead; 33d) Albert Drive, Sheerwater.
Sample Various
Measures 33a) Half carriageway buildouts, 33b) Two-way working, 33c) One-way working, 33d) Two-way working and raised roundabout.
Installed 1991 - 1993
Survey Various
Questions Various
Reactions 33a) The public wanted the buildouts replaced with road humps.
3b) Favourable reaction from residents. Speeds and accidents reduced.
A disadvantage is the loss of parking.
33c) Local people (69%) think that the scheme is a waste of money and they prefer humps. Bus passengers (30%) thought journeys were less comfortable. (See Survey 21d for more detail)
33d) The scheme is perceived as a success. (See Survey 21c for more detail)
Results/Cost Not stated
Location Local Authority schemes in UK.
Sample Comments to Local Authorities
Measures Chicanes and buildouts
Installed Dates not given
Survey None carried out
Questions No specific questions
Reaction Cars which hit buildouts/marker posts are a concern.
Hazards during darkness and bad weather.
Priority signing at chicanes.
Visual intrusion and loss of parking spaces.
Congestion and safety concerns.
Most of the above could not be quantified.
Results Not stated
Cost Minimum of £400 and maximum of £8150 per chicane

Location Various
Sample Residents affected by traffic calming.
Measures All traffic calming measures
Installed Before 1992
Survey Before 1992
Questions General questions
Reactions Residents were 80% in favour & 2% totally against traffic calming. Businesses, 68% in favour & 13% opposed.
Car drivers 66% in favour & 11% against. Emergency services were divided.
Results Not stated
Cost Round-top humps, £500 - £1,000 each. Flat-top £4,000 - £12,000 each.

Location Nelson, Lancashire.
Sample 160 & 189 residents interviewed
Measures Area wide scheme including pedestrian crossings, roundabouts, street closures and parking bays.
Installed June 1985
Survey July 1985 & November 1986
Questions 39 questions not given. Non-English residents had an interpreter present
Reactions Approve of scheme; 65% in July 1985 & 74% in November 1986
Roundabouts were very polarising with 12% & 33% being very unhappy in July 1985 & November 1986 but 13% and 33% being very happy.
Results Accidents reduced by 15%.
Cost £406,000

Location Wrexham, Queen’s Park 20 mph Zone
Sample Residents
Measures Humps, cushions, narrowings and mini-roundabouts
Installed April 1995
Survey Public meeting after scheme implemented
Questions None given
Reactions Generally supportive but reaction against cushions on Queensway was very vociferous. Cushions replaced with flat-top humps. Mini-roundabout was unpopular. No adverse comments after modifications to scheme.
Results/Cost Not stated/£200,000
Location Camden, Calthorpe Street area 20 mph Zone
Sample Before 85 residents & after 58 residents.
Measures Humps and road closures.
Installed Early 1994
Survey Before installation October 1993, after installation June 1994
Questions A seven box system was used which had ‘positive’ or ‘good’ values on the right (eg safe, clean) and ‘negative’ or ‘bad’ values on the left (eg unsafe, filthy) as follows:
What do you feel about Air Quality in your Neighbourhood?
Clean
Filthy
Reactions Generally perception that safety improved but noise and pollution were worse. Seven box system used for questionnaire with ‘positive’ or ‘good’ value on the right.
Noise, 12% thought it had increased. Based on changes of box 1-3 markings ‘before’ to ‘after’
Pollution, 2% thought it had increased.
Results/Cost Not stated

Location Huyton, Hillside Estate
Sample Residents
Measures Speed humps/tables, 20 mph zone, road closures & realigned road
Installed 1993 approx
Survey Not stated
Questions Weighted system for traffic calming surveys. Asked to grade on line from zero to 100 with 50 as no change.
Reaction 64% of residents approved of the scheme.
Results/Cost Not stated

Location 13 estates in a Local Authority which was not specified
Sample 601 residents returned questionnaires in postal survey
Measures Narrow carriageways, shared surfaces, pinch points, rumble strips as recommended by Design Bulletin 32. (DOE & DOT, 1977)
Installed 1970 - 1979
Survey At least 12 months after installation
Question Satisfaction of residents with estate appearance:-
Reaction 63% of residents satisfied with appearance of the estate.
Results/Cost Not stated
### Appendix B: Selected examples from outside UK

#### 41. Australia (Hawley et al, 1993)
Various schemes are discussed in this Australian practitioners manual. The more important are summarised briefly below:

<table>
<thead>
<tr>
<th>Location</th>
<th>41a) City of Stirling, Light Street, a residential street (C53)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample</td>
<td>Residents and motorists</td>
</tr>
<tr>
<td>Measures</td>
<td>Humps (100 mm high round-top)</td>
</tr>
<tr>
<td>Installed</td>
<td>c1981</td>
</tr>
<tr>
<td>Survey</td>
<td>After 3 months</td>
</tr>
<tr>
<td>Questions</td>
<td>Not given</td>
</tr>
<tr>
<td>Reactions</td>
<td>75% of residents found humps satisfactory and wanted them to be retained 80% of residents in surrounding streets were opposed to the humps and 20% of motorists thought that they should be retained.</td>
</tr>
<tr>
<td>Results</td>
<td>Mean speeds reduced from 38.2 mph to 17.2 mph (average of between and on measure. Humps removed and bus route reinstated.</td>
</tr>
<tr>
<td>Cost</td>
<td>Not stated</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location</th>
<th>41b) East Hornsby, Sydney (C10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample</td>
<td>Residents</td>
</tr>
<tr>
<td>Measures</td>
<td>Offset carriageway and recessed parking</td>
</tr>
<tr>
<td>Installed</td>
<td>1986 -1987</td>
</tr>
<tr>
<td>Survey</td>
<td>May 1989</td>
</tr>
<tr>
<td>Questions</td>
<td>Has there been change in the amount of through traffic in your area since the LATM scheme? (Total of 15)</td>
</tr>
<tr>
<td>Example</td>
<td>Much less Slightly less No change Slightly more Much more</td>
</tr>
<tr>
<td>Reactions</td>
<td>17% overall approval</td>
</tr>
<tr>
<td>Results</td>
<td>No effect on traffic volume (0% change) 14.3 mph mean speed reduction</td>
</tr>
<tr>
<td>Cost</td>
<td>Not given</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location</th>
<th>41c) Philip Street (B256)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample</td>
<td>Residents</td>
</tr>
<tr>
<td>Measures</td>
<td>Tight configurations, flat-top humps</td>
</tr>
<tr>
<td>Installed</td>
<td>1991</td>
</tr>
<tr>
<td>Survey</td>
<td>Not given</td>
</tr>
<tr>
<td>Questions</td>
<td>Full evaluation, but not given in manual</td>
</tr>
<tr>
<td>Reactions</td>
<td>Residents acceptance of the scheme at 89%</td>
</tr>
<tr>
<td>Results</td>
<td>Heavy vehicles eliminated</td>
</tr>
<tr>
<td>Cost</td>
<td>$70,000 for measures, scheme total of $450,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location</th>
<th>41d) Gold Coast, Queensland (B49)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample</td>
<td>Residents</td>
</tr>
<tr>
<td>Measures</td>
<td>Round-top humps at a spacing of 200 metres</td>
</tr>
<tr>
<td>Installed</td>
<td>Not given</td>
</tr>
<tr>
<td>Survey</td>
<td>Not given</td>
</tr>
<tr>
<td>Questions</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Reactions</td>
<td>The humps were removed at the request of local residents.</td>
</tr>
<tr>
<td>Results</td>
<td>Drivers chose to use severe acceleration and braking indicating a lack of acceptance by drivers.</td>
</tr>
<tr>
<td>Cost</td>
<td>Not given</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location</th>
<th>41e) Various (B25)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample</td>
<td>Residents</td>
</tr>
<tr>
<td>Measure</td>
<td>Road closures</td>
</tr>
<tr>
<td>Installed</td>
<td>Various</td>
</tr>
<tr>
<td>Survey</td>
<td>Various</td>
</tr>
<tr>
<td>Questions</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Reaction</td>
<td>Can split a community unless they are overwhelmingly supported</td>
</tr>
<tr>
<td>Results</td>
<td>Should not be scattered ‘randomly’ around an area otherwise residents will not be able to understand the system and closures</td>
</tr>
<tr>
<td>Cost</td>
<td>Not given</td>
</tr>
</tbody>
</table>
Location 41f) Mosman, NSW (B62)
Sample Residents
Measures Angled slow points
Installed Not given
Survey Not given
Questions Not given
Reaction Approved of by residents but non-resident drivers objected strongly to the installation
Results/cost Not given

Location 41g) Various (B12)
Sample Residents
Measures Roundabouts
Installed Various
Survey Various
Questions Not given
Reaction High acceptance was reported generally but it was less so in smaller rural townships. There was some confusion at mini-roundabouts sometimes by elderly drivers and also by drivers who abused the roundabout.
Results/cost Not given

42. Denmark (L. Herrstedt, 1992)
Location Vinderup, Skaerbaek, Ugerlose, environmentally adapted through roads.
Sample Residents and motorists
Measures Gateways, chicanes and rumble devices.
Installed 1984 - 1985
Survey September 1985
Questions Speed, measures and speed limits.
Reactions Of car drivers (52%) approved of the schemes. Residents were generally all positive regarding the schemes
Results Overall successful
Cost £800,000

43. Israel (Zaidel et al, 1992)
Locations Urban streets
Sample Various
Measures Traffic calming including humps
Questions Various
Reactions Can vary with time as countries install more traffic calming.
Result Poses the question as to the degree and usefulness of public opinion surveys with regard to level of approval.

44. USA (Gorman et al, 1989)
Location City of Omaha.
Sample 147 returned postcards
Measures Road humps (100 mm high round-top)
Installed 1982 - 1986
Survey 1986 - 1987
Questions Not given
Reactions 82% in favour of the humps and 18% were against. Survey showed that speed humps are very polarising.
Results Speed reductions (85%) were quite small, up to 6 mph (average of 2.3 mph) and after speeds were in the range 31 to 37 mph (10 sites)
Cost Not stated

45. Austria (Wernperger and Sammer, 1995)
Location Graz
Sample Residents
Measures 30 kph in side streets and 50 kph in priority streets
Installed Public discussion started in 1990, trial started at end of August 1992.
Questions Attitudes to the 30 kph limit
Reactions Approval rates 56%, 64%, 44%, 60%, 72 and 77% respectively.
Results Attitudes to accidents, noise, congestion and exhaust gases taken in June 1992, October 1992, March 1993 and June 1994. Accidents (fall) 62%, 54%, 68% and 71%, noise (increase), 31%, 20%, 19% and 34%, congestion (increase), 68%, 37%, 26% and 32%, exhaust gases (increase), 52%, 43%, 31% and 24%.
Cost Not stated
Appendix C: Checklist of issues to consider in questionnaire compilation

<table>
<thead>
<tr>
<th>Issue</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method of questioning</td>
<td></td>
</tr>
<tr>
<td>Interview</td>
<td>Advantage: Detailed questions can be asked</td>
</tr>
<tr>
<td></td>
<td>Disadvantage: Cost</td>
</tr>
<tr>
<td>Postal</td>
<td>Advantage: Cost may be less than for a face to face interview</td>
</tr>
<tr>
<td></td>
<td>Disadvantage: May be less representative due to low response rate</td>
</tr>
<tr>
<td>Telephone</td>
<td>Advantage: Immediate response</td>
</tr>
<tr>
<td></td>
<td>Disadvantage: No photographs can be shown (see below)</td>
</tr>
<tr>
<td>Road user group</td>
<td>If the scheme is aimed at assisting particular groups, are specific questions required for the group?</td>
</tr>
<tr>
<td></td>
<td>a) Pedestrians; with mobility problems? children? all pedestrians?</td>
</tr>
<tr>
<td></td>
<td>b) Cyclists?</td>
</tr>
<tr>
<td></td>
<td>c) Residents?</td>
</tr>
<tr>
<td></td>
<td>d) Emergency services?</td>
</tr>
<tr>
<td></td>
<td>e) Bus operators/passengers?</td>
</tr>
<tr>
<td></td>
<td>f) Motorists?</td>
</tr>
<tr>
<td></td>
<td>g) All general public including non-local motorists?</td>
</tr>
<tr>
<td>Photographs</td>
<td>Photographs of ‘before’ and ‘after’ installation are useful to ensure that respondents are considering the correct section of road. Very important for large schemes or if the environment was enhanced.</td>
</tr>
<tr>
<td>Effectiveness</td>
<td>The perceived effectiveness will depend on the respondents’ expectations. Before and after attitude surveys would therefore be useful but would double the cost of monitoring and would only be worthwhile for innovative schemes.</td>
</tr>
<tr>
<td></td>
<td>Is the effectiveness the same for all types of vehicles?</td>
</tr>
<tr>
<td></td>
<td>Prompts may be required if specific information relating to cars, buses, goods vehicles, bicycles and motorcycles is wanted.</td>
</tr>
<tr>
<td>Safety</td>
<td>The safety of the scheme should be considered because it may be that pedestrians or cyclists felt very vulnerable before the scheme was implemented but it did not show up in the accident statistics. This could lead to the effect ‘risk compensation’ in which they may feel safer afterwards and take less care.</td>
</tr>
<tr>
<td>Feedback</td>
<td>This can be considered to be the most important part of any survey because it allows the Local Authority to analyse comments from the respondents and then to:</td>
</tr>
<tr>
<td></td>
<td>a) Consider if the comments are justified</td>
</tr>
<tr>
<td></td>
<td>b) Adjust the scheme if required</td>
</tr>
<tr>
<td></td>
<td>c) Review any adjustments made and add to local knowledge</td>
</tr>
<tr>
<td></td>
<td>d) Share experiences with others in the same field</td>
</tr>
</tbody>
</table>

1All methods of questioning can be susceptible to vociferous people who are against the scheme.
**Abstract**

Traffic calming has proved to be an effective way of reducing vehicle speeds and accidents. The public generally approve of the concept of traffic calming and they often petition their local highway authority to have calming installed.

This report reviews the published literature describing 45 studies (40 UK, 5 Non-UK) of public attitudes to traffic calming schemes after installation. It gives details of the survey techniques and the types of questions used, together with the results obtained. It also compares the measured effectiveness of the calming schemes with the public assessments of changes in vehicle speeds, traffic flow, accidents, noise, vibration and pollution, to determine to what extent there is agreement between them.

**Related publications**

| TRL312 | Traffic calming - speed cushion schemes by R E Layfield and D I Parry (In preparation) |
| TRL313 | Traffic calming - an assessment of selected on-road chicane schemes by I A Sayer, D I Parry and J K Barker. (In preparation) |
| TRL241 | Cyclists at road narrowings by D G Davies, T J Ryley, S B Taylor and M E Halliday. 1997 (price code I, £32) |
| TRL238 | Traffic calming on major roads: the A47 trunk road at Thorney, Cambridgeshire by A H Wheeler et al. 1997 (price code L, £40) |
| TRL215 | Review of traffic calming schemes in 20 mph zones by D C Webster and A M Mackie. 1996 (price code E, £20) |
| TRL186 | Traffic calming - road hump schemes using 75 mm high humps by D C Webster and R E Layfield. 1996 (price code H, £30) |
| TRL212 | Traffic calming on major roads: the A49 trunk road at Craven Arms, Shropshire by A H Wheeler et al. 1996 (price code L, £40) |
| TRL180 | Traffic calming: vehicle noise emissions alongside speed control cushions and road humps by P Abbott et al. 1995 (price code H, £30) |
| TRL182 | Traffic calming - four schemes on distributor roads by D C Webster. 1995 (price code E, £20) |
| TRL177 | Traffic calming - vehicle activated speed limit reminder signs by D C Webster. 1995 (price code E, £20) |
| TRL174 | The environment assessment of traffic management schemes: a literature review by P G Abbott et al. 1995 (price code L, £40) |
| PR101 | Speed at ‘thumps’ and low height road humps by D C Webster. 1994 (price code G, £28) |
| PR33 | An assessment of rumble strips and rumble areas by D C Webster, R E Layfield. 1993 (price code J, £35) |
| PR18 | Road humps for controlling vehicle speeds by D C Webster. 1993 (price code J, £35) |
| PR14 | Public attitude survey - the New Forest traffic calming programme by R Windle and A R Hodge. 1993 (price code E, £20) |
| CR298 | Survey on public acceptability of traffic calming schemes by R Windle and A M Mackie. 1992 (price code C, £15) |
| CR234 | Perceived effectiveness and favourability towards some road accident countermeasures: a national survey by A Quimby and R Glendinning. 1990 (price code B, £15) |

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