Gloucester Safer City: Final report

Prepared for Road Safety Division, Department for Transport

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TRL Report TRL589
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Introduction

‘Gloucester Safer City’ is the title given to a major road safety initiative taken in 1996 by the Department for Transport (DfT). The purpose was to demonstrate to highway authorities that road accidents and casualties in urban areas can be substantially reduced if significant funds are made available and towns are treated using safety engineering in a strategic manner, but also with safety integrated into other town policies and activities.

£5m was provided through the Local Roads Capital Settlement and the DfT invited local authorities to bid for this opportunity to carry out the demonstration project. The city of Gloucester was selected from 29 authorities who submitted bids. TRL was contracted to offer assistance in the development of the project and to monitor and evaluate its results.

This report presents the main evaluation of the project and describes how it developed, how the monitoring was carried out and what the outcomes were. It also describes the management processes involved.

The project began in April 1996 and was completed in March 2001. A further year was allowed for the assessment of effects.

There were essentially five ‘Safer City’ objectives:
- Accident/casualty reductions through managing the road network in a comprehensive way.
- Understanding the effects of measures/schemes.
- Understanding the management processes.
- Allowing other towns to see the safety benefits of an integrated approach.
- Ensuring understanding (learning from successes achieved and mistakes made) of the processes required to implement a strategic approach.

The safety aims of the project were to be achieved through traffic management measures, physical engineering measures, land use measures, enforcement, publicity, education and training, with a particular focus on the use of Urban Safety Management (USM). Urban Safety Management is an approach to the reduction of road casualties in urban areas which was developed in the 1980s through TRL’s Urban Safety Project. Methods of implementing the approach are outlined in the Institution of Highways and Transportation’s ‘Guidelines for Urban Safety Management’.

USM looks at travel patterns and attendant implications across the whole urban area and aims to reduce accidents by:
- Defining the appropriate road hierarchy.
- Managing traffic on to the right roads.
- Managing the speed of traffic so that it circulates at a more appropriate speed and more safely.
- Co-ordinating all work that influences road safety in the pursuit of objectives for the whole urban area.

The intention of the ‘Safer City’ initiative was to demonstrate the value of applying these principles in a medium sized town that was typical of its kind.

To assist in monitoring safety benefits, ‘control’ towns were also selected, and these have been used to compare the effect on safety of Gloucester’s Safer City Project with that of the normal efforts of local authorities to reduce accidents.

The Safer City Project had a multi-layered management structure which fell broadly into five groups: Steering Group, Safer City Forum, Technical Group, Project Team and was headed by the Gloucester City and Gloucestershire County Councils. The Technical Group was supported by five working groups.

Following the analysis of the traffic and safety problems, remedial actions were considered and plans made for local safety schemes in the city. The strategy was published in ‘A Strategy for the Gloucester Safer City Project’ in 1997 which was updated in 1998 in a second publication ‘Gloucester Safer City Project - a mid-term report’.

An important element of USM is to manage speed to achieve a safer circulation. Such speed management was attempted in Gloucester both by engineering measures and by increased enforcement through additional police checks. A partnership between the police and the Safer City Project was put in place to develop comprehensive enforcement of speed limits using mobile and fixed site detection, partly through speed cameras funded by the Safer City Project.

Considerable monitoring was required to demonstrate whether the Safer City Project objectives were achieved. Accident and casualty numbers were clearly the major indicators but the speeds and flows of traffic across the road network, environmental effects and the changes in public awareness and opinions were also important.

Overall project conclusions

The results from the project are detailed below. In summary the overall conclusions that can be drawn from the project are:
- The project was very successful in achieving its objectives.
- Injury accidents and casualties showed good reductions, particularly for those in the fatal and serious categories.
- Speeds were substantially reduced in areas where speed management measures were installed, and even in non-treated areas small reductions occurred.
- Most engineering treatments used were very effective in reducing accidents.
- Environmental effects of the project were generally not negative. At the end of the project air quality had improved but this was not necessarily as a result of the traffic management. Traffic noise also generally declined in treated areas because of lower speeds and less traffic, but there were a few sites where noise and vibration from heavy goods vehicles increased and were considered by residents living near road humps to be a nuisance.
Public opinion about the project was largely positive but there was also strong opposition to the project or some of its schemes from some members of the public. Public consultation was therefore seen as a very important part of the project. Much effort was necessary to achieve schemes that were acceptable to the public. Acceptance of innovative and radical measures is difficult to gain in the short term and can probably only be achieved over a long time span, where education and consultation are both necessary. One of the principles of Urban Safety Management is to achieve a ‘safer distribution’ of traffic. In older road networks this can be achieved by road closures, pedestrianisation and banned movements or by discouraging measures on unsuitable routes e.g. traffic calming, bus lanes, signal timings etc. The project achieved a considerable amount of traffic re-distribution, but this aspect of the USM approach proved to be one of the most difficult for which to gain public acceptability.

Managing the integrated approach demanded by USM was a challenging part of the project involving political support, public support and co-ordinated working. Various groups needed to be set up to encourage an integrated approach. In this regard a broadly agreed safety strategy was vital to maintain consistency and focus and should be the main guiding principle when Urban Safety Management is adopted.

Results

Accidents

The project was successful in reducing accidents. However, calculating the precise size of the reduction due to the project is complicated by the fact that there was an increase in the rate of reporting of accidents in Gloucester, raising the question of how many accidents there would have been if the project had not been done. This increase was estimated to be about 10% over the period of the project.

Injury accidents in 2001 (the first year after completion of most of the project) were compared with the annual average for the five years before the project started (1991 to 1995). The change was a reduction of 9.5 per cent, but in the control towns there was an increase of 8.6 per cent, representing a net reduction in Gloucester of 16.7 per cent, compared to what would have occurred had Gloucester’s accidents increased at the rate of the control towns. An increase in the proportion of injury accidents reported to the police in Gloucester may mean this could be an underestimate of the accident reductions, the implied overall net reduction being around 24 per cent.

For fatal and serious accidents the reduction in Gloucester was 48.1 per cent while in the control towns the reduction was 17.7 per cent, representing a net reduction for Gloucester of 36.9 per cent compared to what would have occurred had Gloucester’s fatal and serious accidents decreased at the rate of the control towns.

All road user groups appear to have benefited from the project apart from cyclists for whom there was an increase in accidents.

Accidents at sites which received engineering treatment were reduced, on average, by 38%. From the analyses it has also been possible to estimate the non-engineering effect of the project. This can be defined as the overall effect of the project on accidents, excluding the direct effect of engineering treatments. This effect can be assumed to include the effects of a general increase in awareness in Gloucester resulting from greater education, publicity and enforcement. It includes an element of speed reduction achieved through this increased awareness, rather than as a direct result of safety engineering measures on treated sites. The resulting estimate of the non-engineering effect shows that of the 24% overall reduction in injury accidents for the project as a whole, 7% came from by the non-engineering effects.

Speed

A main focus of the project was better management of speed and enforcement of speed limits. Where safety engineering measures to reduce speed were introduced (for example traffic calming), large reductions in 85th percentile speeds of up to about 12mph (from 34.8mph to 22.3mph) were achieved.

There were 11 permanent monitoring sites installed to give a general indication of speed changes in Gloucester. Some of these sites had engineering treatment and some did not. In the majority of cases the mean speeds have decreased year on year. The average for all sites was a reduction of about 3mph (about 10 per cent) between 1997 and 2001. Even at sites with no treatment there were small but significant decreases of about 1mph. Driving cycle data (using an instrumented car) gave a similar result showing that mean speeds in the city decreased gradually between 1996 and 2000, the overall reduction in mean speed being 3.2mph.

A parameter shown to be associated with the risk of accident is the percentage of drivers exceeding the speed limit. By the end of the project, at most of the monitoring sites, there was a substantial reduction in the percentage of drivers exceeding the speed limit. The average percentage exceeding the speed limit reduced from 38% to 24% between 1997 and 2001.

Traffic flow changes

Traffic flows were monitored mainly using permanent loop counter sites. Flow levels in 2001 were lower than 1997 by just under 2%. Data from counts in Cheltenham (used as a control town) also indicated a 2% reduction.

The new road hierarchy required some traffic redistribution onto more suitable routes. In particular, Cheltenham Road and Barton Street were intended to take less traffic and Metz Way more. The project was successful in achieving some re-distribution of traffic in the direction desired.

The effect on traffic distribution of traffic calming a large area was examined in Longlevens, where a large network of mostly residential roads was traffic calmed. Traffic calming in Longlevens had the effect of reducing flows on roads where substantial amounts of traffic calming measures, including vertical deflection, had been installed. Roads with very limited traffic calming such as
build-outs saw minor increases indicating that motorists will make attempts to avoid the more severe traffic calming measures if alternative routes are available.

Environmental effects
Total emissions of CO (carbon monoxide), VOC (volatile organic compounds) and NOx (nitrogen oxide) were substantially lower in 2001 than in 1996. However, there were no significant differences between the changes in traffic emissions on links where traffic management measures had been introduced and the changes on unchanged links. The one exception being on a street which was pedestrianised. The most important and pervasive effect on traffic emission levels was the gradual introduction of catalyst-equipped petrol vehicles although improvements in fuel quality probably contributed to some improvements in air quality, notably reductions in concentrations of benzene.

The general reductions in emissions of some of the pollutants about which there are health concerns, CO2, HC (hydrocarbons), and NOx, coincided with generally good or improving roadside air quality. By 2001 the majority of the sites had seen a reduction in NOx (nitrogen dioxides) concentration to below the national Air Quality Objective. Mean PM10 (particulate matter <10 microns) concentrations during the survey periods were below the Air Quality Objective of 40 µg/m³ (annual mean of daily values) throughout the study.

The noise from light vehicles was reduced at each of the monitoring sites following the installation of the various traffic calming measures. Mean heavy vehicle noise increased slightly at all of the monitoring sites, except alongside a speed cushion, despite decreases in mean vehicle speeds generally comparable with those for light vehicles. For some vehicles, increased body noise (ie. suspension noise and body rattle etc) may also have contributed to the maximum pass-by noise level.

High level noise events (i.e. >80 dB(A)) were logged at a speed cushion site and alongside a junction table. In both cases the number of these events decreased following installation.

The management process
The management structure established in Gloucester was effective in delivering a successful programme. The Safer City programme adopted a partnership approach involving local stakeholders (local residents, members of the public, members of the councils, police, transport operators, emergency services), as well as TRL, who acted in a consultation role.

The initial setting up of the project was satisfactorily completed, with a wide range of technical groups set up so that the various activities of the local authorities could be integrated. However, the initial impetus for such an integrated approach was difficult to manage, maintain and co-ordinate and was less successful than it might have been. There was a tendency for staff to focus on their own specialities and responsibilities. A finding of the project must therefore be that managing the integrated elements of Urban Safety Management is probably the most difficult aspect of applying the approach.

The process was a complex one requiring management of the development of strategy, implementation and public perceptions. It gained from enthusiastic staff and the use of a range of skills within the project team.

Public opinion and attitudes
Questionnaires to both residents and business asked respondents whether they felt road safety had improved in Gloucester during the past five years. In both cases a positive response was recorded with nearly two thirds of local residents and a half of businesses feeling that road safety had improved although business respondents considered safety issues of less importance than residents did.

The residents’ survey found speeding, congestion, parking problems and poor driving standards to be the biggest problems. The business survey found congestion, staff parking and delivery parking to be the biggest problems. Encouragingly, nearly all of the various issues respondents were asked to rate are perceived as less of a problem in 2001 than when the project began in 1996.

Specific aspects of the project were also rated more highly than at the beginning of the project. The highest ratings were in respect of speed cameras (83% rated favourably) and the associated signs and posters, followed by cycle lanes, bus lanes and speed humps (52%). Speed cameras were perceived as a more effective measure to curb speeding than speed humps. Overall the changes made towards improving safety in Gloucester have been recognised by the general population.

Public consultation
The process of carrying out public consultation has shown that the resulting ‘dialogue’ has played an important part not only in increasing acceptance of the measures required, but also in changing the underlying culture relating to the need for road safety measures. There is a need to bring the public in earlier in the planning stage so that they do not feel that decisions have already been made. In some cases individual respondents felt that it took too long to respond to their comments.

Although effective public consultation can be time-consuming, it is vital to achieving greater acceptance and satisfaction with the final outcome. There can be a tension between the time taken to build consensus, and the desire of many of the parties to move on with the work.

Radio was used to a considerable extent but did not feature much in respondents’ recall of how they had received information. Radio can be used to good effect, especially if targeted to groups who are most likely to rely on verbal communication. Exhibitions did not reach a large proportion of residents but they were nonetheless highly valued by the most interested and concerned. Their design and venue choices could perhaps be improved.

Feedback, was an important part of the project team’s work, replying to all those who sent back questionnaires with comments.
Increasingly, road safety and traffic management initiatives are seen as requiring Social Science and Engineering skills in order to develop and implement schemes which are both effective and acceptable. As a very innovative project, the Safer City initiative had a special need for this skills combination.

**Progress and targets**

Overall, achievement against the stated objective did progress steadily, albeit somewhat delayed. This tended to reflect the delays inherent in establishing such a complex project and co-ordinating the inputs of all the various parties. Inevitably there has not been 100% achievement of the overall objective. However substantial progress has been made within all sectors.

Some aspects have been delayed. The most delay initially occurred in the engineering sector, which involved the implementation of the various safety engineering measures. This reflected the additional work that was required in some of the areas to refine the designs as a result of the consultation process.

Other important supporting elements, particularly education and enforcement have shown the widest variation in achievement. This in part reflects the wide ranging nature of the project and the desire to involve other agencies (police and health) over which the project had no direct control.

Also with a relatively small project team, the effort required to maintain the implementation programme and keep all the interested parties involved over a sustained period inevitably resulted in some sectors being given less importance.

Despite this, improvements can be seen by the continued increase in achievement of all sectors.

Management of a city-wide, integrated and strategic approach to safety proved to be a complex and difficult task. It had been recognised that it was this difficulty, rather than any technical difficulties, that had deterred widespread implementation of Urban Safety Management in the past. The processes adopted in Gloucester, particularly in relation to public consultation and public involvement in decision making, meant that these difficulties were overcome and a successful USM project was achieved.

**The way forward**

One result of the project has been to identify the need to revise the original Urban Safety Guidelines, first produced by the Institution of Highways and Transportation (IHT) in 1990. The new guidelines have been produced by TRL in conjunction with IHT and the Department for Transport and develop the lessons from Gloucester into a structured approach which can be used by any local authority.
1 Introduction

In 1996, the Department for Transport (DfT) embarked on a ‘Safe Town’ initiative, to demonstrate that it was possible to substantially reduce road accidents and casualties. This was done by implementing a coherent range of actions for road safety according to a well-defined strategy which brought together all the activities of a local authority as an education authority as well as a highways and planning authority. £5m was provided, over five years, through the Local Roads Capital Settlement, to treat a whole town in a strategic manner, and with safety integrated into other town policies and activities. The DfT initially invited local authorities to bid for the opportunity to be the ‘Safe Town’ and the city of Gloucester was selected from 29 authorities who put in bids. ‘Gloucester Safer City’ was the title then given to the Gloucester project.

The aims of the project were to be achievable through traffic management measures, physical engineering measures, land use measures, enforcement, education and training.

This report describes how the project was designed and implemented, outlines the monitoring carried out and gives the results achieved by the project.

1.1 Urban Safety Management

Urban Safety Management (USM) is an approach to the reduction of road accidents in urban areas which was developed in the 1980s through TRL’s Urban Safety Project. Guidance on how it should be carried out is outlined in the Institution of Highways and Transportation’s ‘Guidelines for Urban Safety Management’ (IHT, 1990). New guidelines are being published in autumn 2003.

The main thinking behind USM lies in the fact that once the worst accident sites have been treated, it becomes increasingly difficult to systematically treat the more scattered accidents that remain. Furthermore, tackling accident sites in isolation can cause traffic and safety problems to migrate to other areas and in some cases the problems may only be treatable by changing traffic patterns completely.

USM looks at travel patterns and attendant implications across the whole urban area and aims to reduce accidents by:

- Defining the appropriate road hierarchy.
- Managing traffic onto the right roads.
- Managing the speed of traffic so that it circulates at a more appropriate speed and more safely.
- Making provision for vulnerable road users.
- Co-ordinating all work that influences road safety in the pursuit of objectives for the whole urban area.

The intention of the ‘Safe Town’ initiative was to demonstrate the value of applying these principles in a medium sized town that was typical of its kind.

1.2 ‘Safe Town’ objectives

There were essentially five ‘Safe Town’ objectives:

- Accident and casualty reductions.
- Understanding the effects of measures/schemes.
- Understanding the management processes.
- Allowing other towns to see the safety benefits of an integrated approach.
- Ensuring understanding of the management processes required to implement a strategic approach.

1.3 Why Gloucester?

‘Safe Town’ applicants had to achieve three key criteria. Firstly the town or city had to be free-standing so that any traffic management effects would be contained within it and it would not be influenced by activity in a neighbouring urban area. Secondly, a population of around 100,000 was required - large enough to enable statistically significant effects on accidents to be demonstrated. It was estimated that such a town size would normally have about 500 road casualties per year. Thirdly a range of types of housing developments and road layouts was desirable. Gloucester fitted the required criteria well; it had a population of 100,165 in 1991, had about 480 casualties per year between 1991 and 1995 and was the final selection by DfT from the 29 towns which applied.

Six control towns were also selected, to be used to compare the effectiveness of Gloucester’s Safer City Project on safety with the normal actions of local authorities. The control towns were all of similar size, although there was a mixture of town character between the towns. The control towns were Cheltenham, Ipswich, Peterborough, Slough, Swindon and Worcester.

1.4 The role of TRL

TRL was commissioned by the Road Safety Division of the DfT to monitor the project and was assisted in the monitoring by Babtie Ross Silcock Ltd and the Transport Studies Group at University College London.

As well as the monitoring role, TRL was also given a technical advisory role, to help the local authorities in delivering the project. Scheme design was very much the responsibility of the local authorities’ Safer City Project Team, but TRL’s technical expertise was available for advice when required.

TRL also carried out studies to monitor vehicle emissions in Gloucester as part of another project for DfT, whose objective was to assess the environmental impacts of urban traffic management and safety schemes.

1.5 Gloucester Safer City targets and objectives

The main aim of Safer City was to reduce injury accidents in Gloucester by at least one third from the 1991-95 average of 390 injury accidents per year. Details of the means to achieve this, and other objectives, and the monitoring required are shown in Table 1.
Management of the project was seen to be particularly important as it was felt by safety professionals that the Urban Safety Management approach had not taken off widely in towns since the guidelines were produced in 1990 (IHT, 1990), more because of perception and management concerns than because of any lack of technical expertise or understanding.

The Safer City Project was given a multi-layered management structure which fell broadly into five groups: Steering Group, Safer City Forum, Technical Group with Working Sub-Groups, and the Project Team. Overall control was the responsibility of the Gloucester City Council and Gloucestershire County Council (Figure 1).

The terms of reference, some of the work done and the people and organisations involved are detailed as follows:

**DfT**: provided the majority of the funding (£5 million) through the Local Roads Capital Settlement. £1 million additional funding was provided through the city’s and county council’s budgets.

**The county and city councils**: were partners in the project with the city having a wide-ranging agency agreement. They had overall control of both the Safer City strategy and its budget through and the Environment Committee of the County Council and the Highways and Planning Committee of the city council. The Project Team was employed by the County Council but located in the city council offices.

**Safer City Steering Group**: consisted of five county councillors and five city councillors who took a very active role in the Safer City Project, meeting every three months. Their primary role was to agree and recommend what should and should not take place. The final decisions however, had to be endorsed by the Highways and Planning Committee and the Environment Committee as shown above.

The terms of reference of the Steering Group included the delivery of projects and initiatives to reduce casualties in Gloucester by one third, to steer the relevant officers where appropriate, to promote road safety in Gloucester, to monitor the effectiveness of each project and to consult with the relevant committees and organisations on the strategy, programme and individual projects. They also had to report annually to the parent committees.

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<td>Traffic counts, accidents and casualties (police and hospital).</td>
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<td>Traffic redistribution.</td>
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<td>Speed management measures (engineering, enforcement etc.).</td>
<td>Speed measurement, accidents and casualties (police and hospital).</td>
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<td>Measures for Vulnerable Road Users.</td>
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<td>Traffic management measures (parking, signals, pedestrianisation, public transport, traffic restraint, park and ride etc.).</td>
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<td>Education/publicity.</td>
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<td>Assessing local authority activity.</td>
<td>Interviews with LA staff, including survey of objectives, plans, and actions of non-safety LA staff.</td>
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| Allow other towns to see the engineering benefits of an integrated approach. | Produce reports/guidelines on strategy and measures. |
| Ensure understanding of the management processes required to implement strategic approach. | Produce reports/guidelines on management. |
In addition to the ten Councillors, officials who advised the Steering Group included Ray Lane (City Council Chief Engineer), David Greensweig (City Council Highway Engineer), Neville Nelder (County Council General Manager), Jackie Harris (County Council Road Safety Manager), Paul Bellotti (Safer City Project Manager), Richard Jones (on behalf of DfT) and Archie Mackie (TRL).

Safer City Forum: was a voluntary body of local representatives, comprising businesses, voluntary groups, transport operators, emergency services, magistrates, cycling groups, disabled groups, ethnic minority organisations, Freight Transport Association, Driving Instructors, Institute of Advanced Motorists, education, health and safety groups. It was attended by elected members and guided by the Project Team. The forum met every three months, to provide an exchange of ideas between the many groups and the Project Team.

The terms of reference of the forum were to consider the development of a Safer City strategy and the projects that arose from it and to give views and advice to the Steering Group. Members were expected to inform their representative organisations and the public of the strategy to be adopted and bring the views of those organisations to the forum and assist in the consultation process. They were also expected to review progress on the project annually and report to the Steering Group.

The forum was involved in a number of activities which were intended to inform its members and allow them to give their views including:

- April 1996 - Accident inventory.
- May 1996 - Proposed strategy discussions.
- September 1996 - Road accidents: easy to cause, hard to reduce part 1.
- November 1996 - Road accidents: easy to cause, hard to reduce part 2.
- May 1997 - Trial of the Gloucester motorist.
- September 1997 - Driver behaviour.
- December 1997 - How best to spend £10,000 to improve road safety in Gloucester.
- May 1998 - Works programme, young driver accidents.
- January 1999 – Safer City mid-term report, Prince Michael road safety award to Mrs Jan Wildman for her contribution to road safety ‘Be aware show you care’.
- May 1999 – Driver behaviour and rehabilitation, ‘be aware show you care’ campaign.
- November 1999 - Speed activated signs with warning messages, walking problems in the city.
- June 2000 - How do we build safe road improvements part 2, local plan review, public open space strategy.
- September 2000 - Think that you know about the Highway Code.
- February 2001 - A view of road safety, the last 5 years of the Safer City Forum and it’s achievements.

The Technical Group: was set up to provide assistance and expertise to support the work of the Project Team and to help to co-ordinate activities. Membership of the group came from the Project Team, the County Council’s Road

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**Figure 1 Management structure for the project**
Safety Unit, the city council’s Highways and Planning Department, DfT, TRL, the police, Gloucester Royal Hospital, Stagecoach (the bus company), magistrates and Gloucestershire Health Authority.

Reporting to the Technical Group were five working groups:
- the data working group;
- the education, training and publicity working group;
- the speed management working group;
- the consultation and media working group;
- the health group.

The working groups are more fully described below.

**Data Working Group:** provided data in support of the Project Team for strategic planning, such as the traffic and accident information, and identified any data that were missing. Additionally, it identified from the data the traffic and safety problems to be considered by the Technical Group and dealt with in the design process.

The Data Working Group also looked at speed, flow and accident data with a view to providing input to the creation of the Safer City Strategy. Members included: Paul Bellotti (Safer City Project Manager), Denise Visor (Gloucestershire County Council), Chris Lines (TRL), Neil Troughton (Gloucester City Council) and Heather Ward (University College London).

**Education, Training and Publicity Working Group:** exploited the opportunities that arose from Safer City for spreading road safety messages and bringing about a better safety awareness amongst the public. It complemented the work of the Safer City Project through education, training and publicity. Additionally, the working group sought extra resources for targeted and complementary education, training and publicity. Members included: Paul Bellotti and Jack Towl (Safer City Project Team), Andre Bovington and Garry Handley (Gloucestershire County Council Road Safety Unit) and Heather Ward (University College London).

**Speed Management Working Group:** produced a speed management plan which identified methods of managing speed appropriate to the desired road hierarchy and coordinated traffic calming schemes to match this hierarchy. The group additionally considered the enforcement and prosecution process and its effectiveness on influencing driver behaviour. The group also proposed additional speed detection systems such as laser guns and mobile speed traps as well as the most up to date speed camera technology.

Group members included: Paul Bellotti (Safer City Project Manager), David Blakeman and Clive Fluck (police), Archie Mackie (TRL), Mary Watkins (magistrate) and Garry Handley (Gloucestershire County Council Road Safety Unit).

**Consultation and Media Working Group:** considered all consultation and media requirements for Safer City. Additionally, it undertook public opinion surveys and direct consultation to support Safer City and to determine appropriate methods for promoting Safer City on a routine basis. The consultation and media working group was responsible for a monthly half-page advert in the local newspaper and leaflets delivered to every household providing scheme information to those likely to be affected. Members included: Paul Bellotti (Safer City Project Manager), Archie Mackie (TRL), and John Barrell (Babtie Ross Silcock Ltd).

**Health Group:** There was also a Health Group which, through the work of Heather Ward (University College London) and Garry Handley (Gloucestershire County Council Road Safety Unit), looked at under-reporting to the police of accidents. This was a potential problem for the evaluation of the effect of the project on accident numbers if the amount of under-reporting changed during the life of the project, perhaps due to the higher profile given to safety in the city.

The Project Team was responsible for implementing the project. It was made up of the project manager, Paul Bellotti, a project engineer, Jack Towl, road safety engineers Elaine Fletcher and Denise Vizor, a road safety officer Paul Remington, and administration officers Elaine Cadman-Cramp and Mary Rose Neville. They were supported by a consultant team of officers from Gloucester City Council and the County Council’s consultant team from Sir William Halcrow.

### 3 Strategy development

The important aspects in the development of a strategic approach to Urban Safety Management are described below.

#### 3.1 Accidents

Accidents in Gloucester, over the 3 years before the project started, were analysed by the Data Group in 5 categories: main roads; local distributor roads; residential roads; pedestrians; cyclists and motor-cyclists. Following an analysis of each category the data were brought together into an overall picture and a report produced for the Technical Group. In summary it identified the following problems.

**A Main roads:**
- Shunt accidents, especially on approaches to roundabouts.
- Right turn accidents at signal junctions.
- Accidents involving young drivers at night-time where speed was a contributory factor.
- Accidents scattered along Bristol Road.
- Concentration of accidents at the junction of Parkend Road with Trier Way.

**B Local distributor roads:**
- Bus passenger accidents.
- Young driver accidents.
- Accidents at priority junctions and private accesses.
- High speed accidents.
C Residential roads:
- Speed related accidents on links.
- Young driver accidents.
- Night time accidents.
- Accidents related to parked vehicles.
- Clusters on Parkend Rd, Station Rd, Northgate/Southgate St and Abbymead Ave.

D Pedestrians:
- Accidents while crossing the bypass (in certain sections).
- Accidents while crossing the inner ring road.
- Accidents in the town centre.
- Accidents in streets with shops.
- Involving children in residential cells.
- Involving children around/on the way to/from school.

E Cyclists and motorcyclists:
- Accidents at priority junctions and private accesses.
- Accidents generally scattered in the city.
- Involving turning movements.
- A high proportion of motorcycle accidents.

This identification of accident problems was used in the planning of safety objectives for the strategic approach.

3.2 The road network strategy
There are two main elements to applying the Urban Safety Management approach to a road network. They are:
- managing traffic to achieve a safer distribution;
- managing speed to achieve a safer circulation.

3.2.1 Road hierarchy
To achieve a safer distribution, an essential part of the strategy was to identify a road hierarchy of main roads, local distributors and residential access roads and then attempt to encourage or force traffic to use this network appropriately. Ideally, through traffic should use only the main roads. The traffic on local distributor roads should require access to premises in the local distributor itself or in residential access roads leading off it and in residential access roads traffic should need access to premises in the access road itself.

As is the case for most towns, prior to the Safer City Project a functional road hierarchy had not been identified for Gloucester. Drivers simply took what they felt were the most direct or quickest routes. In a lot of cases this took them through residential areas along unsuitable roads which were not built to carry high traffic flows and fast commuter traffic. This inappropriate use placed pedestrians and cyclists at greater risk of injury and was reflected in the accident records for some of the local distributor and residential access roads.

The first step in developing the Safer City strategy was therefore to decide what functions particular roads should be performing to provide for local needs, and suggest changes where desirable. However, in the development of the new hierarchy, the design team felt, to a large extent, constrained by the existing use of the road network and that it would be difficult to gain public acceptance for radical re-distribution of traffic movements by road closures and banned turns. In addition some roads would have to keep their existing function even though it was inappropriate to the land use on either side, as suitable alternatives were not available. But there were some good examples of traffic re-distribution - Cheltenham Road, Barton Street, the city centre (which was pedestrianised), plus extensive areas of traffic calming.

The new hierarchy adopted by Gloucester identified three categories of road within the city. At the highest level were the roads that were to remain as through routes – the main roads. These roads were in the main originally designed for motor traffic. Until the Severn Bridge was built, Gloucester was on the main road to South Wales and substantial road improvements had therefore been carried over a long period of years. Although these through routes were in some cases bordered by housing it was not felt appropriate to downgrade them as there were no suitable alternatives. Measures taken on these roads were aimed at reducing traffic speeds to the speed limit and providing facilities for vulnerable road users.

The next level of road was the mixed use road. These in general had neither the capacity nor the alignment to be suitable as through routes, but were providing a through traffic and distributor traffic function. Many were also carrying significant traffic flows and there was no readily available alternative route. Frontages were mainly residential (with front gardens) and there was also a small amount of shopping or commercial development. As with main roads, measures would be taken to reduce traffic speeds to the speed limits. Unlike on main roads, treatment of these mixed use roads included physical speed control measures. On these roads, vulnerable road users, where possible, received a higher priority in relation to motorised traffic, than on main roads.

The remaining roads were essentially for local distribution of traffic or for access only. Traffic speeds were kept low, through-traffic discouraged and vulnerable road users given a high priority. Where justified, physical engineering measures were introduced to maintain low speeds.

This new hierarchy was drawn up taking into account the suitability of different roads and the traffic movements required. Means of making drivers use this new hierarchy in the appropriate way were ‘encouraging’ rather than ‘enforcing’. There was little use made of road closures and banned turns. The main example of closure was the pedestrianisation of the city centre which involved the closure of two main roads. There were six other minor closures. More closures were planned initially but, because of concerns about public acceptance, they were not implemented.

As closures were only used to a limited extent, other measures were used to encourage drivers to use the roads of the new hierarchy which were appropriate for the journeys they were making. These other measures were:
3.2 Speed management

The second important element of Urban Safety Management is to ‘manage speed to achieve a safer circulation’. Such speed management was tackled by both engineering measures and increased enforcement through additional police checks.

A partnership between the police and the Safer City Project making use of a service level agreement was put in place to develop comprehensive enforcement of speed limits using mobile and fixed site detection, through speed cameras and other equipment funded by the Safer City Project.

Publicity about the increased enforcement, through roadside posters showing the number of people caught speeding, and the amount in fines, was used as part of the general press information programme, and was an important part of the speed management strategy.

Speed management by engineering measures took the form of road narrowing using gateways, cycle lanes, central refuges and warning signs on most main roads and general traffic calming on many residential roads.

3.3 Branding and marketing

The image of the Safer City Project needed to be managed to maintain the momentum and branding was seen as an important part of the project. Strong efforts were made to establish a well known image for Safer City. A project logo was designed to be used on all project documents, displays and press items. The logo’s slogan was ‘saving lives, reducing accidents’ (Figure 2). Campaigns were run often in conjunction with other organisations such as the press or local businesses. The consultation exercise and the providing of information via leaflets, exhibitions and the media further contributed to the awareness of the project in the mind of the local people.

3.4 Other policies

In the context of the Safer City Project, local and regional policies were likely to have a direct bearing on how the town changed to reduce the number of road casualties and provide a better environment for all road users. It was important that policy makers in areas other than road safety, and those who influenced them, were involved in order to help to focus their attention as to how they might contribute to road safety and to consider any potential adverse effects on safety their policies and programmes might have. In most cases safety was not reflected in the prime objectives of those working in related areas so balancing competing objectives was an important and necessary part of developing the safety strategy for the town. The presence of other professionals on the Technical Group was therefore important as has been indicated above in Section 2 on the management of the project.

The planning work of all the groups was brought together and a strategy document published in ‘A strategy for the Gloucester Safer City Project’ (Bellotti, 1997) which was updated in a second publication ‘Gloucester Safer City Project - a mid-term report’ (Bellotti, 1998).

4 Planning and implementing the Urban Safety Management programme

4.1 Engineering and enforcement schemes

The city was divided into sub-areas to make implementation of the works programme more manageable. There were fifteen such sub-areas. Traffic...
flows were collected and plotted on a link diagram. A large amount of traffic flow and speed data were available from the city council for initial planning and a monitoring programme was devised to assess long term changes throughout the course of the project.

From the analysis of the problems described in Section 3.1, remedial actions were considered and plans made for safety schemes in the city. An overview of the measures used is given in Section 4.1.2.

In addition, attempts were made to integrate education activities, enforcement, health action, publicity and public opinion into the overall programme.

4.1.1 Approach

Once the strategy had been determined it was possible to devise a work programme to fit in with the five-year timetable. At this stage it was decided that main roads would be analysed and treated separately from the areas. It was apparent that main roads generally separated the different areas rather than passed through them. This characteristic was true for the particular circumstances of Gloucester but may not be the case elsewhere.

The work programme was developed with the main aim being to analyse and treat the routes and areas with the worst casualty records first. However, in reality such an approach was not completely possible. The works involved in the implementation of Safer City were extensive and could cause significant disruption. Other works, such as city centre pedestrianisation, major maintenance and sewer repairs were going on at the same time and it was necessary therefore to co-ordinate Safer City works with these other activities. However within these constraints a ‘worst first’ approach was adopted.

Because Gloucester was a demonstration project with a fixed end-date, it was also necessary to devise a programme that evened out the works over the limited time-scale. Furthermore, given the very tight time-scale applicable in this instance it was necessary to develop, for the first year’s programme, some existing proposals rather than starting from scratch. Hence the first area to be treated was not the Barton/Tredworth area which had the worst safety record but the Longlevens area where there were already some proposals in preparation.

4.1.2 Measures

The purpose of the project was to demonstrate that safety benefits could be achieved using currently available measures. It was not intended that the project would experiment with innovative measures, so the measures implemented were mainly those which had already been tried out elsewhere and proved to have safety benefits. A variety of such measures were used for the following safety objectives.

For enforcement of speed limits:
- dedicated police team to increase enforcement activity;
- laser speed gun;
- in-car video equipment;
- speed cameras.

To encourage drivers to drive at a more appropriate speed:
- roadside posters to advertise the number of people prosecuted and the amount that they were fined (Figure 3);
- traffic calming;
- narrowing of space available for motor vehicles creating better channelisation of main road traffic through:
  - cycle lanes;
  - central refuges;
  - central hatching;
  - build-outs;
  - widening of footpaths;
  - speed activated warning signs;
  - gateway feature at all main road entrances to the city, highlighting the speed limit and its enforcement.
- publicity in the local press;
- coloured anti-skid surfacing.

To improve pedestrian safety in the city centre:
- pedestrianisation (already planned).

To assist pedestrians to cross roads more safely:
- new pelican crossings;
- new zebra crossings;
- central refuges;

Figure 3 Roadside poster on speed enforcement
area-wide traffic calming;
- narrowing of carriageway;
- safer routes for children on their way to and from school.

**To assist pedestrians and cyclists to cross roads:**
- new Toucan crossings.

**To encourage safer cycling:**
- cycle lanes on main roads;
- redesign of roundabouts;
- area-wide traffic calming.

### 4.1.3 Traffic signal timings

Throughout the project opportunities were taken to reduce the time pedestrians had to wait at vehicle activated pedestrian crossings before the ‘green man’ was displayed. On main roads these times were reduced from 40 to 20 seconds and on mixed use-roads from 25/30 seconds to as low as 5 seconds.

In addition transponders at some traffic lights speeded up buses by triggering a green phase for them as they approached.

### 4.1.4 The safety engineering measures installed

The schemes which were implemented are shown in Figure 4 and listed in Table 2.

All schemes were safety audited by TMS Ltd.

As can be seen from Table 2, schemes comprised a variety of safety engineering treatments, ranging from large area-wide traffic calming schemes to site specific treatments such as anti-skid surfacing or speed cameras.

More detailed description and illustrations of the measures are provided in Appendix A.

### 4.2 Additional enforcement activity

Gloucestershire Constabulary is responsible for enforcement of the law within the Gloucester Safer City area and police officers from that force were invited to sit on the both the Technical Committee and the Speed Management Working Group. The Constabulary worked...
<table>
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closely with the Safer City Project Team to ensure that enforcement activity was co-ordinated with the overall aims of the project. For example when an area of the city was about to have traffic calming installed, speed-related enforcement was stepped up in that area of the city. During these campaigns (periods which lasted about 12 months each) over 1000 drivers were either cautioned or reported. Although no such information is available for the period before the Safer City Project, it is almost certain that enforcement activity was considerably greater during the period of the Safer City Project than before it began.

During the Safer City Project the police operated a number of fixed speed camera sites. The hours of operation for each site are shown in Table 3. When a camera site was not operational with live film, dummy flash units were used and were set to be triggered at 5mph above the speed limit.

Following the signing of the service level agreement between Gloucestershire Constabulary and the Safer City Project team in 1998, the Constabulary was also responsible for deploying in-car video, provided by the Safer City Project, in two dedicated patrol cars. These were available for use 24 hours a day. Although no information has been made available on the number of prosecutions that have resulted from the use of this equipment, the officer responsible for its deployment reported that 51 tapes were purchased for use in court cases, implying a substantial use of this process.

The in-car video equipment was popular within the Constabulary. It was regarded as extremely useful as it provided capture of irrefutable evidence. This evidence tended to lead to guilty pleas, saving both police time and the resources of the courts.

As an example of the co-operation between agencies engendered by the Safer City Project the police and county road safety officer co-operated on ‘Operation Reducer.’ In this operation, on the day a national speed campaign was launched, the police stopped all vehicles travelling at over 30mph. The drivers were offered the choice of attending a short safety presentation or receiving a fixed penalty ticket. They all preferred the former. The presentation was on the hazards of speed and included two Australian TV advertisements which showed the horrific effects of accidents involving speeding. Each was the reconstruction of a crash involving a car and a pedestrian.

### Table 3 Hours of operation for speed camera sites (fixed sites)

<table>
<thead>
<tr>
<th>Site</th>
<th>1997 to March 1998</th>
<th>April 1998 to January 2001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metz Way</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bristol Road (Morelands)</td>
<td>622</td>
<td>2126</td>
</tr>
<tr>
<td>Bristol Road (Permal)</td>
<td>1087</td>
<td>2066</td>
</tr>
<tr>
<td>Finlay Road</td>
<td>912</td>
<td>1940</td>
</tr>
<tr>
<td>Eastern Avenue (Ambulance Station)</td>
<td>1106</td>
<td>4426</td>
</tr>
<tr>
<td>Eastern Avenue (Post Office)</td>
<td>1150</td>
<td>3841</td>
</tr>
<tr>
<td>Eastern Avenue (TA Centre)</td>
<td>221</td>
<td>3114</td>
</tr>
<tr>
<td>London Road (Inbound)</td>
<td>336</td>
<td>5334</td>
</tr>
<tr>
<td>London Road (Outbound)</td>
<td>Installed 1999 – 134 hours to January 2001</td>
<td>Installed 1999 – 2781 hours to January 2001</td>
</tr>
</tbody>
</table>

4.3 Public consultation

Public acceptability is a very important part of being able to implement a strategic road safety plan. The importance of proper consultation when introducing measures to improve road safety has been widely recognised in recent years. In Gloucester the scale of the works and the tight timetable made it critical to ensure public acceptability. Whilst a hundred percent support is usually unachievable, it is essential that the majority of the public believe that what is being done is desirable.

Public consultation was therefore an important element within the project and was tackled in a number of ways:

- Information and feedback.
- Consultation.
- Assessment of public opinion.

Area based consultation involved exhibitions and leaflets delivered to all households in the area where improvements were being planned. Comment at the outline stage and later at the detailed design stage was invited via the use of pre-paid postcards.

Local area consultation was carried out at three stages. The first stage started with an outline concept to gather views about the preferences of people who live and work in the area. Exhibitions in schools and community halls were used to show plans and photographs depicting the problems and typical safety measures that could be used. The second stage, at the detailed scheme design stage, was to issue a comprehensive leaflet to every household in the area showing the location of all the proposed features.

The final stage was the formal advertisement of the scheme after plans had been modified in the light of the views expressed earlier.

At all stages, results from consultation were taken to the appropriate local authority committee for scrutiny and were available to the public.

At the city-wide level there were three main strands to consultation. Firstly, a Safer City Forum, secondly regular, paid for, coverage in the local newspaper and thirdly the traditional forms of public meetings, exhibitions and leaflets.
The Safer City Forum was set up to involve the people of Gloucester in the project. This was a voluntary body of representatives from local organisations such as transport operators, emergency services, magistrates, disabled groups and ethnic minority organisations. The forum was attended by elected members and guided by the Project Team, and was essentially a way of exchanging ideas between the various groups and the Project Team.

For more general consultation, members of the public and key stakeholders were informed of proposals and their views sought, by a variety of methods, including pamphlets and public exhibitions. Other forms of public consultation were developed and used, especially in areas where response was initially low, or where opinion was divided (Table 4).

In the early stages of the project, public consultation took the form of press announcements, and area-wide leaflets containing a free-post questionnaire about proposed road safety measures for an area. In most cases there was also a staffed series of exhibitions.

However, low response rates to this consultation process in some areas, or issues on which there appeared to be a divergence of views led to the use of on-street surveys and citizens’ panels (making use of members of the public to come to a view on proposals). Citizens’ panels were not a widely used form of consultation, and were not used at the outset of developing a scheme.

As part of the monitoring and evaluation (see Section 5.8), Social Research Associates carried out annual public attitude surveys. These proved extremely useful to the project because they provided representative information from which public responses to consultation could be considered. It is well known that people who object to proposals are more likely to make representations than those who support them and that a vociferous minority can give a false impression of public views. The annual surveys enabled officials and elected members to see how representative responses to consultation were.

### 4.4 Education activity

The principal aim of the Education Training and Publicity (ETP) Group was to exploit opportunities that arose from the Safer City Project for spreading road safety messages and to bring about a better safety awareness and improved road user behaviour. In the early stages of the project its attention and activity was re-focussed on a geographical basis within Gloucester linked to the implementation of the engineering measures. For example the group decided, in

<table>
<thead>
<tr>
<th>Table 4 Type of public consultation</th>
<th>Example</th>
<th>When used</th>
<th>Response to feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>Providing information.</td>
<td>Press advertisements.</td>
<td>To reach a wider audience.</td>
<td></td>
</tr>
<tr>
<td>Information and seeking feedback.</td>
<td>Exhibitions.</td>
<td>To give information and obtain a response.</td>
<td>Further consultation in response to proposed changes; development of projects in response to comments.</td>
</tr>
<tr>
<td></td>
<td>Area wide leaflet drop.</td>
<td>To inform and seek feedback.</td>
<td>Written response to comments.</td>
</tr>
<tr>
<td></td>
<td>Press announcements inviting comment.</td>
<td>To reach a wider audience.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Letters.</td>
<td>To target individuals in a particular street.</td>
<td></td>
</tr>
<tr>
<td>Additional consultation.</td>
<td>Face to face surveys – in addition to annual assessment survey (below).</td>
<td>To ensure the representativeness of views. Useful when response rates are low or views are challenged.</td>
<td>The views obtained may help to validate or challenge a course of action.</td>
</tr>
<tr>
<td></td>
<td>Citizens panels.</td>
<td>To try and obtain a consensus and understanding of conflicting points of view.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Focus groups.</td>
<td>Where reasons for behaviour of sub groups were poorly understood, e.g. lack of participation by socio-economic groups D and E in some types of public consultation.</td>
<td>Better knowledge of how messages on road safety are deconstructed, as well as involving groups seen as ‘hard to reach’.</td>
</tr>
<tr>
<td>Assessment survey.</td>
<td>Annual assessment survey throughout life of project.</td>
<td>Enables a project team to understand the broader picture in terms of acceptability, and to benchmark progress.</td>
<td>In a long term project of this nature an annual assessment survey provides a view of trends over time in how the project is perceived.</td>
</tr>
<tr>
<td>Safer City Forum.</td>
<td>Set up at start of project to act as a link between the Steering Group, interested organisations and the public.</td>
<td>A useful link, sounding board and channel for information dissemination.</td>
<td></td>
</tr>
</tbody>
</table>
the first instance, to concentrate its efforts in the Longlevens area as this was the first area to be treated with safety engineering measures.

In order to raise awareness and profile of the Safer City Project, the 1996 national ‘Kill Your Speed’ campaign was launched locally in Longlevens with attendant publicity and media interest. The roadside launch involved a ‘thumbs up-thumbs down’ interactive speed check for passing motorists.

‘Wheels’, a programme for young offenders involved in car crime in the city had produced a song, on audio-cassette tape, which contained a speed reduction message in a form likely to appeal to young people. A city night-club agreed to play the tape and a daytime press launch was arranged.

Community Area Safety Teams (CAST) were set up to involve people who provide public services within the community.

Other projects which were re-focussed over a period of time for introduction to the Safer City Project were:

- ‘Footsteps’ which is a progressive modular programme which introduces traffic education to 3-5 year olds by targeting parents and pre-school teachers. It was introduced to 10 play groups in the city.
- ‘Walk to school’ came out of the national ‘Walk to School Week’ campaign. A number of schools were involved in this initiative.
- Safer routes to school, including the use of yellow footprints (see Appendix A) to guide children and their parents to crossing places, were introduced.
- SAGE (Safer Driving with Age), an older drivers programme, was developed. This programme gave older drivers information about eye tests and the effects of medication, while helping them to improve their practical driving ability. Health screening was undertaken by GPs.

Another aspect of the ETP programme was a driver improvement course, which was set up to target motorists prosecuted for driving without due care and attention. Offenders were given the option of appearing in court or attending the course with the penalty reduced to receiving a caution if the course was completed satisfactorily. Since 1997 about 600 drivers per year have opted for this course.

Road safety leaflets were also produced which targeted the new intake of pupils at schools and a questionnaire was developed to find out more about journeys made by child pedestrians and cyclists. These were distributed through the road safety officers to schools in the area. Where appropriate, documents for the consultation process on proposals for road safety measures for an area were printed in the languages spoken by people in the area as well as in English.

A road safety video in Bengali and Gujarati was assessed and then shown to people in the area, to increase their awareness of road safety issues and what they could do to keep their children safe. Its popularity amongst the public led to Chinese and English language versions also being distributed.

PAID - People Against Irresponsible Drivers – was a city-wide initiative launched to encourage people to take a stand against irresponsible drivers by signing a pledge and displaying a symbol on their cars. The scheme was awarded a grant from the city council and was supported by the Chief Fire Officer and Chief Ambulance Officer for Gloucestershire.

‘Be Safe-Be Seen’ was a publicity initiative carried out in Barton and Tredworth. High visibility reflectors were produced to help make people, especially children, more visible. They were distributed through luncheon clubs and were a great success with the older residents who also took them for their younger family members.

The drink-drive campaigns, which were already in operation, continued and were attended by good media interest.

Puffin crossings were introduced as part of the Safer City Project so new leaflets were produced explaining how to use them and how they differed from pelican crossings.

CASSIE (Care and Sympathy Shared In Empathy) is a local bereavement group for people who have lost a family member in a road traffic accident. Safer City gave its support to the group and donated £10,000 to produce leaflets and a publicity campaign called Be Aware - Show you care which aimed to bring about lower speeds. The road safety officers arranged for the campaign to go into the local schools.

The ETP group also formulated a local education training and publicity plan for the Barton and Tredworth areas which were amongst the most difficult areas to treat. Road safety problems within the community were aired and news and information was fed back to local people. A health visitor, based at the Barton Gate surgery, dealt mainly with pre-school children from a variety of ethnic backgrounds. Access to a translator and interpreter was provided for her. A community nurse for the elderly and an inspector from Barton Police Station also joined the group.

When they were treated by the Safer City Project, the other areas were dealt with in a similar way to those described above, including bringing in local people as part of the CAST teams.

Roadside information posters alongside an improvement were used to tell road users about the reasons for the work. Other campaigns were undertaken. In a partnership with Halfords (a Motor Accessory and Cycle retailer) and the police, during National Cycle Week, a bicycle post coding and cycle safety event was organised. 110 bicycles were post coded and given a safety check by a Halfords’ engineer. A prize draw was also held, and Halfords donated a bicycle and Safer City donated prizes of between £5 and £100 in vouchers for redemption against cycle safety equipment at the store.

In another partnership a local paper, The Citizen, and Mitchell’s Cycle Shop, held a 13-week campaign called ‘Keep Your Lid On’. This campaign started when a child suffered serious injuries in a cycle accident after he had left his helmet at home because other children teased him about wearing it. Safer City joined the campaign in its second year. A child wearing a cycle helmet was
photographed and their picture was published in the paper. The winner claimed their prize donated by Safer City and the cycle shop. The idea was that when children read about members from their peer group wearing helmets and the attendant publicity, it should bring down some of the barriers to wearing a helmet while cycling but information is not available on how successful it was.

4.5 Health activity

Gloucestershire Accident Action Group is a group led by the Gloucestershire Health Promotion Group based in Gloucester. The group meets approximately at quarterly intervals. Its formation predates that of the Safer City Project and covers prevention of all types of accidental injury, not just road accidents.

The Accident Action Group membership comprises representatives of the following:

- Gloucestershire Health Authority.
- Health Promotion Gloucestershire.
- Gloucestershire Road Safety Unit.
- Gloucestershire Fire and Rescue Service.
- Trading Standards Department.
- Community Nurse.
- Accident Liaison Health Visitor.
- Gloucestershire Ambulance NHS Trust.
- Gloucestershire Home Safety Check Scheme.

One of the main activities of the group was to develop, agree and implement an action plan as part of the Gloucestershire Accident Action Strategy. This group comprised members from different agencies active in accident prevention throughout the county and provided a good example of people working together to set local targets and action plans.

During the period of the Safer City Project the programme for the group involved input to the development of a Health Improvement Plan, which was a partnership between the health authority and the local authorities to bring about improvements in the health of local communities. This involved assessing their health needs and, as part of their improvement in health, addressing the problem of accidental injury, in which road accidents play a large part.

5 Monitoring and evaluation

5.1 Introduction

The preceding chapters have described how the project was implemented and what measures, projects and campaigns were used. How well the various parts of the project worked and what the Safer City Project as a whole achieved is described in this chapter.

Table 1 in Section 1.5 shows some of the monitoring required to demonstrate whether the Safer City Project objectives were achieved. Accident and casualty numbers were clearly the major indicators of the success or otherwise of the project in safety terms. But it was also important to measure the effect of the project on other aspects of mobility such as the speeds and flows of traffic across the road network to gain a better understanding of how the various measures worked. Any changes in public awareness and opinions were also important in being able to judge the acceptability of the project to the citizens of Gloucester.

More detailed aspects of the monitoring and results are described below.

5.2 Control towns

In order to be sure that any changes in accident numbers in Gloucester were due to the Safer City Project rather than as a result of broader trends in accident numbers, it was important to compare the accident trends in Gloucester with what occurred in similar towns over the period of the project. As described in the Introduction, six control towns were selected for this comparison.

Before comparing accident trends in the control towns with those in Gloucester, it was also important to find out what safety activities the control towns themselves had been involved in which might have caused a change in accident numbers over and above what might be expected from underlying trends.

Each control town was therefore asked to provide an indication of what safety programmes it had carried out during the life of the Gloucester project and how much they had cost. One difficulty was that in some towns safety expenditure was not easy to identify separately as it was often integrated with other programmes, so overall expenditure on safety could be greater than that identified specifically as expenditure on safety schemes.

Expenditure varied between the towns and was substantially less than had been spent in Gloucester (see Table 5). The average expenditure on safety measures calculated from the data provided by the control towns was £1.3m over the five year period of the Safer City Project.

Table 5 Expenditure in control towns

<table>
<thead>
<tr>
<th>Town</th>
<th>Spend from Apr 96 – Mar 01</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ipswich</td>
<td>£2.25m</td>
</tr>
<tr>
<td>Peterborough</td>
<td>£1m</td>
</tr>
<tr>
<td>Slough</td>
<td>£2.5m*</td>
</tr>
<tr>
<td>Cheltenham</td>
<td>£0.5m</td>
</tr>
<tr>
<td>Worcester</td>
<td>£0.1m**</td>
</tr>
<tr>
<td>Swindon</td>
<td>£1.7m</td>
</tr>
<tr>
<td>Average per town</td>
<td>£1.3m</td>
</tr>
<tr>
<td>Gloucester</td>
<td>£6m</td>
</tr>
</tbody>
</table>

* Estimated from one year’s data.
** Excludes safety work included in other LA programmes.

5.2.1 Summary of control town characteristics and safety programmes

The control towns are all of similar size, although there is a mixture of town character between the towns.
Cheltenham
Cheltenham is a historic town where 50% was built before 1940. It had a population of 103,566 in 1991.

Cheltenham’s programme of safety measures had been quite small. Traffic calming is not widespread. However the following features have been implemented:
- Town centre pedestrianisation.
- A distributor road with speed cushions.
- A 20mph zone.
- Speed cameras.
- Red light cameras.
- New pedestrian crossings.
- Mini-roundabouts and refuges.
- Anti-skid surfacing.

Worcester
Worcester is a historic town which dates back to Roman times. The population was 81,538 in 1991.

Worcester also has had a fairly low level of implementation of safety measures. One speed camera has been introduced and some pedestrian crossings. There has been little use of anti-skid surfacing and little calming apart from one road which has been treated with speed tables, raised junctions and humps. One ‘Safe Route to school’ has been installed. The city centre has been pedestrianised.

Ipswich
Ipswich is fairly modern with a considerable proportion built in the inter-war years. It had a population of 115,400 in 1991.

A small amount of traffic calming has been installed, mainly on a long distributor road, using humps and speed tables to discourage a rat-run. A cycle lane shared with the footpath on a main road has also been installed plus some other lengths of cycle lanes, with Toucans and raised crossing points at the side roads. The town centre has been pedestrianised and a 20mph zone and cycle lane close to the town centre have been installed. A few sites have been treated with anti-skid surfacing.

Slough
Slough is a relatively new town where only 33% was built before 1940. It had a population of 98,790 in 1991.

Here there has been substantial implementation of safety measures. Many streets have had traffic calming installed, using humps and cushions. Several sizeable 20mph zones, and traffic calming on local distributors have also been implemented, using standard humps or speed cameras. Several sites have anti-skid surfacing, there are long lengths of cycle lane with advanced stop lines and narrowings for pedestrian crossings have also been introduced.

Special 20mph speed limits for short lengths of road through traffic light junctions on main roads have been implemented. Main roads have also been treated with cameras, mini-roundabouts, refuges, channelisation using red surfacing, and right turn bays. A distributor road has been calmed with plateaux, cushions and chicanes. There have also been improvements in street lighting.

The town centre has been partially pedestrianised, the remaining part being for buses and taxis only.

Swindon
Swindon had much of its original development associated with the railways, but has developed considerably in recent times with a variety of new businesses. The population was 167,641 in 1991.

The town has installed a number of safety measures, including numerous mini-roundabouts and small roundabouts, central hatching and refuges. New pelican crossings and Toucans have been introduced. Large areas have been traffic calmed using cushions, speed tables and narrowings. On main roads speed cameras, camera signs, and cycle lanes have been implemented.

Peterborough
Peterborough is a relatively new city where only 28% was built before 1945. It had a population of 149,402 in 1991.

As much of it was built in the post-war ‘new town’ era, much of it has a hierarchical network design with segregation of much of the traffic from other functions.

But overall there has been little in the way of speed management. Some safety features such as parking bays and narrowing to give a chicane effect have been implemented in a few roads and some traffic calming has been installed on distributor roads and in residential areas using 20mph zones with humps and mini-roundabouts. A few new crossings have been installed and some anti-skid surfacing.

The town centre has been pedestrianised.

5.3 Accidents
5.3.1 Changes
Injury accidents in 2001 (the first year after completion of most of the project) were compared with the annual average for the five years before the project started (1991 to 1995).

The change was a reduction of 9.5 per cent, but in the control towns there was an increase of 8.6 per cent, which represents a net reduction in Gloucester of 16.7 per cent.

For fatal and serious accidents the reduction in Gloucester was 48.1 per cent while in the control towns the reduction was 17.7 per cent, representing a net reduction for Gloucester of 36.9 per cent. (See footnote to Table 6 for explanation of how net percentages are calculated).

Accident numbers do, of course, fluctuate from year to year simply by chance so using only one year of after data could be less reliable than being able to use a number of years. However, even using this limited time period, the changes in accident numbers in Gloucester relative to the control towns shown in Tables 6 and 7 are statistically significant (Chi square: p<.05)

The KSI ratio (proportion of fatal and serious accidents to all injury accidents) also decreased - from 13% to 8%. The corresponding values for the control towns were 17% to 13%.

5.3.2 Road user groups
In a project such as this different road user groups may be affected differently. There was to some extent a focus on
vulnerable road users but the intention was that all road user groups should benefit. Results for the different road user groups are given in Tables 8 to 11, where they are also compared with the control towns and national figures. All road user groups appear to have benefited from the project apart from cyclists for whom there was an increase in accidents. The reduction for motor cyclists is not statistically significant but all the other changes shown in Tables 8 to 11 are statistically significant (Chi square P<0.05). Although cycling accidents appear to have increased in the after period studied, all but one of the cycling accidents involved slight injury and were not particularly related to measures installed within the project. There was no evidence of an increase in cycling. Preliminary accident data for 2002 show that cycling accidents had declined to 7.5% less than in the before period.

5.3.3 Effect of treatments

To assess any reduction in reported injury accidents due to the project in the places which had been treated, injury accident data for 11.25 years were examined, covering both the ‘before’ and ‘after’ period. This needed to be done by comparison with what would be expected during the ‘after’ period had the treatment, or the project, not been in operation. Accidents at 40 treated sites, routes or areas have been subjected to a ‘before–after’ analysis to estimate the effects of various treatments. A wide variety of treatments were applied (see Section 4.1).

The different treatments were installed at different points in time, so that there was no common ‘after’

### Table 6 Changes – all injury accidents

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gloucester</td>
<td>390</td>
<td>353</td>
<td>-9.5</td>
<td>-16.7*</td>
</tr>
<tr>
<td>Control towns</td>
<td>466</td>
<td>506</td>
<td>+8.6</td>
<td></td>
</tr>
<tr>
<td>National (GB urban accidents)</td>
<td>171658</td>
<td>167048</td>
<td>-2.7</td>
<td></td>
</tr>
</tbody>
</table>

*The control town accidents rose to 108.6% of their 91-95 average while in Gloucester accidents fell to 90.5% of their 91-95 average. This represents a 16.7% net change. Similar calculations apply to all comparisons of percentage changes.

### Table 7 Changes – fatal and serious accidents

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gloucester</td>
<td>52</td>
<td>27</td>
<td>-48.1</td>
<td>-36.9</td>
</tr>
<tr>
<td>Control towns</td>
<td>79</td>
<td>65</td>
<td>-17.7</td>
<td></td>
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<tr>
<td>National (GB urban accidents)</td>
<td>28854</td>
<td>22036</td>
<td>-23.6</td>
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</tbody>
</table>

Numbers do not allow for changes in reporting rates – see Section 5.3.4.

### Table 8 Pedestrian casualties

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gloucester</td>
<td>92.4</td>
<td>52</td>
<td>-43.7</td>
<td>-27.6</td>
</tr>
<tr>
<td>Control towns</td>
<td>92.3</td>
<td>71.7</td>
<td>-22.3</td>
<td></td>
</tr>
<tr>
<td>National (GB urban casualties)</td>
<td>47683</td>
<td>39031</td>
<td>-18.1</td>
<td></td>
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</tbody>
</table>

Numbers do not allow for changes in reporting rates – see Section 5.3.4.

### Table 9 Cyclist casualties

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gloucester</td>
<td>63.4</td>
<td>76</td>
<td>+19.8</td>
<td>+42.9</td>
</tr>
<tr>
<td>Control towns</td>
<td>86.5</td>
<td>72.5</td>
<td>-16.1</td>
<td></td>
</tr>
<tr>
<td>National (GB urban casualties)</td>
<td>22246</td>
<td>17603</td>
<td>-20.9</td>
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</tbody>
</table>

Numbers do not allow for changes in reporting rates – see Section 5.3.4.

### Table 10 Motor-cyclist casualties

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gloucester</td>
<td>61.2</td>
<td>47</td>
<td>-23.3</td>
<td>-16.1</td>
</tr>
<tr>
<td>Control towns</td>
<td>70.2</td>
<td>64.2</td>
<td>-8.5</td>
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</tr>
<tr>
<td>National (GB urban casualties)</td>
<td>19511</td>
<td>21606</td>
<td>+10.7</td>
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</tbody>
</table>

Numbers do not allow for changes in reporting rates – see Section 5.3.4.

### Table 11 In vehicle casualties

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gloucester</td>
<td>259.4</td>
<td>262</td>
<td>+1.0</td>
<td>-28.5</td>
</tr>
<tr>
<td>Control towns</td>
<td>333.2</td>
<td>470.9</td>
<td>+41.3</td>
<td></td>
</tr>
<tr>
<td>National (GB urban casualties)</td>
<td>124902</td>
<td>136963</td>
<td>+9.7</td>
<td></td>
</tr>
</tbody>
</table>

Numbers do not allow for changes in reporting rates – see Section 5.3.4.
period for the treatments or the sites. Installation work for the safety treatments took between 1 month and 33 months to complete. These ‘roadwork’ periods were distinguished from both the ‘before’ and ‘after’ periods and were studied separately.

To estimate the effect of a treatment it is necessary to estimate what the expected number of accidents during the ‘after’ period would have been had the treatment not been implemented. An estimate of this key quantity has been made by combining data from the ‘before’ period with that from a ‘comparison set’ consisting of all the ‘untreated’ sites in the city. The comparison set serves to allow for background trends in the accident history of the city.

An examination of the accident data from the comparison set revealed that there was a strong seasonal component in the frequency of monthly accidents during the 11.25 years of the study period. Accidents tended to be higher in the summer months and autumn/winter months (i.e. October/December) than at other times. For example, in the summer months of June, July and August accidents were respectively, 13%, 22%, 19% higher than in January. In the months of October, November and December accidents were respectively 21%, 34% and 25% higher than in January. There were also some variations in the yearly accident data during the study period which can be attributed to a range of unmeasured and unknown factors. Both the seasonal and yearly factors from the comparison set were used to estimate expected accidents in the ‘after’ period by means of a statistical model.

The effects of the treatments were estimated by calculating the ‘excess’ number of accidents (the actual number of accidents in the ‘after’ period minus the number expected) month by month, and from this time series, the ‘cumulative excess’ over time. A positive excess would mean an adverse effect and a negative excess would mean a beneficial effect of the treatment on road safety.

Overall, the analysis shows that during the ‘after’ periods there would have been a total of 588 accidents at the treated sites, had no treatments been implemented. The actual number was 367, indicating that there was a reduction of 37.7% (±3.3%) in accidents due to the treatments.

During the periods when the site treatments were being installed (the ‘roadwork’ periods) 154 accidents occurred. The number of accidents expected to occur during this period was 186 accidents, so that the number of accidents had fallen by 17.3% (±6.7%) during these periods.

The changes in accidents in the after period were also examined by treatment type. Where area treatment was carried out, there were 42.2% (±5.34%) fewer accidents than expected.

Route treatments were also very effective in achieving improved road safety. Accidents were 27.8% (±6.86%) fewer than expected. It was estimated that 155 accidents would have occurred without the treatment, whereas in practice, 112 occurred.

The installation of traffic signals, a toucan crossing and a roundabout resulted in 55.4% (±12.9%) fewer accidents than expected.

At three speed camera sites, 21.3% (±15.53%) fewer accidents were recorded than expected.

The installation of vehicle activated signs resulted in 22.3% (±29.49%) fewer accidents than expected.

Anti-skid treatment was found to be very effective in achieving improved road safety. Where the anti-skid treatment was applied, accidents in ‘dry’ conditions were reduced by 37.6% (±7.90%) and in ‘wet’ conditions by 51.5% (±9.04%). The overall effect of the treatment was 42.8% (±5.99%) fewer accidents than expectation.

All these beneficial results of the effect of treatments were highly significant statistically, apart from those at the speed camera and vehicle activated signs sites. Accident numbers there were small.

The above results are all based on the accident histories of the treated sites (2067 accidents) compared to those of untreated sites (2113 accidents) covering a period of 11.25 years.

It would have been desirable to have used the empirical Bayes method (Hauer, 1997) to analyse this data. This approach would have ensured the reduction or elimination of selection bias in the analysis arising from the choice of sites for treatment. However, the method would have required site by site data from an appropriate comparison set of untreated sites, data which in the present study, was not available. In reviewing these results, although most of the treatments analysed in this study have shown substantial road safety benefits, it has to be borne in mind that some element of regression to the mean will remain. However, in view of the fact that the ‘before’ period for the majority of sites is at least 5 years, and in some cases considerably longer, it seems fair to say that regression to the mean is unlikely to unduly distort the beneficial road safety findings achieved by the treatments assessed in this study.

Since the comparison sites in this study were untreated sites in Gloucester, any widespread effect of the project, over and above that generated directly by the treatments (for example, due to general education and publicity, and ‘halo’ effects of the measures) are excluded from these estimated benefits but are discussed later in Section 5.3.5.

5.3.4 Levels of reporting to the police of road accident casualties

Not all road traffic accidents where someone is injured are reported to the police. Using only the police record of accidents and injuries (known as STATS19) gives an incomplete picture of the risk to people in Gloucester. Many people who are injured go to the Accident and Emergency Department of the Gloucester Royal Infirmary and others, mainly with minor injuries, go to their GP for treatment. The hospital keeps records of those who say they have been injured in a road traffic accident and these files can be compared with the records kept by the police. It is not possible to access records kept by GPs and no estimate can be made of the numbers of people who attend surgeries but not hospitals.

The extent of matching of the hospital records with the police records can be used to estimate the levels of reporting of injury accidents to the police. If all road traffic injuries were reported to the police, the STATS19 record would allow accurate estimates of risk to be calculated. However, for various reasons not all injury accidents are reported to the police.
When a road safety initiative as large as the one in Gloucester is being implemented awareness of road safety issues is increased and with it may come the tendency to report more accidents to the police than before. If the police records only were used and the citizens of Gloucester did report a higher proportion of their accidents, then reporting biases would occur in the data and conventional ‘before’ and ‘after’ comparisons could underestimate the casualty reduction effect of the project. The hospital matching process allows an estimate to be made of this reporting bias as it is less likely that an injured person would change their behaviour in respect of attendance at a hospital for treatment as a result of a large road safety initiative.

The data for the five years from 1996 to 2000 have been matched after gaining permission to access the data from both hospital and police and assurances of confidentiality given. This gave two datasets - one with the hospital record of people injured in road accidents and the other the police record of the accident which gave details of the casualties. These two sets were matched using date, location, gender and age information. This left two types of unmatched record. Those only appearing in the police set and those only appearing in the hospital set.

Mechanisms that may affect reporting

There are three underlying mechanisms that could influence the reporting of casualties to the police or to the hospital, and the effect these might have on apparent changes in casualty numbers, as follows:

i  The publicity associated with the schemes raised awareness of the general public to road accidents which could result in an increase in reporting of accidents to the police.

ii  Insurance companies are increasingly requiring police accident reference numbers to be provided by claimants to enable the insurers to process claims using information provided by the police. This could lead to increased levels of reporting.

iii  Hospitals are now able to recoup treatment costs from drivers who are at fault, or their insurers. There could be a tendency to under report road accidents as the cause of injury to the hospital by those who might be expected to contribute, or who are driving without insurance.

If the total number of people injured and the proportion of them seeking treatment remains the same then mechanisms (i) and (ii) would result in an increasing number of casualties being reported to the police, an increase in the number of casualties known to both police and hospital and a decrease in those known only to the hospital.

Mechanism (iii) however would not change the numbers reported to the police but would reduce the numbers reported at the hospital.

If the total number of people injured goes down this will be reflected in the hospital records even if an increasing percentage of these accidents are reported to the police.

If the number of accidents known to the police increases without any equivalent increase in the number reported to the hospital it is likely that mechanisms (i) and (ii) are dominating.

Results of the matching exercise

In 1996 there were 388 casualties reported to the police (only known to the police plus known to both the police and the hospital) and 597 registered by the hospitals (only known to the hospital plus known to both the hospital and to the police). These figures indicate that only 52 per cent of known casualties reported their injuries to the police in 1996 (see Table 12).

Table 12 Reporting rates and numbers of casualties for male and females in 1996

<table>
<thead>
<tr>
<th>Casualty</th>
<th>Only known to police</th>
<th>Only known to hospital</th>
<th>Known to both</th>
<th>All known casualties</th>
<th>Percentage reported to police</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>86</td>
<td>200</td>
<td>135</td>
<td>421</td>
<td>52</td>
</tr>
<tr>
<td>Females</td>
<td>61</td>
<td>153</td>
<td>106</td>
<td>320</td>
<td>52</td>
</tr>
<tr>
<td>Unknown</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>All casualties</td>
<td>147</td>
<td>356</td>
<td>241</td>
<td>744</td>
<td>52</td>
</tr>
</tbody>
</table>

In 1997 there were 422 casualties reported to the police and 603 registered by the hospital. This indicated that the percentage of known casualties who reported their injuries to the police in 1997 had risen to 57 (see Table 13).

Table 13 Reporting rates and numbers of casualties for male and females in 1997

<table>
<thead>
<tr>
<th>Casualty</th>
<th>Only known to police</th>
<th>Only known to hospital</th>
<th>Known to both</th>
<th>All known casualties</th>
<th>Percentage reported to police</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>78</td>
<td>164</td>
<td>139</td>
<td>381</td>
<td>57</td>
</tr>
<tr>
<td>Female</td>
<td>64</td>
<td>159</td>
<td>141</td>
<td>364</td>
<td>56</td>
</tr>
<tr>
<td>Unknown</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>All casualties</td>
<td>142</td>
<td>323</td>
<td>280</td>
<td>745</td>
<td>57</td>
</tr>
</tbody>
</table>

In 1998 there were 479 casualties reported to the police and 599 registered by the hospital. This indicates that, by 1998, 60 percent were reporting their injuries to the police (Table 14).

Table 14 Reporting rates and numbers of casualties for male and females in 1998

<table>
<thead>
<tr>
<th>Casualty</th>
<th>Only known to police</th>
<th>Only known to hospital</th>
<th>Known to both</th>
<th>All known casualties</th>
<th>Percentage reported to police</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>114</td>
<td>177</td>
<td>152</td>
<td>443</td>
<td>60</td>
</tr>
<tr>
<td>Female</td>
<td>90</td>
<td>148</td>
<td>122</td>
<td>360</td>
<td>58</td>
</tr>
<tr>
<td>Unknown</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>All casualties</td>
<td>205</td>
<td>325</td>
<td>274</td>
<td>804</td>
<td>60</td>
</tr>
</tbody>
</table>

In 1999 there were 487 casualties reported to the police and 639 registered by the hospital indicating that 59 per cent reported their injuries to the police (Table 15).

In 2000 there were 463 casualties reported to the police and 587 registered by the hospital so that 59 per cent reported their injuries to the police (Table 16).

The matching exercise showed that there was a statistically significant increase in the number of people
Accidents at sites which received engineering treatment were reduced, on average, by 38%.

From the analyses it has also been possible to estimate the non-engineering effect of the project. This can be defined as the overall effect of the project on accidents, excluding the direct effect of engineering treatments. This can be assumed to include the effects of a general increase in awareness in Gloucester resulting from greater education, publicity and enforcement. It includes an element of speed reduction achieved through this increased awareness, rather than as a direct result of safety engineering measures on treated sites.

The estimate of the non-engineering effect of the project has been made on the basis of:

- the overall 24% reduction in injury accidents achieved (allowing for the proportion of accidents reported to the police and the control towns comparison);
- the 38% reduction in injury accidents achieved on treated sites (this already includes the level of reporting effect because it is based on a comparison with untreated sites in Gloucester);
- about half the ‘before’ accidents in Gloucester occurring on treated sites and about half on untreated sites.

The resulting estimate of the non-engineering effect is a 7% reduction in injury accidents contributing to the overall reduction for the project as a whole of 24%.

### 5.4 Speed

A separate detailed report is available on speed and speed changes as a result of the project (Gorell, 2003) but a summary of the main findings is given below.

Speed monitoring was undertaken in the following ways:

- assessment of general trends in speed behaviour by means of long term monitoring at a representative sample of eleven sites, using loop detectors and data loggers;
- comparison with a ‘control’ town using two sites in Cheltenham to compare with speeds in Gloucester;
- assessment of the effect of engineering measures using short term before and after laser gun monitoring at sites where engineering measures were installed e.g. gateways, traffic calming and route treatment;
- assessment of changes in journey times through ‘instrumented car’ driving cycles;
- assessment of peoples’ fear about speeding traffic through annual interview surveys amongst a representative sample of residents;
- assessment of the effect of the enforcement programme through camera and offences data.

#### 5.4.1 Permanent loop site data

There were 11 permanent speed measuring sites in Gloucester which were installed and monitored by TRL. There were also two control sites in the town of Cheltenham. These loop sites enabled both traffic flow and vehicle speeds to be recorded on a continuous basis. The data were collected from each site approximately every 6 weeks.
Year on year comparison of vehicle speeds
In order to make a year on year comparison of vehicle speeds, information from each site, from approximately the same time of year, was used. The data covered five consecutive weekdays for the month of May for each location. For each site the percentage over the speed limit, the 85th percentile speed, mean speed and standard deviation associated with the speed measurements were calculated.

In the majority of cases the mean speeds have decreased year on year. The average for all sites is a reduction of about 3mph (about 10 per cent) between 1997 and 2001.

The data from the two control sites in Cheltenham did not allow firm conclusions on trends in speeds there. One of the sites (Hales Road) indicated that speeds had remained static whereas the other site (Cirencester Road) indicated that speeds had reduced.

Nationally, speeds have remained broadly at the same level during this period, suggesting that the decrease in speed in Gloucester is a real effect of the project.

Higher speeds
Recent research indicates that there is a safety benefit associated with reducing the speed of faster drivers (Taylor, Lynam and Baruya, 2000). A parameter shown to be associated with accident frequency is the percentage of drivers exceeding the speed limit. This is given in Table 17 where it can be seen that in most cases there has been a substantial reduction in the percentage of drivers exceeding the speed limit in the year 2001 compared with 1997, the year after the project started.

Reductions in the speeds of faster drivers occurred at most sites. The average percentage exceeding the speed limit reduced from 38% to 24% between 1997 and 2001. The two control sites in Cheltenham (sites 12 and 13) showed less overall reduction.

5.4.2 Driving cycle surveys
As part of the monitoring of the safer city project, driving cycle surveys (described below) were undertaken at

<table>
<thead>
<tr>
<th>Site No.</th>
<th>Road</th>
<th>Direction</th>
<th>Speed limit Mph</th>
<th>1997</th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bristol Rd**</td>
<td>Northbound</td>
<td>30</td>
<td>73.3</td>
<td>46.8</td>
<td>62.4</td>
<td>47.5</td>
<td>54.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Southbound</td>
<td>30</td>
<td>52.5</td>
<td>71.5</td>
<td>86</td>
<td>63.3</td>
<td>63.2</td>
</tr>
<tr>
<td>2</td>
<td>Metz Way</td>
<td>Westbound</td>
<td>40</td>
<td>49.8</td>
<td>55.2</td>
<td>56.5</td>
<td>46.9</td>
<td>42.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Eastbound</td>
<td>40</td>
<td>61.4</td>
<td>56.4</td>
<td>43.9</td>
<td>29.4</td>
<td>25.5</td>
</tr>
<tr>
<td>3</td>
<td>Barton Street**</td>
<td>Westbound</td>
<td>30</td>
<td>17.4</td>
<td>17.3</td>
<td>17.5</td>
<td>7.6</td>
<td>2.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Eastbound</td>
<td>30</td>
<td>12.7</td>
<td>11.7</td>
<td>10.7</td>
<td>8.2</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Finlay Road**</td>
<td>Northbound</td>
<td>40</td>
<td>26.3</td>
<td>3.1</td>
<td>3.7</td>
<td>4</td>
<td>4.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Southbound</td>
<td>40</td>
<td>8.3</td>
<td>19.3</td>
<td>8.1</td>
<td>7.8</td>
<td>5.2</td>
</tr>
<tr>
<td>5</td>
<td>Trier Way</td>
<td>Northbound NS</td>
<td>30</td>
<td>31</td>
<td>28.3</td>
<td>25.9</td>
<td>*</td>
<td>21.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Northbound OS</td>
<td>30</td>
<td>42.8</td>
<td>51</td>
<td>44.1</td>
<td>*</td>
<td>25.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Southbound NS</td>
<td>30</td>
<td>48.1</td>
<td>44.3</td>
<td>26.4</td>
<td>*</td>
<td>16.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Southbound NS</td>
<td>30</td>
<td>44</td>
<td>44.5</td>
<td>*</td>
<td>*</td>
<td>17.7</td>
</tr>
<tr>
<td>6</td>
<td>Abbeymead Avenue</td>
<td>Northbound</td>
<td>40</td>
<td>13.5</td>
<td>31</td>
<td>17.6</td>
<td>14.7</td>
<td>9.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Southbound</td>
<td>40</td>
<td>12</td>
<td>11</td>
<td>11.3</td>
<td>10.8</td>
<td>9</td>
</tr>
<tr>
<td>7</td>
<td>Hucclecote Rd**</td>
<td>Westbound</td>
<td>30</td>
<td>59.5</td>
<td>63.8</td>
<td>57.9</td>
<td>48.5</td>
<td>38.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Eastbound</td>
<td>30</td>
<td>50.6</td>
<td>60.2</td>
<td>54.7</td>
<td>50.9</td>
<td>48.1</td>
</tr>
<tr>
<td>8</td>
<td>Cheltenham Rd**</td>
<td>Westbound</td>
<td>30</td>
<td>42.5</td>
<td>15</td>
<td>8.3</td>
<td>9.8</td>
<td>8.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Eastbound</td>
<td>30</td>
<td>65.6</td>
<td>6.7</td>
<td>4</td>
<td>8</td>
<td>16.9</td>
</tr>
<tr>
<td>9</td>
<td>High St, Tredworth **</td>
<td>Northbound</td>
<td>30</td>
<td>*</td>
<td>*</td>
<td>13.9</td>
<td>3.3</td>
<td>5.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Southbound</td>
<td>30</td>
<td>20.4</td>
<td>21.7</td>
<td>17.2</td>
<td>14.5</td>
<td>5.3</td>
</tr>
<tr>
<td>10</td>
<td>King Edwards Ave</td>
<td>Northbound</td>
<td>30</td>
<td>20.4</td>
<td>21.7</td>
<td>17.2</td>
<td>14.5</td>
<td>5.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Southbound</td>
<td>30</td>
<td>14.6</td>
<td>26.6</td>
<td>24.3</td>
<td>23.2</td>
<td>22.6</td>
</tr>
<tr>
<td>11</td>
<td>Llanthorny Rd</td>
<td>Northbound</td>
<td>30</td>
<td>47.5</td>
<td>48.8</td>
<td>38.6</td>
<td>22.8</td>
<td>35.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Southbound</td>
<td>30</td>
<td>36.5</td>
<td>32.2</td>
<td>44.6</td>
<td>38.1</td>
<td>43.5</td>
</tr>
<tr>
<td>12</td>
<td>Hales Rd (Cheltenham)</td>
<td>Northbound</td>
<td>30</td>
<td>70.5</td>
<td>74</td>
<td>71.3</td>
<td>72.9</td>
<td>66.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Southbound</td>
<td>30</td>
<td>82.2</td>
<td>78.2</td>
<td>76.6</td>
<td>45.4</td>
<td>70.1</td>
</tr>
<tr>
<td>13</td>
<td>Cirencester Rd (Cheltenham)</td>
<td>Northbound</td>
<td>30</td>
<td>88.9</td>
<td>64.4</td>
<td>62</td>
<td>59.7</td>
<td>51.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Southbound</td>
<td>30</td>
<td>65.7</td>
<td>90</td>
<td>89</td>
<td>88.2</td>
<td>72.9</td>
</tr>
</tbody>
</table>

* No data available
** Speed reducing measures installed
regular intervals. The main purpose of these driving cycles was to collect data for the evaluation of emission levels. However, speed data were also collected and analysed. A summary of the main conclusions with respect to speed is presented below.

The driving cycles made measurements on most of the main roads in the Gloucester City area. The speed data were collected during two-week surveys in which an instrumented car was driven in the normal traffic flow (often referred to as the ‘floating vehicle’ method). A PC-based data acquisition system was fitted inside the passenger compartment of the car to enable its road speed to be logged every second. The drivers were instructed to drive as normally as possible along the routes selected, and in such a way that their speed reflected that of the surrounding traffic.

The mean speed of each driving cycle on a link was calculated from the length of the link and the time taken to travel along it. The resulting values were again averaged to give an overall mean speed for the link.

These data showed that the overall mean speed in the city decreased gradually between 1996 and 2000. The overall reduction in mean speed was 3.2mph, with an annual decrease of 0.6mph. These data give very similar results to the permanent loop site data.

5.4.3 LASER speed measurement from area-wide traffic calming scheme in Longlevens

Before traffic calming measures were installed in the Longlevens area, a number of speed measurements, using hand held LASER gun equipment were undertaken. These measurements covered a maximum period of two hours and were undertaken when vehicles were in free-flow conditions, that is during the weekday morning or afternoon off-peak. These measurements were based on a sample of 100 cars or light vans and covered both directions. The speed measurements were repeated at the same sites, sampling a similar number of vehicles, after implementation of the scheme. The results are presented in Table 18. The speed limit is 30mph.

The speeds after scheme installation show that at the measures mean and 85th percentile speeds were reduced by up to about 12mph depending on the type of measure and location. Between measures there were also substantial speed reductions of up to about 4mph.

5.4.4 Other LASER speed measurements

Periodically, speed measurements using a hand-held LASER gun were undertaken in other parts of Gloucester. These measurements also covered a maximum period of two hours and were undertaken when cars or light vans were in free-flow conditions, that is during the weekday morning or afternoon off-peak.

A number of such before and after speed measurements were undertaken at various sites where traffic calming measures had been installed. The measurements were taken between calming measures, not at them. The results are presented in Table 19. The speed limit on these roads is 30mph.

It can be seen from Table 19 that each of the features installed lead to a reduction in mean and 85th percentile speed.

### Table 18 Effect of traffic calming on car speed in Longlevens

<table>
<thead>
<tr>
<th>Feature</th>
<th>Speed before (mph)</th>
<th>Speed after (mph)</th>
<th>(Change in speed before to after)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>85th percentile</td>
<td>Mean</td>
</tr>
<tr>
<td>At speed cushion</td>
<td>30.3</td>
<td>34.2</td>
<td>22.1 (-8.2)</td>
</tr>
<tr>
<td>At raised junction</td>
<td>30.5</td>
<td>34.8</td>
<td>18.8 (-11.7)</td>
</tr>
<tr>
<td>At road hump</td>
<td>30.5</td>
<td>34.8</td>
<td>20.1 (-10.4)</td>
</tr>
<tr>
<td>Between speed cushion and road hump</td>
<td>30.1</td>
<td>34.6</td>
<td>26.4 (-3.7)</td>
</tr>
<tr>
<td>Between raised junctions</td>
<td>25.2</td>
<td>29.2</td>
<td>22.8 (-2.4)</td>
</tr>
<tr>
<td>At dummy hump</td>
<td>30.0</td>
<td>34.2</td>
<td>24.8 (-5.2)</td>
</tr>
</tbody>
</table>

### Table 19 Speed reductions between measures- results for specific areas

<table>
<thead>
<tr>
<th>Location</th>
<th>Aug-00 Before installation</th>
<th>Jan-02 After installation</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean speed (mph)</td>
<td>85th percentile speed (mph)</td>
<td>Mean speed (mph)</td>
</tr>
<tr>
<td>Reservoir Road (Southbound)</td>
<td>31.8</td>
<td>35.6</td>
<td>27.9</td>
</tr>
<tr>
<td>Stroud Road (Southbound)</td>
<td>35.9</td>
<td>40.0</td>
<td>29.0</td>
</tr>
<tr>
<td>Tuffley Lane (West Bound)</td>
<td>30.1</td>
<td>34.8</td>
<td>25.5</td>
</tr>
<tr>
<td>Bodiam Avenue (Southbound)</td>
<td>28.0</td>
<td>32.2</td>
<td>25.9</td>
</tr>
<tr>
<td>Grange Road (Southbound)</td>
<td>28.2</td>
<td>31.6</td>
<td>24.5</td>
</tr>
<tr>
<td>Zoons Road (Southbound)</td>
<td>26.5</td>
<td>30.7</td>
<td>23.5</td>
</tr>
</tbody>
</table>
5.4.5 Results from area wide traffic calming scheme in Linden/Podsmead

Area-wide traffic calming was implemented in the Linden/Podsmead area. Two roads continued to have a 30mph speed limit (Tuffley Avenue and Podsmead Road), but a 20mph limit was introduced into the rest of the area (including Seymour Road).

In order to enforce speed limit compliance on three of the roads (Tuffley Avenue, Podsmead Road and Seymour Road) the SPECS camera system was installed as an alternative to physical traffic calming measures such as humps. The SPECS system is new technology for the enforcement of speed limits with Gloucester being one of the first towns to implement it. SPECS consists of pairs of video cameras. Six pairs were used in the scheme. The cameras were installed a set distance apart to create a speed controlled zone. As vehicles passed between the entry and exit camera points their number plates were digitally recorded. The images on the video of matching number plates were paired up, and these were used to determine the average vehicle speed between the cameras. Advanced warning signs were installed to alert drivers that they were entering an area where the speeds were being monitored by the SPECS system. The signs featured a specially designed logo and the words ‘Camera Controlled Speed Zone’. Speed humps were installed on Linden Road and speed cushions on Calton Road.

The speeds on these five roads with measures were monitored using pneumatic tubes. Results are presented in Table 20.

It can be seen from Table 20 that at each site the mean speeds and 85th percentile speeds have reduced following the introduction of the SPECS system.

In March 2002, this reduction was up to about 4mph in comparison with the ‘before’ speed data recorded in November 1999. The humps and cushions have led to a large decrease in speed. This is more apparent in March 2002 than September 2001.

5.4.6 Vehicle activated signs

Traffic calming on main roads can prove difficult and, as alternatives to physical engineering measures or speed cameras, vehicle activated signs using micro-wave detection equipment were installed at seven sites subject to a 30mph speed limit. If the vehicle speed was above a pre-set trigger speed then a roadside sign was illuminated to show drivers that they had exceeded the speed limit. Similar signs have been used elsewhere in the UK and abroad (Webster, 1995, Bowers, 2001, Winnett and Wheeler, 2003).

Table 20 Speed and flow data from the Linden/Podsmead scheme

Table 20

<table>
<thead>
<tr>
<th>Speed limit (mph)</th>
<th>Speed of vehicles (mph)</th>
<th>Mean speed</th>
<th>85th percentile</th>
<th>% over 20mph</th>
<th>% over 30mph</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Day</td>
<td>Night</td>
<td>24 hour</td>
<td>Day</td>
</tr>
<tr>
<td>November 1999</td>
<td>Tuffley Avenue</td>
<td>30</td>
<td>29.8</td>
<td>31.1</td>
<td>30.1</td>
</tr>
<tr>
<td></td>
<td>Podsmead Road</td>
<td>30</td>
<td>29.4</td>
<td>31.8</td>
<td>29.9</td>
</tr>
<tr>
<td></td>
<td>Seymour Road</td>
<td>30</td>
<td>21.8</td>
<td>23.6</td>
<td>22.2</td>
</tr>
<tr>
<td></td>
<td>Linden Road</td>
<td>30</td>
<td>23.9</td>
<td>24.8</td>
<td>24.1</td>
</tr>
<tr>
<td></td>
<td>Calton Road</td>
<td>30</td>
<td>22.8</td>
<td>25.9</td>
<td>23.4</td>
</tr>
<tr>
<td>September 2001</td>
<td>Tuffley Avenue (SPECS)</td>
<td>30</td>
<td>26.9</td>
<td>27.5</td>
<td>27.0</td>
</tr>
<tr>
<td></td>
<td>Podsmead Road (SPECS)</td>
<td>30</td>
<td>27.6</td>
<td>28.3</td>
<td>27.7</td>
</tr>
<tr>
<td></td>
<td>Seymour Road (SPECS)</td>
<td>20</td>
<td>20.4</td>
<td>22.1</td>
<td>20.7</td>
</tr>
<tr>
<td></td>
<td>Linden Road (humps)</td>
<td>20</td>
<td>20.1</td>
<td>20.4</td>
<td>20.1</td>
</tr>
<tr>
<td></td>
<td>Calton Road (cushions)</td>
<td>20</td>
<td>20.0</td>
<td>23.4</td>
<td>20.6</td>
</tr>
<tr>
<td>March 2002</td>
<td>Tuffley Avenue (SPECS)</td>
<td>30</td>
<td>27.1</td>
<td>26.3</td>
<td>27.0</td>
</tr>
<tr>
<td></td>
<td>Podsmead Road (SPECS)</td>
<td>30</td>
<td>26.7</td>
<td>27.4</td>
<td>26.8</td>
</tr>
<tr>
<td></td>
<td>Seymour Road (SPECS)</td>
<td>20</td>
<td>20.2</td>
<td>20.9</td>
<td>20.3</td>
</tr>
<tr>
<td></td>
<td>Linden Road (humps)</td>
<td>20</td>
<td>18.7</td>
<td>18.6</td>
<td>18.7</td>
</tr>
<tr>
<td></td>
<td>Calton Road (cushions)</td>
<td>20</td>
<td>19.7</td>
<td>22.2</td>
<td>20.1</td>
</tr>
<tr>
<td>Difference</td>
<td>Tuffley Avenue (SPECS)</td>
<td>-2.9</td>
<td>-3.6</td>
<td>-3.1</td>
<td>-3.9</td>
</tr>
<tr>
<td>September 2001</td>
<td>Podsmead Road (SPECS)</td>
<td>-1.8</td>
<td>-3.5</td>
<td>-2.2</td>
<td>-2.9</td>
</tr>
<tr>
<td>Difference</td>
<td>Seymour Road (SPECS)</td>
<td>-1.4</td>
<td>-1.5</td>
<td>-1.5</td>
<td>-2.7</td>
</tr>
<tr>
<td></td>
<td>Linden Road (humps)</td>
<td>-3.8</td>
<td>-4.4</td>
<td>-4.0</td>
<td>-5.7</td>
</tr>
<tr>
<td>Difference</td>
<td>Calton Road (cushions)</td>
<td>-2.8</td>
<td>-2.5</td>
<td>-2.8</td>
<td>-3.4</td>
</tr>
<tr>
<td>March 2002</td>
<td>Tuffley Avenue (SPECS)</td>
<td>-2.7</td>
<td>-4.8</td>
<td>-3.1</td>
<td>-3.8</td>
</tr>
<tr>
<td>Difference</td>
<td>Podsmead Road (SPECS)</td>
<td>-2.7</td>
<td>-4.4</td>
<td>-3.1</td>
<td>-3.6</td>
</tr>
<tr>
<td>Difference</td>
<td>Seymour Road (SPECS)</td>
<td>-1.6</td>
<td>-2.7</td>
<td>-1.9</td>
<td>-2.5</td>
</tr>
<tr>
<td></td>
<td>Linden Road (humps)</td>
<td>-5.2</td>
<td>-6.2</td>
<td>-5.4</td>
<td>-7.3</td>
</tr>
<tr>
<td>Difference</td>
<td>Calton Road (cushions)</td>
<td>-3.1</td>
<td>-3.7</td>
<td>-3.3</td>
<td>-3.9</td>
</tr>
</tbody>
</table>
In Gloucester, the roadside signs displayed a speed limit roundel and a message. The message was shown in two parts displayed consecutively. For example, ‘Kill your speed’ followed immediately by ‘not a person’ (see Appendix A). In all, four different messages were used as follows:

<table>
<thead>
<tr>
<th>First message</th>
<th>Second message</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAVE LIFE</td>
<td>SLOW DOWN</td>
</tr>
<tr>
<td>KILL YOUR SPEED</td>
<td>NOT A PERSON</td>
</tr>
<tr>
<td>SPEED KILLS</td>
<td>SLOW DOWN</td>
</tr>
<tr>
<td>TOO FAST</td>
<td>TOO FAST</td>
</tr>
</tbody>
</table>

Trigger speeds were initially set at 34mph to 36mph but were subsequently lowered to 30mph.

Speed analysis was undertaken at 4 of the sites. The speed measurements were made using inductive loops located 60m after each sign. The only exception to this was the sign located at Awebridge Way where the measurements were undertaken 230m after the sign. Speed measurements for the vehicle activated signs are presented in Table 21.

The results indicate that there has been a reduction in mean and 85th percentile speeds as a result of the introduction of the vehicle activated signs. These have ranged from about 1mph to 4mph. The reductions have been apparent during all parts of the day.

### 5.4.7 Enforcement of speed limits

The number of offenders detected per hour at speed camera sites has declined during the project. This implies that the vehicle speeds past each camera site have decreased.

Overall speeding detected by LASER gun and GATSO speed cameras resulted in about 4,000 prosecutions for speeding per year, and speeding fines in excess of £160,000 per year. The number of speeding tickets issued has quadrupled since the start of the Safer City Project. (This was not part of a cost recovery programme).

### 5.4.8 Conclusions on speed

Generally speeds have decreased in Gloucester. The average for all the permanent monitoring sites is a reduction of about 3mph (about 10 per cent) in mean speeds between 1997 and 2001.

The driving cycle data gave a similar result, showing that mean speeds in the city decreased gradually between 1996 and 2000. The overall reduction in mean speed was 3.2mph.

There was also a substantial reduction, from 38% to 24%, in the average percentage of drivers exceeding the speed limit.

The installation of the various speed control measures had a large effect, reducing mean and 85th percentile speeds by up to 12.5mph depending on the type of measure and location.

The SPECS speed camera system reduced mean and 85th percentile speeds by around 4mph.

There was also a reduction in mean and 85th percentile speeds as a result of the introduction of the vehicle activated signs. This ranged from about 1mph to 5mph.

Increased police enforcement resulted in the number of speeding tickets issued quadrupling since the start of the Safer City Project.

All these reductions in speed were statistically significant and taken as a whole, all the sources of data point to lower vehicle speeds in Gloucester as a result of the Safer City Project.

### 5.5 Traffic flow changes

#### 5.5.1 Overall flow levels

Monitoring traffic flow changes was relevant to the project to answer two specific questions:

- Did the overall volumes of traffic change during the project?
- How much redistribution of traffic was there around the road network?

Traffic flows were monitored mainly using the 11 permanent loop counter sites which are described in

<table>
<thead>
<tr>
<th>Table 21: Speeds at vehicle activated signs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sign location and direction of measurement</strong></td>
</tr>
<tr>
<td>****</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td><strong>Bristol Road</strong></td>
</tr>
<tr>
<td>Gas works (Northbound)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Gas works (Southbound)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Painswick Road</strong></td>
</tr>
<tr>
<td>Nr Funeral Home (Southbound)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Awebridge Way (Northbound)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
Section 5.4.1. In order to establish whether flow levels changed, the flows recorded for 5 consecutive weekdays at each of the sites were summed. Information from approximately the same time of year was used. The month of May was selected for each of the years 1997 to 2001. The results are shown in Table 22.

Table 22 Total flow through permanent loop sites

<table>
<thead>
<tr>
<th>Year</th>
<th>Total flow through permanent loop sites during five consecutive week days</th>
<th>Percentage change with respect to 1997</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td>173176</td>
<td>-</td>
</tr>
<tr>
<td>1998</td>
<td>174152</td>
<td>0.56</td>
</tr>
<tr>
<td>1999</td>
<td>168882</td>
<td>-2.48</td>
</tr>
<tr>
<td>2000</td>
<td>167028</td>
<td>-3.55</td>
</tr>
<tr>
<td>2001</td>
<td>169786</td>
<td>-1.96</td>
</tr>
</tbody>
</table>

The table indicates that flow levels in 2001 were lower than in 1997 by just under 2%.

Data from counts in Cheltenham also indicated a 2% reduction.

5.5.2 Traffic re-distribution

Main road redistribution

The new road hierarchy required some traffic redistribution onto more suitable routes, although, as mentioned earlier, the measures to achieve this were not strong. In particular, Cheltenham Road and Barton Street were intended to take less traffic and Metz Way more.

Changes in traffic flow on these three roads are shown in Table 23 which does indicate that the project was successful in achieving some re-distribution of traffic in the direction desired.

Table 23 Traffic re-distribution

<table>
<thead>
<tr>
<th>Site</th>
<th>Daily flow 1996</th>
<th>Daily flow 2001</th>
<th>Change %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cheltenham Road</td>
<td>13806</td>
<td>11902</td>
<td>-14</td>
</tr>
<tr>
<td>Barton Street</td>
<td>12700</td>
<td>9530</td>
<td>-25</td>
</tr>
<tr>
<td>Metz Way</td>
<td>17595</td>
<td>19229</td>
<td>+9</td>
</tr>
</tbody>
</table>

Local re-distribution

The effect on traffic distribution of traffic calming a large area was examined in Longlevens, where a large network of mostly residential roads was treated.

Data from automatic traffic counters indicated that traffic flows had been reduced by between 5% and 9% on roads where substantial amounts of traffic calming measures, including vertical deflection, had been installed. Roads with more limited traffic calming, such as build-outs, saw minor increases of around 4% indicating that motorists will make attempts to avoid the more severe traffic calming measures if alternative routes are available.

5.6 Environmental effects

Monitoring of the environmental effects of the Gloucester Safer City Project started in 1996, and continued until the spring of 2002. A detailed account of the emissions and air quality aspects is given in a separate report (Boulter et al., 2003) but a summary of the main findings is given below.

The safety and traffic management measures were introduced incrementally, so not only was there a need to assess the environmental impacts of the Safer City Project as a whole during its lifetime, there was also a need to assess the impact of individual measures as they were introduced. In view of this, some of the environmental surveys were city-wide and repeated throughout the life of the project, whilst others were more local and tailored to assess specific schemes.

Detailed annual surveys of passenger car driving cycles, traffic flow, and traffic composition were undertaken along a sample of main roads in Gloucester which were likely to be affected by the safety or traffic management measures. From the driving cycles, the corresponding changes in vehicle exhaust emissions were evaluated. Measurements of ambient pollutant concentrations were also made in order to relate changes in emissions to changes in local air quality. Measurements of vehicle and traffic noise together with ground-borne vibration were also taken at selected sites before and after the installation of traffic calming.

Total emissions of CO (carbon monoxide) in the city were 26% lower in 2001 than in 1996. Total VOC (volatile organic compounds) emissions decreased by 30%, total NOx (nitrogen oxide) emissions decreased by 36%, and total PM_{10} (particulate matter <10 microns) emissions decreased by 12%. Total emissions of CO2 (carbon dioxide) were found to have decreased by 4%

Transport related changes. When the changes in emissions over time were considered, those of CO, HC (hydrocarbons) and NOx resulting from changes in driving pattern were much less than the changes in emissions due to changes in the LDV (light duty vehicle) fleet. There was a strong net downward trend in emissions of CO, HC and NOx per LDV-km, and an upward trend in emissions of CO2. These changes may have been a result of the introduction of more catalyst-equipped petrol vehicles into the LDV fleet between the annual assessments. In addition, changes in fuel quality may have also affected emissions, notably emissions of benzene which were significantly reduced at all sites.

There were no significant differences between the changes in emissions per vehicle - kilometre on links where measures had been installed and links where they had not.

Traffic emissions by link type generally followed similar patterns to those observed for vehicle emissions: year-on-year decreases in emissions of CO, HC and NOx, and a steady increase in CO2 emissions. Again, there were no significant differences between the changes in traffic emissions on links where traffic management measures had been introduced and the changes on unaffected links.

The most important and pervasive effect on traffic emission levels was the gradual introduction of catalyst-equipped petrol vehicles.

Air quality. The general reductions in emissions of some of the pollutants about which there are health concerns, CO, HC, and NOx, coincided with generally good or improving
roadside air quality. By 2001 the majority of the sites had seen a reduction in NO\textsubscript{2} concentration to below the National Air Quality Objective. Only three sites, Bristol Road, Barton Street and Finlay Road were above the Objective in 2001. Mean PM\textsubscript{10} concentrations during the survey periods were below the air quality Objective of 40 µg/m\textsuperscript{3} (annual mean of daily values) throughout the study.

As mentioned above, during the study the concentration of benzene at the roadside sites decreased significantly possibly as a result of the improvement in fuel quality introduced nationally at the beginning of 2000. The introduction of the safety and traffic management measures does not appear to have greatly affected local benzene concentrations.

Over the period 1997 to 2001 all the sites (other than the background ‘control’ site) had statistically significant reductions in NO\textsubscript{2} concentration. Again the introduction of the safety and traffic management measures do not appear to have greatly affected local concentrations.

A comparison of air quality data before and after the installation of the Hucclecote Road area wide traffic calming scheme revealed that, although concentrations of CO, benzene and NO\textsubscript{2} decreased after installation, the scheme itself had not contributed to the changes in air pollution levels in the area.

**Vehicle noise.** The noise from light vehicles was reduced at each of the monitoring sites following the installation of the various traffic calming measures. The noise reductions at the vertical deflections were 5.2 dB(A) alongside the speed cushion, 5.3 dB(A) alongside the hump, and 6.6 dB(A) alongside the junction table. The reduction in noise between speed cushions was only 2.7 dB(A).

Mean heavy vehicle noise increased slightly at all of the monitoring sites, except alongside the speed cushion, despite decreases in mean vehicle speeds generally comparable with those for light vehicles. The decrease in mean noise level at the cushion was 0.7 dB(A). At the other sites mean noise level increased by between 0.2 and 1.5 dB(A). These changes in noise level were not found to be statistically significant.

For some vehicles, increased body noise may also have contributed to the maximum pass-by noise level.

High level noise events (i.e. >80 dB(A)) were logged at the speed cushion site and alongside the junction table before and after scheme implementation. At the speed cushion the number of high level noise events over the 24-hour period was reduced from 32 to 21 following the installation of the speed cushions.

At the junction table the number of high level noise events was reduced from 13 to 0.

**Traffic noise.** Daytime traffic noise exposure (L\textsubscript{A10,18h}) was reduced at all of the monitoring sites following the installation of the traffic calming measures. Reductions in L\textsubscript{A10,18h} were between 5.8 and 2.8 dB(A).

Night-time noise levels at most sites were reduced by nearly 6 dB(A) (L\textsubscript{A10,6h}) except at the junction table where the noise level was little changed. This was a result of the nearby A40 tending to dominate night-time noise levels, hence diminishing any benefit in reduction in local traffic noise.

**Ground-borne vibration.** Levels of ground-borne vibration at the junction tables were not found to have increased significantly. The maximum levels recorded were unlikely to have been perceptible either before or after installation of the feature. At the speed cushion several events were recorded which may have caused perceptible vibration and therefore nuisance inside the property. Alongside the hump, at least one event was recorded which could have been perceptible. These perceptible vibration events would not be severe enough to cause damage to property.

5.7 The management process

The management structure established in Gloucester was effective in delivering a successful programme. The process was a complex one and the important issues to be considered have been highlighted.

The Safer City Programme adopted a partnership approach involving local stakeholders (local residents, members of the public, members of the councils, police, transport operators, emergency services). There were a variety of expectations from each of the partners and this required careful management. In order to meet this objective it was considered important to ensure that changes were not imposed on businesses and communities as a whole, but that they shared in the decision making process.

This was achieved by:

- Informing, educating and reporting back about constraints, successes and failures.
- Listening to people’s views.
- Responding to consensus views.
- Being open about the working methods.

This process ensured:

- A smooth decision making process.
- The ability to deliver the project in a short space of time.
- The ability to deal with dissent constructively.
- An understanding of the consensus view.
- A project that people generally wanted.

5.7.1 How the process worked

**Pre-project planning**

A major problem encountered immediately the project started was the lack of lead-time into the programme. This meant that the Project Team was being assembled (the team was employed by Gloucestershire County Council on a fixed term contract for five years) at the same time that it was supposed to be developing the strategy and programme of local safety schemes. A lead-time of at least one year would have enabled a much smoother start to the programme and also the necessary time to develop the structures and groups involved and provide suitable training and instruction where required.

It was also suggested that a lead-time of at least one year would have enabled more time to assess a wider range of possible approaches and perhaps this increased range of choice would have benefited the project. As a result of the lack of lead in, time was lost and as a consequence the
Project Team were trying to recover the programme schedule for the first two years. Due to the tight initial time-scale it was necessary to develop some existing proposals rather than start from scratch. Hence the first area to be treated was not the Barton Tredworth area which had the worst safety record but the Longlevens area where there were already proposals in preparation.

Planning considerations
It was considered that the wider planning issues caused some difficulties. The fact that a planning application can be applied for but not acted on for nearly five years may suddenly impact on an installed safety scheme. For example, a new supermarket and 24 hour petrol station on the opposite side of a dual carriageway to a housing area caused problems due to accessibility and severance. The result of this late development was that cars needed to access the shopping facilities, while pedestrians from the housing area wanted to cross the road but there was inadequate provision to do so.

A greater contribution from planners (who were represented on the Technical Group), identifying potential conflicts of interest, would have provided the Project Team with a wider view of the development of the city and would have contributed to the longer term view of road safety development.

In addition, planners need to look more to enhance safety when urban areas are being re-designed. This is particularly so over the long term and further emphasises the need for a city-wide strategy for transport and land use development agreed by all agencies. Conflicts can be created between the road network design and how urban spaces are handled, which an agreed strategy can often resolve. New forms of urban layout are also possible, such as pedestrian streets, home zones, 20mph zones etc. but, for these to come to fruition, a common approach between planners and traffic safety engineers is required.

Safer City Forum
One of the strong points about the forum was that it instilled a feeling of commitment to the project and raised the profile of road safety in Gloucester. This was particularly so when there had been letters in the local newspaper criticising the project. The intention was that forum members were in a position to counter some of the objections by ensuring that organisations were informed about the reasoning behind the measures chosen for implementation.

The forum also provided an opportunity to discuss specific issues with the officers of the council and the Project Team. Interest groups, such as vulnerable road users (cyclists and pedestrians) were represented within the forum.

The forum was not chosen as a road safety expert or elite group, rather it was chosen to reflect back to the Project Team concerns voiced by the local stakeholders where the safety schemes would impact. It was considered that here also, a lead-time of at least a year would have enabled the group to have been able to function more effectively, having had the time to understand more fully the issues involved.

Public consultation and participation
Consultation is very expensive in staff time but is an important aspect of achieving public support and acceptance of proposed changes to the area where a community lives. The detailed local knowledge of residents can result in a better scheme than one devised by the experts on their own. An important part of the process is to report back to communities showing how their opinions have been taken into account and once the work has been completed to tell them what results have been achieved.

In this regard the consultation process worked well in Gloucester. Public views were carefully considered and a broad consensus was generally achieved.

5.7.2 Project management – what worked?
The DfT provided the majority of the funding and was therefore the main client for the project, so a reporting line existed between the Project Team and the client (Figure 1). TRL worked with the client in a technical capacity within the Technical Group. The Technical Group included various professionals (see Section 2) within the community. The DfT/TRL also acted in a steering capacity interacting with the Project Team in order to ensure that the USM strategy was appropriately implemented. This arrangement worked reasonably well in practice although there were occasional conflicts of direction.

The Project Team requested terms of reference from the DfT defining the individual roles of the participant organisations. This document was not drafted and a consequence of this appears to be the failure to develop a hierarchical chain of responsibility and management. The result by default was a matrix structure but this lacked clear accountability.

There was no individual appointed as overall project director. Although such an appointment may not be practical in a multi-organisation, co-operative project, it could have assisted the activities of the Project Team. Enthusiastic elected members and officials working in a co-operative way were essential if the project was to succeed. In this respect, the project was well served.

For other agencies, working on Urban Safety Management is inevitably a lower priority than their key work areas. Enthusiastic staff can put in the required effort because they believe it worthwhile. Planning officers may have their own expectations that may also result in conflicts. The consideration of wider issues, for example, urban regeneration, sustainability, and employment, may appear to conflict with road safety requirements but might have allowed the Project Team to gather more information about other plans and strategies within Gloucester which would impinge on the delivery of the Safer City Project. For example, knowledge of the existence of approved planning applications could then have been fed into the initial Safer City strategy planning.

A key difficulty at the beginning of the project was a lack of staff with experience in the detailed design of traffic calming measures. It is difficult to see how this can be remedied before a programme of such works is underway. However when planning a programme such as Safer City the length of the learning curve needs to be taken into account.
The project manager was appointed in March 1996, just before the project started and initially he had the support of an engineer and a road safety accident investigator. There was in addition part time clerical support. Over time this proved quite inadequate and at times the team required seven officers including three dealing with public consultation.

The time and budget constraints imposed at the start of the project put pressure on the Project Team to implement schemes immediately rather than plan an overall strategy. As a consequence, some of the early safety schemes lacked coherence and consistency.

5.7.3 Summary of management issues

Important elements are:

- Develop terms of reference by the client side defining the individual roles of the participants.
- Develop an appropriate way of agreeing and reporting the obligations of the groups.
- Develop a hierarchical chain of command.
- Select an overall project director or controller.
- Encourage enthusiastic staff.
- Select engineers with experience in the detailed design of traffic calming measures.
- Ensure the Project Team is adequately staffed.
- Maximise lead-time into the programme. Allow lead-in times in order to develop participant groups (i.e. this would have enabled the forum to have been able to function more effectively).
- Assess a wider range of approaches to deal with safety of the network.
- Thorough consultation.

5.7.4 Managing perceptions

The Safer City Project was successful in the sense that it made road safety a high profile public issue. Safer City reports made available to the public, press articles, radio 'phone ins' and interviews, leaflets, consultations and exhibitions showed the genuine concern of the Project Team to fully involve the public in the initiative. By taking into consideration their opinions and discussing the rationale behind the schemes, there was a positive effort to develop ownership and partnership with the Gloucester residents and the public responded well to early inclusion in the planning stage.

The presence of cycling groups on the Safer City Forum resulted in their becoming more involved in consultation. The Safer City Strategy involved the use of cycle lanes and increased use of cycle friendly measures and the contribution of the cyclist groups was valuable in the detailed design and implementation of these measures.

The annual public attitude surveys carried out during the project and described in detail below, proved extremely useful to the project because they provided a baseline from which public responses to consultation could be considered. They also enabled officials and elected members to see how representative responses to consultation were. The surveys were also of value in understanding awareness, acceptability and perceptions of the success of the Safer City Project. Generally they showed that the majority of local people supported both the project in general and specific measures.

Responses to consultation varied considerably and as a consequence methodologies (i.e. on street surveys and the citizen’s panel) were developed to encourage participation and develop a representative response.

The emergency services were consulted during the development of schemes but there were sometimes different views as to what was acceptable. The concerns about being able to meet response times were sometimes an issue. But the Safer City Project Team made considerable efforts to accommodate the concerns of the emergency services by adopting designs of traffic calming schemes that would impact less on response times but still achieve the safety benefits required. For example, on certain routes speed cushions or 'H' humps were used instead of full carriageway-width humps, while on other routes speed cameras, e.g. the SPECS system, were used instead of physical traffic calming measures.

Gloucestershire County Council’s Road Safety Unit received a charter mark for its high standards of public involvement and the Safer City consultation programme was a key element in their submission. In 2000 the county and city council were runners up in the first Guardian IPPR national award for public involvement and winners of the Prince Michael Premier Road Safety Award.

Summary points concerning managing perception:

- Decide an appropriate communication strategy to meet the needs of the residents.
- Need for early public consultation.
- Develop a wide dialogue with the public.
- Use the detailed local knowledge of residents.
- Show how and why opinions are taken into account.
- Involve the media, especially local radio.
- Provide the press with material for features.
- Develop educational awareness, especially in schools.
- Need to consult the emergency services, the police and transport operators at an early stage.
- Develop Project Team skills to include consultation techniques.

5.8 Public opinion and attitudes

Since the Safer City Project began in 1996, an annual survey has been undertaken by Social Research Associates (SRA) to monitor perceptions and attitudes of residents. In addition, less frequent surveys of visitors and businesses have also been undertaken. The initial round of surveys was intended to set a baseline position against which changes in opinions could be gauged.

Before undertaking the surveys preliminary discussions were held with the project officers and preliminary questionnaires were piloted. Following this limited trial the questionnaires were refined and finalised for all groups of interviewees. The initial surveys consisted of street surveys of 100 randomly selected visitors in the city centre, postal questionnaires sent to the majority of businesses (450), and
a stratified random sample of 600 residents identified from the electoral roll for face to face home interviews. Response rates were about 75% for residents and about 33% for the business sample.

5.8.1 Results
The first survey was undertaken in 1996, after the Safer City Project had been announced but before any substantive work had been done in the city. Awareness was already being raised of road safety issues by way of specific area consultations and speed enforcement. Some general project publicity had also been started. These early attitude surveys sought to determine attitudes to safety within the city, as well as to gauge awareness of the increasing work that was being undertaken.

General views were:
- Speeding was a major concern amongst residents.
- There was support for the Safer City Project, but pessimism about what it might achieve.
- Parking was an issue in many residential areas.
- There was support for cycling and tolerance for shared use in residential areas, but disappointment that the cycle lanes did not continue in the city centre.
- Additional cycle facilities would be needed to encourage a major shift to cycling on a regular basis.
- Personal safety concerns were restricting walking, particularly on journeys to school.

The four issues which householders were very bothered about were speeding (41% of respondents), poor driving (25%), parking (24%) and congestion (17%). Speeding was a worry to many local people both on main A roads and on other major routes in suburban areas. Concerns about safety were widespread and people gave frequent examples of past accidents, near misses and fears about future accidents (Figure 5).

Poor driving was seen as another big problem and some people explained this by the spread out nature of estates and the tendency of young people in particular to purchase old cars and drive irresponsibly. Some residents also felt that the police did not do enough to tackle driving offences.

It is interesting to note that very few people were bothered by pollution. To the extent that there was a concern (10% dirt and 7% fumes) it was based on visual evidence such as smoke emissions, washing getting dirty on the line, dust blowing in people’s eyes and unpleasant smells. There was little concern about unseen pollutants, whether traffic-based or not.

Visitors to Gloucester were less concerned about traffic issues than residents or businesses. Less than 10% were ‘very bothered’ by any of the problems mentioned other than dust and dirt (16% ‘very bothered’). Indeed the majority of visitors found their visit enjoyable.

Local business managers were also asked to give their views on traffic and safety issues and the results showed differences compared with the other groups (Figure 5). Business respondents were bothered by congestion (60% saying they were ‘very bothered’ by it), with parking for staff the next most serious concern (45% ‘very bothered’).

![Figure 5](image_url)

**Figure 5** Percentage of respondents ‘very bothered’ by specific traffic and environmental issues
More than one third of business respondents were ‘very bothered by’ dirt and dust, fumes, parking for deliveries and the number of lorries in the city centre.

Local residents gave similar ratings for road safety in local areas to those for the city centre (Figures 6 and 7). 66% felt that road safety in their local areas was good or reasonable, with only 16% giving negative ratings.

This brief summary set the baseline position against which the annual surveys were used to monitor any changes in attitudes. The following sections review these changes over the course of the project.

5.8.2 Residents’ responses over the period of the project

Figure 8 shows the ‘very bothered’ rating for all of the issues comparing years 1996 to 2000. For the majority of issues the ratings are more favourable at the end of the project than in previous years.

Figure 9 shows the results from the residents’ survey for the years 1997 to 2000 for road safety within the city centre. As can be seen, the percentage of ‘good’ and ‘reasonable’ ratings have been consistently high throughout the duration of the project.

Local residents were also asked whether they felt road safety had improved in the local areas. The results (Figure 10) from the years 1997 to 2000 again show that ‘good’ and ‘reasonable’ ratings have been consistently high throughout the duration of the project.

Further analysis of the results (Figure 11) show differences between ratings within the project sub areas. The chart below shows the results from the years 1997 to

![Figure 6 Rating for road safety in Gloucester city](image)

![Figure 7 Rating for road safety in local area](image)
2000. Once again, the ratings have been consistently high throughout the duration of the project.

The year on year variations in ratings often correlate with the timing of works and awareness of the project. Those areas where works are or have been underway generally rate road safety lower at that time, similarly those who have yet to have improvements undertaken rate safety lower in anticipation of works being undertaken that are already in place elsewhere. It is linked to raising expectations and then being seen to deliver. In all cases the end state shows an improvement over the starting point. Nearly all of the aspects respondents were asked to rate received a more favourable response than at the beginning of the project.

As far as specific measures were concerned, speed cameras and the associated signs and posters were rated the most positively, followed by ratings for the cycle lanes, bus lanes and speed humps.

Figure 8 Residents’ survey, percentage of respondents ‘very bothered’ by various issues, 1996 to 2000
83% of respondents rated speed cameras as good or OK.
79% of respondents rated speed camera signs and posters as good or OK.
77% of respondents rated cycle lanes as good or OK.
69% of respondents rated bus lanes as good or OK.
52% of respondents rated speed humps as good or OK.

Speed cameras were perceived as a more effective measure to control speeding than speed humps. Speed humps although accepted as effective most of the time were also seen as encouraging poor driving standards, especially in younger drivers and declined in popularity as more were installed in the city.

The other aspects of the project’s works, such as the Safer City article in The Citizen, gateways, brighter street lighting, wider pavements/narrower roads were rated as good or OK by approximately a third of respondents.

Residents were also asked about modal use for different purposes. Apart from journeys to school and local parks, the car was predominant. However, at the start of the project 6% went to work by cycle and 8% went by bus for non-food shopping, especially when visiting the city centre. In addition, strong desires were expressed both to walk and to cycle if safer conditions could be created. This involved improvements to the transport system but for walking there was felt to be an additional need for improvements in personal safety. Year on year
comparisons have been made for each mode of travel as tabulated below (Table 24).

There was a reduction in car travel for a number of the activities (Table 24) and small increase in bus travel for the majority of activities (Table 25).

Overall, walking as a mode of travel appeared to have declined (Table 26), although walking to leisure activities, for example, going to the pub (27%) and visiting the park (33%) remained substantial.

Cycling, as a mode of transport was consistently low and had declined for a number of the activities although any changes were small (Table 27).

The results from all the surveys show little evidence of substantial modal shift. This is supported by the findings that when respondents were asked directly if their travel patterns had changed during the five years most (96% to 99%) respondents said they had not. Walking was a significant mode for leisure and recreational purposes and there was some qualitative evidence that people in traffic calmed areas were beginning to walk more.

Table 24 Residents' survey, percentage of respondents using a car for each purpose, 1996 to 2000

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<td>66%</td>
<td>63%</td>
<td>69%</td>
<td>65%</td>
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<tr>
<td>General</td>
<td>51%</td>
<td>34%</td>
<td>51%</td>
<td>61%</td>
<td>59%</td>
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<tr>
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<td>41%</td>
<td>34%</td>
<td>36%</td>
<td>39%</td>
<td>18%</td>
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<tr>
<td>Work</td>
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<td>68%</td>
<td>67%</td>
<td>73%</td>
<td>49%</td>
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<td>70%</td>
<td>71%</td>
<td>74%</td>
<td>56%</td>
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<td>Park</td>
<td>28%</td>
<td>38%</td>
<td>34%</td>
<td>31%</td>
<td>27%</td>
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<tr>
<td>Visit friends</td>
<td>75%</td>
<td>69%</td>
<td>67%</td>
<td>71%</td>
<td>66%</td>
</tr>
<tr>
<td>Visit club</td>
<td>62%</td>
<td>63%</td>
<td>59%</td>
<td>59%</td>
<td>44%</td>
</tr>
</tbody>
</table>

Table 25 Residents' survey, percentage of respondents using a bus for each purpose, 1996 to 2000

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<td>7%</td>
<td>4%</td>
<td>7%</td>
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<td>11%</td>
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<tr>
<td>School</td>
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<td>12%</td>
<td>10%</td>
<td>4%</td>
<td>2%</td>
</tr>
<tr>
<td>Work</td>
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<td>9%</td>
<td>5%</td>
<td>4%</td>
<td>2%</td>
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<tr>
<td>Cinema</td>
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<td>6%</td>
<td>5%</td>
<td>7%</td>
<td>5%</td>
</tr>
<tr>
<td>Pub</td>
<td>3%</td>
<td>4%</td>
<td>3%</td>
<td>5%</td>
<td>4%</td>
</tr>
<tr>
<td>Park</td>
<td>1%</td>
<td>4%</td>
<td>2%</td>
<td>1%</td>
<td>2%</td>
</tr>
<tr>
<td>Visit friends</td>
<td>4%</td>
<td>5%</td>
<td>3%</td>
<td>3%</td>
<td>4%</td>
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<tr>
<td>Visit club</td>
<td>2%</td>
<td>3%</td>
<td>6%</td>
<td>3%</td>
<td>2%</td>
</tr>
</tbody>
</table>

Table 26 Residents' survey, percentage of respondents walking for each purpose, 1996 to 2000

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>Food</td>
<td>17%</td>
<td>12%</td>
<td>17%</td>
<td>14%</td>
<td>9%</td>
</tr>
<tr>
<td>General</td>
<td>29%</td>
<td>45%</td>
<td>24%</td>
<td>21%</td>
<td>12%</td>
</tr>
<tr>
<td>School</td>
<td>43%</td>
<td>45%</td>
<td>38%</td>
<td>46%</td>
<td>13%</td>
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<tr>
<td>Work</td>
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<td>8%</td>
<td>15%</td>
<td>11%</td>
<td>5%</td>
</tr>
<tr>
<td>Cinema</td>
<td>14%</td>
<td>12%</td>
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<td>14%</td>
<td>6%</td>
</tr>
<tr>
<td>Pub</td>
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<tr>
<td>Park</td>
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<td>49%</td>
<td>56%</td>
<td>60%</td>
<td>33%</td>
</tr>
<tr>
<td>Visit friends</td>
<td>8%</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>7%</td>
</tr>
<tr>
<td>Visit club</td>
<td>20%</td>
<td>20%</td>
<td>23%</td>
<td>29%</td>
<td>12%</td>
</tr>
</tbody>
</table>

Table 27 Residents' survey, percentage of respondents cycling for each purpose, 1996 to 2000

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>Food</td>
<td>1%</td>
<td>1%</td>
<td>&gt;1%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>General</td>
<td>3%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
<td>2%</td>
</tr>
<tr>
<td>School</td>
<td>4%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Work</td>
<td>6%</td>
<td>6%</td>
<td>4%</td>
<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td>Cinema</td>
<td>2%</td>
<td>0%</td>
<td>1%</td>
<td>0%</td>
<td>&gt;1%</td>
</tr>
<tr>
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<td>3%</td>
<td>2%</td>
<td>&gt;1%</td>
</tr>
<tr>
<td>Visit friends</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Visit club</td>
<td>1%</td>
<td>1%</td>
<td>2%</td>
<td>1%</td>
<td>3%</td>
</tr>
</tbody>
</table>

Figure 11 Percentage good rating for road safety in the local area, by area, 1997 to 2000
With respect to children’s travel patterns, parents allowed children more independent travel than previously. Road safety (as a single issue) was not a reason why children were not allowed independent travel. Nevertheless parents were still concerned about personal safety issues and needed reassurance that both road safety and personal security was satisfactory before allowing children to go out on their own.

5.8.3 Business responses
In 1997 and 2000 business surveys were repeated. A postal questionnaire was sent to 450 businesses. 166 responses were received in 1997 and 152 in 2000, response rates of 37% and 34% respectively, compared with 30% in 1996.

Overall road safety ratings for the city centre had improved over the years (Table 28), with an increasing percentage rating road safety as ‘good’ and fewer business respondents rating road safety as ‘not very good’, ‘poor’ or ‘dreadful’ (Table 29).

| Table 28 Distribution of ratings for road safety in the city centre |
|--------------------|----------------|----------------|
| Good               | Reasonable    | Mixed views   |
| Businesses         | Businesses    | Businesses    |
| 11%                | 69%           | Not asked     |
| 14%                | 69%           | Not asked     |
| 33%                | 38%           | 15%           |
| Not very good      | Poor          | Dreadful      |
| 11%                | 5%            | 3%            |
| 14%                | 1%            | 1%            |
| 6%                 | 3%            | 3%            |
| Do not know        |               |               |
| 1%                 |               | 2%            |

| Table 29 Details of positive ratings by business respondents |
|-----------------|----------------|----------------|
| % of total sample rating positively | % of total sample rating positively |                  |
| 1997             | 2000           |                  |
| Speed cameras    | 77%            | 80%             |
| New speed cameras| 68%            | 86%             |
| Posters / adverts| 40%            | 36%             |
| Gateways         | 28%            | 36%             |
| Road humps       | 40%            | 39%             |
| Brighter lighting| 30%            | 41%             |
| Wider pavements / narrower roads | 30% | 30% |
| Cycle lanes      | 59%            | 72%             |

Table 30 Traffic issues which businesses rated as ‘big problems’

<table>
<thead>
<tr>
<th>% of businesses identifying ‘big problems’ 1996</th>
<th>% of businesses identifying ‘big problems’ 2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congestion</td>
<td>60%</td>
</tr>
<tr>
<td>Parking for staff</td>
<td>46%</td>
</tr>
<tr>
<td>Lorries</td>
<td>36%</td>
</tr>
<tr>
<td>Fumes</td>
<td>33%</td>
</tr>
<tr>
<td>Parking for deliveries</td>
<td>30%</td>
</tr>
<tr>
<td>Dirt &amp; Dust</td>
<td>33%</td>
</tr>
<tr>
<td>Crossing the road</td>
<td>26%</td>
</tr>
<tr>
<td>Noise</td>
<td>29%</td>
</tr>
<tr>
<td>Poor driving</td>
<td>27%</td>
</tr>
<tr>
<td>Cyclists on the pavement</td>
<td>15%</td>
</tr>
<tr>
<td>Vibration</td>
<td>23%</td>
</tr>
<tr>
<td>Poor lighting</td>
<td>11%</td>
</tr>
<tr>
<td>Speeding</td>
<td>18%</td>
</tr>
<tr>
<td>Poor signing</td>
<td>14%</td>
</tr>
<tr>
<td>Narrow pavements</td>
<td>5%</td>
</tr>
</tbody>
</table>

As already mentioned, business respondents judged the problem of congestion as a major concern, with parking for staff being the second biggest problem. There were also difficulties with deliveries and access for customers picking up large or heavy purchases. The majority of traffic and safety issues asked about have shown some improvement over the years, with congestion showing the biggest improvement (Table 30).

5.8.4 Conclusions on public opinion

In 2000 both the residents’ and business questionnaires asked respondents whether they felt road safety had improved in Gloucester during the past five years. In both cases a positive response was recorded with nearly two thirds of local residents and a half of business responses feeling that road safety had improved although business respondents considered safety issues of less importance than residents did (Figure 12).

The residents’ survey found speeding, congestion, parking problems and poor driving standards to be the biggest problems. The business survey found congestion, staff parking and delivery parking to be the biggest problems. Encouragingly, nearly all of the various issues respondents were asked to rate were perceived as less of a problem in 2000 than when the project began in 1996. Specific aspects of the project were rated more highly than at the beginning of the project. The highest ratings were in respect of speed cameras (83% rated favourably) and the associated signs and posters, followed by cycle lanes, bus lanes and speed humps (52%). Speed cameras were perceived as a more effective measure to curb speeding than speed humps. Overall the changes made towards improving safety in Gloucester have been recognised by the general population.

5.9 Public consultation evaluation
From its inception the Safer City Project was designed to be consultative, in the broadest sense.

In the early stages of the project (1996-7), public consultation took the form of press announcements and area-wide leaflets containing a free-post questionnaire about proposed road safety measures for an area. In most cases there was also a staffed series of exhibitions.

However, low response rates to this consultation process, led to the use of on-street surveys and Citizens’ Panels, although this was not a widely used form of consultation, and was not used at the outset of developing a scheme.

The Safer City Project also attracted some vociferous criticism for some measures, or particular area projects. The
criticism was voiced in a variety of ways, including letters to Councillors, the Safer City Team and the local daily paper (‘The Citizen’). There were critical articles in the press, and petitions organised about measures. One problem with opposition expressed as comment, is that it is difficult to know how representative it is of popular opinion.

It is against this background that the annual Safer City Attitude Surveys (1996-2000), which were based on a stratified random sample, was of value in understanding awareness, acceptability and perceptions of the success of the Safer City Project. These annual surveys were not strictly part of the consultation process, but were geared to monitoring the project. However, they were extremely useful in demonstrating that overall the majority of local people supported both the project in general and particular measures. It was particularly useful when this view was challenged by individual interest groups. In addition the survey also highlighted other areas of concern, such as personal security issues, relative to anxieties about danger from traffic.

Brochures and leaflets were widely used throughout the life of the project, distributed to households and businesses within the area affected by a proposed scheme. In general the schemes were prefaced by discussions with key stakeholders, and the area was then leafleted, with a questionnaire. Response rates tended to be very low, around 8% (low response rates are typical of this type of survey), but where they were even lower or opinion was divided, more consultation took place, including face to face surveys, and in two cases, citizens’ panels and focus groups. Projects were frequently modified as a result of the consultation, and the residents re-consulted by leaflet, with viable alternative suggestions. Including a questionnaire with the leaflet was found to be indispensable – in the two cases where residents were invited to write in (Matson and Painswick roundabout), rather than complete a short form, very low response rates were achieved.

Exhibitions did not attract very large audiences, and the fully staffed exhibitions at public venues were discontinued by the end of 1998, although there were some unstaffed exhibitions mounted in locations such as schools within the area of a scheme.

Press advertisements were used throughout the life of the project, appearing regularly in The Citizen, and occasionally also in the free papers.

5.9.1 Survey of general views on consultation

Panel discussion

A panel discussion day was held on 20th February 2001 with key stakeholders in the Safer City Project, such as councillors and local authority officials, the Safer City Project Team, CASSIE, emergency services, and public transport operators. The purpose of this was to reflect on the Safer City Project. It took the form of looking at what had worked well and what lessons had been learned about devising and implementing a major project.

The participants agreed that overall the project was a success. The key findings relating to the consultation process are summarised below.

Publicity was perceived as being an important part of consultation, and in general it was felt that this aspect had been successfully handled.

There was a perceived need for wider community consultation earlier in the project.

It was felt that the attitudinal research had been carried out well, and had involved a wider audience. The annual attitude surveys were considered to be of value as they gave an insight into how the project was perceived by a representative sample of the public over time. This was of particular value when vociferous and unrepresentative groups claimed they spoke for the community.

The citizens’ panels were seen as adding great value, and had enabled contentious issues on individual schemes to be resolved within the community, by its residents. This successful experience led to the suggestion that it would have been beneficial to establish a larger

![Figure 12](image-url)
community panel early in the life of the project as a means of ongoing consultation.

Education was felt to be an under-developed element, both with respect to schools and to the general public. There was a strong consensus of the need to ‘piggy back’ on existing projects and opportunities. An example of this could be the use of related projects such as health initiatives, which could also feed into the discussions. In addition curriculum slots in school could be used and opportunities for involving the public as citizens exploited.

The Safer City Forum itself was perceived by those present to provide excellent potential as a mechanism to build relationships at all levels within the project. It was also seen as providing an opportunity to various groups of people to participate, engendering a sense of ownership of the project. However there was a lack of decision making power and this was felt to be a reason why interest diminished on the part of some members.

Discussions with the editor of The Citizen also suggested that although the paper supported the project in editorial terms, there was scope for the provision of more material for features. When these were lacking it left a gap which tended to be filled with ‘bad news’ stories about the project. In addition, the copy provided for the paid advertisements was thought to be rather bland.

Another issue was the Safer City policy decision not to reply to critical letters (and articles) which appeared in the press. The editor felt that this left an impression of not caring about opposing views. He felt that there was an opportunity missed to state a more positive opposing case, and reply to erroneous statements of fact. It is common practice, however, for official bodies not to get involved in replying to letters in the press, preferring to deal with complainants directly.

Additional survey
To ascertain how consultation affected the views of residents an additional survey comprising 240 interviews with residents was carried out in each of three areas of the city. The areas were selected to give a mix of time-scales of implementation, response to consultation and methods used. Residents were selected on a random basis from the electoral roll and a sample of people with businesses in the areas was also included. The interview schedules were focused on obtaining a combination of quantitative data and qualitative insights.

The results showed a steady build up of public awareness (Table 31). This is perhaps not surprising in light of the infrastructure changes in the three areas. However, there were clear indications that most people also equated the Safer City Project with safety messages such as not speeding and being aware of cyclists and pedestrians. Many people also had a sense of civic pride that Gloucester had taken a lead in the area and were aware of the reduction in accidents achieved by the project.

Respondents were asked to express approval or disapproval of a range of measures. The results show high levels of support for different measures with the exception of road humps (Table 32). Opinions on road humps in these areas selected to assess consultation were less favourable than in the general city-wide sample. Road humps were seen by some people as a cause of noise and a source of discomfort to those with spinal problems.

Respondents were also asked about specific aspects of consultation which had been used in their areas. Examples were used to discuss the various printed methods and photographs and press cuttings were also shown (Table 33).

Table 31 Overall views - percentage of respondents in individual areas

<table>
<thead>
<tr>
<th>Overall, has the Safer City Project been a good thing for Gloucester?</th>
<th>Longlevens</th>
<th>Matson &amp; Tuffley</th>
<th>Barton &amp; Tredworth</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very good</td>
<td>51%</td>
<td>58%</td>
<td>59%</td>
<td>56%</td>
</tr>
<tr>
<td>Good</td>
<td>17%</td>
<td>13%</td>
<td>11%</td>
<td>14%</td>
</tr>
<tr>
<td>Reasonable</td>
<td>28%</td>
<td>23%</td>
<td>25%</td>
<td>25%</td>
</tr>
<tr>
<td>Mixed views</td>
<td>3%</td>
<td>8%</td>
<td>5%</td>
<td>5%</td>
</tr>
</tbody>
</table>

Table 32 Percentage of respondents with opinions about safety measures

<table>
<thead>
<tr>
<th>Approve</th>
<th>Disapprove</th>
<th>Mixed views</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cycle lanes</td>
<td>68%</td>
<td>15%</td>
</tr>
<tr>
<td>Road humps</td>
<td>22%</td>
<td>57%</td>
</tr>
<tr>
<td>New crossings</td>
<td>76%</td>
<td>9%</td>
</tr>
<tr>
<td>Speed cameras</td>
<td>77%</td>
<td>11%</td>
</tr>
<tr>
<td>Anti-speeding signs</td>
<td>83%</td>
<td>7%</td>
</tr>
</tbody>
</table>

Over half had read pamphlets about the project and felt they were a good or reasonable method of consultation. The maps were clear and in most cases people had been able to understand the location and nature of what was proposed. The inclusion of photographs was also helpful. Separate deliveries ensured that pamphlets did not get lost amongst other ‘circulars’ which were frequently received.

Questionnaires were also popular. Overall 32% claimed they had replied to a questionnaire although checks showed that this was higher than the returns received by the project.

Table 33 Percentage of respondents in individual area ratings pamphlets and questionnaires

| Read pamphlets | 70% | 53% | 47% | 57% |
| Positive | 84% | 56% | 62% | 68% |
| Mixed views | 7% | 1% | 9% | 6% |
| Negative | 8% | 7% | 20% | 12% |
| No opinion/don’t know | 1% | 37% | 8% | 15% |

| Replied to questionnaire | 33% | 36% | 26% | 32% |
| Positive | 85% | 43% | 68% | 65% |
| Mixed views | 3% | 0% | 8% | 4% |
| Negative | 7% | 5% | 13% | 8% |
| No opinion/don’t know | 5% | 53% | 12% | 23% |
Written pamphlets and questionnaires were not seen by all as user friendly. Even the offer of material in ethnic minority languages was not always useful as some people who could not speak English could not read their own language either. A telephone translation service was offered to help those individuals with language difficulties.

There was also a commonly held view that expressing an opinion would not affect outcomes which were felt to have already been decided. To some extent there was a conflict between the need for well presented pamphlets which people can understand and the impression which can thus be gained that the suggestions shown have already been decided.

'They wouldn’t show you all those maps and photos if they hadn’t already decided.'

'If they were really interested in our opinion, they would ask us what we wanted instead of just showing us what their plans are.'

'I did send the questionnaire back but I never heard any more and they didn’t do what I suggested.'

Many people had returned questionnaires, read the pamphlets and written or phoned the Council. There was also a range of very positive comments about the feedback, especially to individual letters.

'I dashed off a short note and I got back a really long and interesting letter from them.'

'They kept writing and saying they wanted our ideas. I thought it was very good and even though I didn’t agree with everything they did I did feel we had had our chance to say what we thought.'

Throughout the five years of the Safer City Project, regular fortnightly half page ‘advertisements’ in the local newspaper were used by the Safer City Project Team to give information and publicise the aims of the project. In addition the newspaper published many letters from local people about aspects of the project and also carried editorial articles. The newspaper itself achieves high levels of household penetration and thus the two thirds who had read articles about the project represents a high proportion of all residents in Gloucester.

The decision of the Project Team not to reply to letters in the press meant that most people read negative views about the project in the letters page without seeing an official response.

Similarly and in contrast, the Safer City ‘advertisements’ were often seen as evidence of an uncritical editorial stance by the Citizen. However, overall it was felt that the local paper was a good method of communication and debate. For many people the local paper was their only reading and along with the local radio, their main source of local news.

As part of this question the role of local radio was also discussed but, unlike the articles in The Citizen, few respondents could recall hearing items about the project on the radio although there were a number of radio features and discussions about the project.

Overall 12% of respondents recalled visiting an exhibition related to the project. Those who had attended exhibitions had found them generally rather boring and as with the pamphlets inclined to give the impression that decisions had been made.

'It was just a load of all writing.'

'I did go but it never gave the sense of what the changes would really be like and the problems like parking in the cycle lane which came about. They should be more honest and tell you the pros and cons.'

In contrast some people had found the opportunity to talk to project officers very helpful both in terms of being able to explore the issues in more detail and also in face to face communication.

'I spent half an hour talking to the men there – they were very knowledgeable and explained a lot which wasn’t spelled out in the exhibition. I thought they were very approachable too.'

The concept of what councillors (as distinct from officers and central government) did was very hazy. Few people knew who their councillors were or how to get in touch with them. Others felt daunted at the idea of writing a formal letter to their councillor.

There was the desire for more verbal and face to face contact. There was reluctance to respond to general requests for participation. It was not that people were apathetic but many lacked confidence, thought their views were uninformed, and felt daunted by technical officers. In contrast, direct contact was welcomed and often responded to positively. This was certainly the experience of asking individual residents to volunteer for a citizen’s panel or discussions stemming from the face to face surveys carried out during the project.

'I’ve had a lot to say today I know but I would never think of writing all that.'

'Councillors should come round individual streets and ask people to come out and talk – we only see them doing that at election time.'

'I saw where the exhibition was but I would be too shy to go into something like that – they all look at you as you go in and then pounce on you and talk gobbledegook.'

'I do care about safety but young people don’t want to go to stuffy old exhibitions – we want street festivals and open air things.'

'We ladies (Muslim) don’t go to such things but we would discuss it in our own group.'

The citizens’ panels were also well received. Although few people actually took a direct part many had heard about it either via local neighbourhood networks or in the local press (Table 34).

'My neighbour was on the panel and we all talked about it each week.'
that the resulting ‘dialogue’ has played an important part
The process of carrying out public consultation has shown
Overview
with comments. work, replying to all those who sent back questionnaires responding to opposing views. explaining how and why a decision was reached, and
An important part of the consultation process is feedback, Feedback and evaluation
important to consider carefully the most effective way of communicating with the target group. Techniques
There was a need to be open both about the constraints on the consultation process and the known disadvantages as well as benefits of proposed measures. Demonstrations could be more localised, without necessarily being elaborate: examples could include cardboard cut-outs, chalk in the road, polystyrene mock-ups, etc.
Radio was used to a considerable extent but did not feature much in respondents recall of how they had received information. Radio can be used to good effect, especially if targeted to groups who are most likely to rely on verbal communication
Exhibitions did not reach a large proportion of residents but they were nonetheless highly valued by the most interested and concerned. Their design and venue choices could perhaps be improved.
There is evidence that various groups in society respond in different ways to particular consultation techniques. For example, some people find attending a conventionally structured exhibition intimidating, while others find it boring. Literacy levels, as well as the relative deprivation of an area may affect responses to a leaflet. It is therefore important to consider carefully the most effective way of communicating with the target group.

Feedback and evaluation
An important part of the consultation process is feedback, explaining how and why a decision was reached, and responding to opposing views.
Feedback, was an important part of the Project Team’s work, replying to all those who sent back questionnaires with comments.

Overview
The process of carrying out public consultation has shown that the resulting ‘dialogue’ has played an important part not only in increasing acceptance of the measures required, but also in changing the underlying culture relating to the need for road safety measures
Increasingly road safety and traffic management initiatives are seen as requiring Social Science and Engineering skills in order to develop and implement schemes which are both effective and acceptable. As a very innovative project, the Safer City initiative had a special need for this skills combination. It was fortunate that the Project Team brought a variety of capabilities to the task and also a willingness to develop new skills. Given that similar projects are likely to recruit people with primary skills in transport engineering, there will be a particular need to provide engineers with supplementary training in managerial skills, consultation techniques and ‘softer’ traffic management solutions.

5.9.2 Conclusions on consultation
There is a need to bring the public in earlier in the planning stage so that they do not feel that decisions have already been made. The length of time given to consultation may seem too long for individual respondents expecting feedback.
Although effective public consultation can be time-consuming, it is vital to achieving greater acceptance and satisfaction with the final outcome. There can be a tension between the time taken to build consensus, and the desire of many of the parties to move on with the work.

Techniques
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5.10 Disaggregated Effectiveness Evaluation (DEE®)
The preceding sections have described various elements of both the project process and its organisation. The successful completion of the Safer City Project required a complex interaction between various organisations and individuals. In order to meet the various objectives of the project disparate interests had to be brought together to share a common goal. In order to track the progress of these disparate elements an objectives achievement methodology was applied. The particular system used is called Disaggregated Effectiveness Evaluation (DEE©) and has been developed by Dr Alan Ross to monitor and evaluate the effectiveness of International Funding Agency Investment in a wide range of international projects.

5.10.1 The process
The system works by agreeing a defined objective for any project, organisation or masterplan which is then broken down into a number of easily defined sectors. These in turn are broken down into smaller constituent components and elements. At this level, the outputs for these elements are then defined. For each output a number of simple indicators of achievement can be specified with agreed target dates for completion. Taken together, the achievement of these indicators gives the professionals involved a high degree of confidence that if all the indicators are fully completed then the overall objective will also be achieved (see Figures 13 to 16).
In the case of the Gloucester Safer City Project an overall project objective for achievement was defined as: To achieve a one third reduction in casualties from the 1991-95 average level in the city by the implementation of a comprehensive city-wide safety strategy, in order to enable the people of Gloucester to make safer use of the road network.

The definition of such an objective, not only encompassed the main focus of the project (a reduction in casualties) but also looked at some of the constituent elements which took place over the five years of the project. This enabled the project to be split into five main sectors of activity. These were:

<table>
<thead>
<tr>
<th>Area</th>
<th>Longlevens</th>
<th>Matson &amp; Taffley</th>
<th>Barton &amp; Tredworth</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>53%</td>
<td>53%</td>
<td>45%</td>
<td>50%</td>
</tr>
<tr>
<td>Mixed views</td>
<td>12%</td>
<td>7%</td>
<td>13%</td>
<td>10%</td>
</tr>
<tr>
<td>Negative</td>
<td>27%</td>
<td>30%</td>
<td>21%</td>
<td>26%</td>
</tr>
<tr>
<td>No opinion/don’t know</td>
<td>7%</td>
<td>11%</td>
<td>21%</td>
<td>13%</td>
</tr>
</tbody>
</table>
SECTOR OBJECTIVE
To achieve a one third casualty reduction of the 1991-95 average in order to enable the people of Gloucester to make safer use of road network by the implementation of a comprehensive city-wide safety strategy.

Figure 13 DEE© framework
Figure 14 DEE© sector – co-ordination framework

(Note: The numbers assigned to each stage represent the weightings allocated. See text)

Figure 15 Achievement profiles
Similar objectives were set for each sector of activity and detailed frameworks of activity developed for each sector. The overall framework for the project is shown below, together with a detailed framework for the Coordination Sector (Figures 13 and 14).

In order to assess the contribution of each indicator to the overall achievement of the project objective, weightings were applied to each element at each level. Starting at the highest level, the relative importance of each sector was assessed such that in total all sectors achieve 100% contribution at that level. At this stage equal importance was given to each of the five sectors, i.e., each element has a 20% weighting. The process was then repeated within each sector, considering one level at a time and ensuring that overall weightings sum to 100% for each grouping contributing to the next level.

For example, within co-ordination, element 1.1.2 Technical Group has two contributing elements at output level - Support for the Project Team and liaison with outside bodies. Support for the Project Team was considered more important and was given a weighting of 70%, whilst liaison was given a weighting of only 30%.

Weighting was applied to all elements, right down to the individual indicators. Initially, target dates for completion were set for each indicator. For each 3 month period the partial achievement of the indicator was estimated, until full completion took place, hopefully by the target date. This achievement over time allowed a Planned Achievement Profile (PAP) to be developed for each indicator and, taken together, they provided an achievement profile for the whole project.

Typical achievement profiles for some of the Gloucester indicators are shown in Figure 15.

Once the overall planned profile had been prepared, monitoring consisted of measuring or estimating the actual achievement of indicators on a quarterly basis. As can be seen from the overall performance (Figure 16), achievement varied by sector.

5.10.2 Conclusions on progress
Overall, achievement against the stated objective did progress steadily, albeit somewhat delayed. This tended to reflect the delays inherent in establishing such a complex project and co-ordinating the inputs of all the various parties. Inevitably 100% achievement of the overall objective has not been achieved. However substantial progress has been made within all sectors.

Some aspects were delayed. The most delay initially occurred in the engineering sector, which involved the implementation of the various safety engineering
measures. This reflected the additional work that was required in some of the areas to refine the designs as a result of the consultation process.

Other important supporting elements, particularly education and enforcement showed the widest variation in achievement. This in part reflects the wide ranging nature of the project and the desire to involve other agencies (police and health) over which the project had no direct control.

Also with a relatively small project team, the effort required to maintain the implementation programme and keep all the interested parties involved over a sustained period inevitably resulted in some sectors being given less importance.

Despite this, improvements can be seen by the continued increase in achievement of all sectors.

6 Summary of results

6.1 Accidents
The project was successful in reducing accidents. However calculating the precise size of the reduction is complicated by the fact that there was an increase in the rate of reporting of accidents in Gloucester, raising the question of how many accidents there would have been if the project had not been done.

The actual numbers of injury accidents reported in the first year after the project compared with the average for the five years before it began indicate a reduction in all injury accidents of 9.5% and of 48.1% in fatal and serious accidents. But if allowance is made for the around 10% increase in the accident reporting rate and for the accident numbers in the control towns (+8.6%) it is estimated that the reduction in injury accidents as a result of the project is around 24%. It is less likely that the increase in reporting rates will have affected the numbers of fatal and serious accidents reported so the best estimate for the change in that category of accident is a reduction of around 37% (allowing for the control town data only).

All road user groups appear to have benefited from the project apart from cyclists for whom there was an increase in accidents.

Accidents at sites which received engineering treatment were reduced, on average, by 38%.

From the analyses it has also been possible to estimate the non-engineering effect of the project. This can be defined as the overall effect of the project on accidents, excluding the direct effect of engineering treatments. This effect can be assumed to include the effects of a general increase in awareness in Gloucester resulting from greater education, publicity and enforcement. It includes an element of speed reduction achieved through this increased awareness, rather than as a direct result of safety engineering measures on treated sites.

The estimate of the non-engineering effect of the project has been made on the basis of:
- the overall 24% reduction in injury accidents achieved (allowing for the effect of under-reporting and the control towns comparison);
- the 38% reduction in injury accidents achieved on treated sites (this already includes the under-reporting effect because it is based on a comparison with untreated sites in Gloucester);
- about half the ‘before’ accidents in Gloucester occurring on treated sites and about half on untreated sites.

The resulting estimate of the non-engineering effect is a 7% reduction in injury accidents contributing to the overall reduction for the project as a whole of 24%.

6.2 Speed
A main focus of the project was better management of speed and enforcement of speed limits. Where safety engineering measures to reduce speed were introduced (for example traffic calming), large reductions in 85th percentile speeds of up to about 12mph (from 34.8mph to 22.3mph) were achieved.

There were 11 permanent monitoring sites installed to give a general indication of speed changes in Gloucester. Some of these sites had engineering treatment and some did not. In the majority of cases the mean speeds have decreased year on year. The average for all sites was a reduction of about 3mph (about 10 per cent) between 1997 and 2001. Even at sites with no treatment there were small but significant decreases of about 1mph. Driving cycle data gave a similar result showing that mean speeds in the city decreased gradually between 1996 and 2000, the overall reduction in mean speed being 3.2mph.

A parameter shown to be associated with the risk of accident is the percentage of drivers exceeding the speed limit. By the end of the project, at most of the monitoring sites, there was a substantial reduction in the percentage of drivers exceeding the speed limit. The average percentage exceeding the speed limit reduced from 38% to 24% between 1997 and 2001.

6.3 Traffic flow changes
Traffic flows were monitored mainly using the 11 permanent loop counter sites which are described in the Section 5.4 on speed.

Flow levels in 2001 were lower than in 1997 by just under 2%. Data from counts in Cheltenham also indicated a 2% reduction.

The new road hierarchy required some traffic redistribution onto more suitable routes. In particular Cheltenham Road and Barton Street were intended to take less traffic and Metz Way more. The project was successful in achieving some re-distribution of traffic in the direction desired.

The effect on traffic distribution of traffic calming a large area was examined in Longlevens, where a large network of mostly residential roads was traffic calmed. Traffic calming in Longlevens had the effect of reducing flows on roads where substantial amounts of traffic calming measures, including vertical deflection, had been installed. Roads with very limited traffic calming such as build-outs saw minor increases indicating that motorists will make attempts to avoid the more severe traffic calming measures if alternative routes are available.
6.4 Environment effects

Total emissions of CO (carbon monoxide), VOC (volatile organic compounds) and NO\textsubscript{x} (nitrogen oxide) were lower in 2001 than in 1996. However, there were no significant differences between the changes in traffic emissions on links where traffic management measures had been introduced and the changes on unaffected links. The most important and pervasive effect on traffic emission levels was the gradual introduction of catalyst-equipped petrol vehicles and changes in fuel quality that occurred during 2000.

The general reductions in emissions of some of the pollutants about which there are health concerns, CO, HC (hydrocarbons), and NO\textsubscript{x}, coincided with generally good or improving roadside air quality. By 2001 the majority of the sites had seen a reduction in NO\textsubscript{x} concentration to below the Air Quality Objective. Mean PM\textsubscript{10} (particulate matter <10 microns) concentrations during the survey periods were below the air quality Objective of 40 µg/m\textsuperscript{3} (annual mean of daily values) throughout the study.

The noise from light vehicles was reduced at each of the monitoring sites following the installation of the various traffic calming measures. Mean heavy vehicle noise increased slightly at all of the monitoring sites, except alongside a speed cushion, despite decreases in mean vehicle speeds generally comparable with those for light vehicles. For some vehicles, increased body noise may also have contributed to the maximum pass-by noise level.

High level noise events (i.e. >80 dB(A)) were logged at a speed cushion site and alongside the junction table. In both cases the number of events decreased following installation.

6.5 The management process

The management structure established in Gloucester was effective in delivering a successful programme. The Safer City programme adopted a partnership approach involving local stakeholders (local residents, members of the public, members of the councils, police, transport operators, emergency services).

The process was a complex one requiring management of the development of strategy, implementation and public perceptions. It gained from enthusiastic staff and the use of a range of skills within the Project Team.

6.6 Public opinion and attitudes

Questionnaires to residents and businesses asked respondents whether they felt road safety had improved in Gloucester during the past five years. In both cases a positive response was recorded with nearly two thirds of local residents and a half of businesses feeling that road safety had improved although business respondents considered safety issues of less importance than residents did.

The residents’ survey found speeding, congestion, parking problems and poor driving standards to be the biggest problems. The business survey found congestion, staff parking and delivery parking to be the biggest problems. Encouragingly, nearly all of the various issues respondents were asked to rate are perceived as less of a problem in 2001 than when the project began in 1996.

Specific aspects of the project were rated more highly than at the beginning of the project. The highest ratings were in respect of speed cameras (83% rated favourably) and the associated signs and posters, followed by cycle lanes, bus lanes and speed humps (52%). Speed cameras were perceived as a more effective measure to curb speeding than speed humps. Overall the changes made towards improving safety in Gloucester have been recognised by the general population.

6.7 Public consultation

The process of carrying out public consultation has shown that the resulting ‘dialogue’ has played an important part not only in increasing acceptance of the measures required, but also in changing the underlying culture relating to the need for road safety measures.

There is a need to bring the public in earlier in the planning stage so that they do not feel that decisions have already been made. The length of time given to consultation may seem too long for individual respondents expecting feedback.

Although effective public consultation can be time-consuming, it is vital to achieving greater acceptance and satisfaction with the final outcome. There can be a tension between the time taken to build consensus, and the desire of many of the parties to move on with the work.

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Radio was used to a considerable extent but did not feature much in respondents’ recall of how they had received information. Radio can be used to good effect, especially if targeted to groups who are most likely to rely on verbal communication.

Exhibitions did not reach a large proportion of residents but they were nonetheless highly valued by the most interested and concerned. Their design and venue choices could perhaps be improved.

There is evidence that various groups in society respond in different ways to particular consultation techniques. For example, some people find attending a conventionally structured exhibition intimidating, while others find it boring. Literacy levels, as well as the relative deprivation of an area may affect responses to a leaflet. It is therefore important to consider carefully the most effective way of communicating with the target group.

Feedback was an important part of the Project Team’s work, replying to all those who sent back questionnaires with comments.

Increasingly, road safety and traffic management initiatives are seen as requiring Social Science and Engineering skills in order to develop and implement schemes which are both effective and acceptable. As a very innovative project, the Safer City initiative had a special need for this skills combination. It was fortunate
that the Project Team brought a variety of capabilities to the task and also a willingness to develop new skills. Given that similar projects are likely to recruit people with primary skills in transport engineering, there will be a particular need to provide engineers with supplementary.

6.8 Progress and targets
Overall, achievement against the stated objective did progress steadily, albeit somewhat delayed. This tended to reflect the delays inherent in establishing such a complex project and co-ordinating the inputs of all the various parties. Inevitably, there has not been 100% achievement of the overall objective. However substantial progress has been made within all sectors.

Some aspects have been delayed. The most delay initially occurred in the engineering sector, which involved the implementation of the various safety engineering measures. This reflected the additional work that was required in some of the areas to refine the designs as a result of the consultation process.

Other important supporting elements, particularly education and enforcement have shown the widest variation in achievement. This in part reflects the wide ranging nature of the project and the desire to involve other agencies (police and health) over which the project had no direct control.

Also with a relatively small project team, the effort required to maintain the implementation programme and keep all the interested parties involved over a sustained period inevitably resulted in some sectors being given less importance.

Despite this, improvements can be seen by the continued increase in achievement of all sectors.

7 Discussion and conclusions
Section 1.2 listed the objectives of the ‘Safer City Project’. They were:

- accident and casualty reductions;
- understanding the effects of measures/schemes;
- understanding the management processes;
- allowing other towns to see the engineering benefits of an integrated approach;
- ensuring understanding of the management processes required to implement a strategic approach.

These objectives are reviewed below.

7.1 Accident and casualty reductions
Injury accidents in 2001 (the first year after completion of most of the project) were compared with the annual average for the five years before the project started (1991 to 1995). The change was a reduction of 9.5 per cent, but in the control towns there was an increase of 8.6 per cent, resulting in a net reduction in Gloucester of 16.7 per cent. An increase in the proportion of injury accidents reported to the police in Gloucester may mean this could be an underestimate of the accident reductions by up to 10 per cent, making the overall net reduction around 24 per cent.

For fatal and serious accidents the reduction in Gloucester was 48.1 per cent while in the control towns the reduction was 17.7 per cent, resulting in a net reduction for Gloucester of 37 per cent.

7.2 Understanding the effects of measures/schemes
Accidents: The results for the treated sites are very encouraging. Compared to the untreated sites accidents on the treated sites were 38% fewer than expected during the ‘after’ period. Accidents were 21% to 55% lower than expected depending on the type of treatment applied. Area treated sites had 42% fewer accidents than expected. Route treated sites achieved 28% fewer accidents. Accidents were 55% lower than expected where signals, toucan and roundabouts were installed. Anti-skid treatment achieved 43% fewer accidents than expected. In ‘wet’ conditions accidents were 52% lower and in ‘dry’ conditions 38% lower than expected where anti-skid treatment was applied. All these results are statistically significant. There were also fewer accidents than expected at speed camera and vehicle activated signs, 21% and 22%, respectively but the small numbers at those sites mean that the reductions are not statistically significant.

The non-engineering effects: These include the effect of increased awareness of road safety in Gloucester, resulting from greater education, training, publicity and enforcement. The estimate of the non-engineering effect of the project is a 7% reduction in injury accidents contributing to the overall reduction for the project as a whole of 24%.

7.3 Understanding the management processes
The initial setting up of the project was satisfactorily completed, with a wide range of technical groups set up so that the various activities of the local authorities could be integrated. However, the initial impetus for such an integrated approach was difficult to manage, maintain and co-ordinate and was less successful than it might have been. There was a tendency for staff to focus on their own specialities and responsibilities. A finding of the project must therefore be that managing the integrated elements of Urban Safety Management is probably the most difficult aspect of applying the approach. It requires a management set-up which ideally formally enforces an integrated approach rather than one which relies on voluntary cooperation between departments and organisations.

The support for the project of the elected members and staff of the local authorities was crucial for the project’s successful implementation. In this respect the project was well served with the members’ role in the community enabling them to take a broad view of local issues and impacts, sometimes controversial at election times. The Project Team also deserves credit for achieving delivery of the project on time and to budget, despite the many pressures of managing a project of such a large scale.

Having a city-wide strategy is seen as important in Urban Safety Management, but drawing up a strategy caused some difficulties. There appeared initially to be local preference for acting without an overall city-wide strategy of aims, objectives and measures and instead
developing action from assessment of the problems at individual roads and streets. This latter approach ran the risk of measures in one area being in conflict with those in another or at least being less coherent than those developed from an overall strategy, but had the merit of being able to make a start more quickly. The strategy based USM was seen as difficult to do without detailed investigations on site, and was also different from the firefighting approach which the local authority staff were more used to using. It was also necessary to achieve the first year spend without much time for planning. However, the Project Team was encouraged to make use of the USM approach and a strategy was produced from which an integrated approach and strategic outcome were achieved.

The engineering implementation, which was the main funded part of the project, made good progress with funding for each year fairly precisely spent, but there were difficulties in achieving the first year spend in a manner that would fit the overall strategy as time was needed to design and agree such a strategy. Site specific measures or measures already in the pipeline were therefore used to achieve the required first year spend.

It was considered that the wider planning issues caused some difficulties. The fact that a planning application can be approved but not acted upon for nearly five years may suddenly impact on the safety of the road network. For example, a new supermarket and 24 hour petrol station on the opposite side of a dual carriageway to a housing area caused problems of accessibility and severance.

A greater contribution from planners (who were represented on the Technical Group), identifying potential conflicts of interest would have provided the Project Team with a wider view of the development of the city and would have contributed to the longer term approach to the road safety strategy.

In addition planners need to look more to enhance safety when urban areas are being re-designed. This is particularly so over the long term and further emphasises the need for a city-wide strategy for transport and land use development and safety agreed by all agencies. Conflicts can be created between the road network design and how urban spaces are handled which an agreed strategy can often resolve. New forms of urban layout are also possible such as pedestrian streets, home zones, 20mph zones etc but, for these to come to fruition, a common approach between planners and traffic safety engineers is required.

One of the strong points about the Safer City Forum (on which many city organisations were represented) was that it instilled a feeling of commitment to the project and raised the profile of road safety in Gloucester. This was particularly so when there had been letters in the local newspaper criticising the project. The intention was that forum members were in a position to counter some of the anger by ensuring that organisations were informed about the reasoning behind the measures chosen for implementation.

The forum also provided an opportunity to discuss specific issues with the officers of the Council and the Project Team. Interest groups, such as vulnerable road users (cyclists, pedestrians and disability groups) were represented within the forum.

Public consultation and participation are also seen as important elements in USM. Consultation is very expensive in staff time but is an important aspect of achieving public support and acceptance of proposed changes to the area where a community lives. The detailed local knowledge of residents can result in a better scheme than one devised by the experts on their own. An important part of the process is to report back to communities showing how their opinions have been taken into account and once the work had been completed telling them what results have been achieved.

Public consultation was extensive, in an attempt to achieve acceptable and effective schemes. Gloucestershire County Council’s Road Safety Unit received a charter mark for its high standards of public involvement and the Safer City consultation programme was a key element in their submission. The views of the public were given a lot of weight in developing schemes but this meant that there was a tendency to pull back from radical proposals when public opposition was encountered. This weakened the potential safety benefits of some schemes but it meant that a broad consensus for what was implemented was generally achieved with the result that public opinion surveys showed positive gains in relation to the attitudes of local people about road safety in the city of Gloucester.

7.4 Allowing other towns to see the safety benefits of an integrated approach

The publication of reports by the Project Team during the period of the project (Bellotti 1997 and Bellotti 1998) started the process of publicising the benefits of the approach. This objective will be further enhanced with the publication of this final report on results which will enable other local authorities to see how the USM process can be implemented and what benefits in accident reduction can be achieved.

Making use of the lessons learnt in the project, new guidelines on Urban Safety Management will be published. These are currently being prepared by the DfT, the IHT and TRL, with the purpose of encouraging local authorities to make use of the USM approach as the way forward in making our urban areas safer and more pleasant places to live in.

In addition to these documents, a number of presentations, seminars and guided tours, including government ministers, were organised or participated in by Gloucestershire County Council and Gloucester City staff throughout the period of the project.

7.5 Ensuring understanding of the management processes required to implement a strategic approach

Management of a city-wide, integrated and strategic approach to safety proved to be a complex and difficult task. It had been recognised that it was this difficulty, rather than any technical difficulties, that had deterred widespread implementation of Urban Safety Management in the past. The processes adopted in Gloucester, particularly in relation to public consultation and public involvement in decision making meant that these difficulties were overcome and a successful USM project was achieved in the time required by the DfT.
7.6 Overall project conclusions

The overall conclusions that can be drawn from the project are:

- The project was very successful in achieving its objectives.
- Injury accidents and casualties showed good reductions particularly for those in the fatal and serious categories.
- Speeds were substantially reduced in areas where speed management measures were installed, and even in non-treated areas small reductions occurred.
- Most engineering treatments used were very effective in reducing accidents.
- Environmental effects of the project were generally not negative. At the end of the project air quality had improved but this was not necessarily as a result of the traffic management. Traffic noise also generally declined in treated areas because of lower speeds and less traffic, but there were a few sites where noise and vibration from heavy goods vehicles increased and were considered by residents living near road humps to be a nuisance.
- Public opinion about the project was largely positive but there was also strong opposition to the project or some of its schemes from some members of the public. Public consultation was therefore seen as a very important part of the project. Much effort was necessary to achieve schemes that were acceptable to the public. This meant that innovative and radical measures were difficult to gain acceptance for and can probably only be achieved over a long time span, where education and consultation are both necessary. One of the principles of Urban Safety Management is to achieve a ‘safer distribution’ of traffic. In older road networks this can be achieved by road closures, pedestrianisation and banned movements or by discouraging measures on unsuitable routes e.g. traffic calming, bus lanes, signal timings etc. The project achieved a considerable amount of traffic re-distribution, but this aspect of the USM approach proved to be one of the most difficult for which to gain public acceptability.

- Managing the integrated approach demanded by USM was a challenging part of the project involving political support, public support and co-ordinated working. Various groups needed to be set up to encourage an integrated approach. In this regard a broadly agreed safety strategy was vital to maintain consistency and focus and should be the main guiding document when Urban Safety Management is adopted.

8 The way forward

The Gloucester Safer City Project has shown that Urban Safety Management is a powerful way to achieve casualty savings. Its purpose was to demonstrate that a strategic approach to safety management can offer advantages over the well-established practices of local.

One result of the project has been to identify the need to revise the original Urban Safety Guidelines, first produced by the Institution of Highways and Transportation (IHT) in 1990. The new guidelines have been produced by TRL in conjunction with IHT and the Department for Transport and develop the lessons from Gloucester into a structured approach which can be used by any local authority.

9 Acknowledgements

Thanks are due to a very large number of people who assisted TRL with the project. Firstly the many local authority staff in Gloucester City Council and Gloucestershire County Council, in particular Jackie Harris, Ray Lane, Paul Bellotti, David Greensweig, Denise Britton, Elaine Cadman-Cramp and Garry Handley.

At TRL Mike Winnett, Ryszard Gorell and Babul Baruya contributed to the management, speed and accident analyses; Paul Boulter, Phil Abbott, Greg Watts, Greg Harris, Jane Cloke and Roger Layfield were responsible for the emission, air quality and noise research; David Webster dealt with data management; Sandra Woodjets and Nita Brown carried out much of the data collection; and Nina Korsak assisted with data analysis.

Thanks also go to Heather Ward and Sandy Robertson at University College London for carrying out the hospital matching study and other assistance, to John Barrell for the DEE analysis and to Kris Beuret and Social Research Associates for doing the public opinion and consultation studies.

10 References


Appendix A: The safety engineering measures installed in Gloucester

Gateways
At the beginning of the project it was decided that on the main routes into the city the entrances to the built-up area needed to indicate to drivers that they were entering a different type of road environment, where safety was being specifically targeted. A gateway effect was created where works were undertaken to narrow the road, highlight the signs and highlight the boundary. The speeds at the gateways were reduced on average by about 3mph.

Anti skid treatments
There was a comprehensive programme of anti-skid surfacing at junctions which had a significant accident record. Eight locations were treated where a total of 51 casualties had occurred over the previous three years.

Figure A1 Stroud Road gateway

Figure A2 Stroud Road–Bourton Road junction
Speed cameras
During the first year of the project, seven speed camera housings were installed on main roads and a camera provided for the police. This was not a cost recovery partnership but it was possible to reach a service level agreement with the police for resourcing the operation of fixed cameras and operating a mobile camera. Throughout most of the project two police officers were employed largely full time on this activity.
Towards the end of the project a new type of speed camera system had just been approved for use. It is referred to as SPECS. Unlike the static cameras, the system used does not measure speed at one spot but, using number plate recognition technology, measures speed over a long distance. SPECS was installed in one of the areas.
Mobile enforcement was closely co-ordinated with the project teams’ engineering work by concentrating enforcement on areas where work was about to begin.

![Speed camera Bristol Road](image)

Figure A3 Speed camera Bristol Road

Vehicle speed-activated speed limit reminder signs
A total of 7 speed-activated signs were installed on two main roads - Bristol Road and Painswick Road. These signs displayed a warning to drivers to reduce speed if they were driving above a predetermined speed. The signs were all installed on stretches of road which had 30mph speed limits, except for one where the speed limit was 40mph. The speeds to trigger the activation of the 30mph signs were originally set at 34mph or 36mph but were reduced to 30mph about two months after installation. Those for the 40mph road were set at 40mph throughout.

![Vehicle activated sign – Bristol Road](image)

Figure A4 Vehicle activated sign – Bristol Road
Pedestrian crossings
A number of new or modified pedestrian crossings were installed as part of the measures to improve crossing facilities for pedestrians. Some of the installations were toucan crossings, which also aided cyclists to cross safely. The number and type of crossing installed are shown in Table A1.

<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
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<tbody>
<tr>
<td>New zebra</td>
<td>11</td>
</tr>
<tr>
<td>New toucan</td>
<td>7</td>
</tr>
<tr>
<td>New pelican</td>
<td>2</td>
</tr>
<tr>
<td>Zebra replaced by pelican</td>
<td>1</td>
</tr>
<tr>
<td>Pelican replaced by zebra</td>
<td>2</td>
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</tbody>
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20mph school safety zones
In the area surrounding four schools special safety zones were created. They were planned in conjunction with the schools themselves. Measures installed were 20mph speed limit roundels, speed cushions, road narrowings, guard-railing, anti-skid surfacing on the approach to zebra crossings, raised junctions and ‘coloured footprints’. The coloured footprints were designed to show the children the safe routes to and from school.

There was also information given to parents about parking outside schools to supplement the ‘School Keep Clear’ markings and the designated ‘Parent Parking’ near the schools.

Figure A5 Heron School – school safety zone

Figure A6 Coloured foot prints
The areas

Longlevens
The Longlevens area to the north-east of the city centre was the first area to be treated. The area is mainly residential although Cheltenham Road, a main link with the city of Cheltenham, runs through it.

On the residential roads, vertical deflection was introduced, especially raised tables at junctions and on links, to reduce traffic speeds to below the 30mph limit. On one road, Innsworth Lane, where there was some rat-running lorry traffic from a local depot, a weight limit was introduced to reduce noise nuisance for residents.

On Elmbridge Road, a local distributor road, advisory cycle lanes coloured red were installed.

On Cheltenham Road speed cushions, and an impression of narrowing of the road produced by bus and cycle lanes were designed to achieve speed reduction.

Figure A7 Cheltenham Road speed cushions and cycle lane

Figure A8 Cheltenham Road bus lane
The cycle lanes and more time for pedestrians at crossings improved conditions for vulnerable road users.
In addition, posters were displayed showing how many drivers had been prosecuted for speeding in the Longlevens area and how much they had paid in fines.
Consultation on the proposals, using an exhibition in a local school, with engineers close on hand to answer any specific questions, produced a good response from local people.

Figure A9 Longlevens public exhibition

Barton and Tredworth
Barton and Tredworth, to the south-east of the city centre, is an area of mainly nineteenth century housing built in a grid iron layout.

Figure A10 Barton Street
The area has a poor quality of housing and the lowest car ownership in the city. The main road through the area, Barton Street, is lined with shops for part of its length but the shopping environment is unattractive. Barton Street was originally a main road running out of the city but an inner ring-road and an alternative route parallel to Barton St (Metz Way) meant that much of its original purpose for through traffic had been superseded. Despite this, traffic flows on Barton Street remained high.

The agreed way forward for treating the area was to keep Barton Street two-way, but treat to provide a better environment for pedestrians. The main measures used were speed cushions and low profile humps. In addition the footway was widened and pedestrian crossings (zebras) were installed. At the signalled junctions advanced stop lines for cyclists were installed.

Figure A11 Barton Street

Figure A12 Tredworth Road advance cycle provision at signals
**Tuffley**
Tuffley is an extensive residential area to the south of the City. With only 25 casualties in three years there was not sufficient justification for introducing the density of measures used in Longlevens and Barton/Tredworth.

When the first consultation document was issued there was concern expressed at the relative paucity of measures and that many roads would have virtually no treatment. The measures that have been introduced (mainly vertical deflection) have been selectively sited with the aim of getting traffic speeds below the 30mph limit.

**Matson**
For the Matson area as a whole, measures similar to those used in Tuffley were proposed, mainly road humps, speed cushions, central islands and speed roundels.

![Figure A13 Matson Lane](image-url)

![Figure A14 Banebury Road, junction with Norbury Avenue](image-url)
There was also a special problem with Reservoir Road, a residential road that was used as a rat-run by some drivers in preference to Finlay Road, a parallel through route. Closure of Reservoir Road was proposed but this produced a very mixed response with some residents vehemently opposed to it. A second citizen’s jury was therefore convened. It concluded that the road should be kept open, but road humps and a pedestrian crossing should be installed.

**Figure A15** Reservoir Road

**Figure A16** Reservoir Road – roundabout to be replaced by junction table and give way arrangement
**Coney Hill**
Coney Hill is a small residential area not far from the city centre. Coney Hill Road was being used as a through route although quite unsuitable for the purpose. The problems were exacerbated by the fact that there was a school and shops on one side of the road but the majority of housing was on the other. Unsurprisingly there was a speed and child pedestrian safety problem. A relatively small traffic calming project, mainly road humps, speed cushions and raised junctions was implemented.

![Figure A17 Coney Hill Road](image)

**Hucclecote**
Hucclecote is a residential area to the east of the city centre which is bordered by the M5 motorway and the Barnwood by-pass. The residential roads were treated with road humps and low profile panels (coloured red). The main distributor road (Barnwood Road/Hucclecote Road) was treated with cycle-lane markings, low profile panels, a toucan crossing and 3 ‘H’ humps.

![Figure A18 Humped crossing Hucclecote Road zebra](image)
Linden / Podsmead.
The final area to be treated as part of the Safer City Project was Linden/Podsmead, a residential area due south of the city centre. A 20mph limit was introduced for all the residential roads, made effective by road humps. On the local distributor roads, as they were bus routes, the existing 30mph speed limit was retained and enforced using a network of speed cameras called SPECS. The system used does not measure speed at one spot but, using number plate recognition technology, measures speed over a long distance, in this case over about 1km on each of three roads.

Figure A19 SPECS camera system

The Routes

Finlay Road
Finlay Road was built in the 1930s as a main road for through traffic. It is a wide single carriageway approximately 1 kilometre long with houses set back on either side. At the start of the project it had been a major barrier to pedestrian movement with only one pedestrian facility, a pelican crossing, half way along its length. As a main road in the hierarchy, traffic capacity had to be maintained. However, speeds were high, with nearly all vehicles exceeding the 40mph limit in free flow conditions.

Figure A20 Finlay Road

The methods used to reduce vehicle speeds became a model for elsewhere in the city. The primary aim was to re-allocate road space so as to make the road appear narrower and hence speeds lower. Cycle lanes were created along its length and a string of traffic islands and ladder hatching marked along the centre. The pelican crossing was converted to a toucan crossing so as to assist cyclists as well as pedestrians, and a new crossing added.
**London Road**
As its name suggests, London Road is an old main road, extending about 1km eastwards from the city centre. Treatment consisted of road narrowings and the introduction of short lengths of bus lane. The aim was to reduce the road space available to vehicle users, reduce the apparent width of the road and hence reduce speed. Difficulties were claimed by cyclists at the narrowings where there was a tendency for car drivers to travel too close to them. Signs were therefore erected reminding drivers of the need to take care when there were cyclists in the traffic flow.

![Figure A21 London Road bus and cycle Lane](image1)

**Stroud Road**
In Stroud Road (which is approximately 4kms long), as with Finlay Road, the intention was to reallocate road space and hence reduce vehicle speed. The same treatment of cycle lanes and traffic islands was employed. The works were combined with major maintenance which was required at the same time. Rather than following usual practise and maintaining to the previous standard, the road was rebuilt incorporating the safety measures. If adopted more widely this way of using maintenance funds could often provide more opportunities to create safety improvements.

![Figure A22 Stroud Road cycle lane and traffic islands](image2)
**Metz Way**

Metz Way is about 1.5 kilometres long and was built about ten years ago as a by-pass for Barton Street. It is a wide single carriageway. The measures taken under the Safer City Project included central hatching to discourage overtaking and advance signs to warn drivers of the possibility of queuing traffic.

![Figure A23 Metz Way](image)

**Bristol Road**

Bristol Road is the main road running some 3.5 kilometres out of the city to the south. It was treated in a similar manner to Finlay Road and Stroud Road, with road space re-allocation using cycle lanes but it was more difficult to treat because of its restricted width.

![Figure A24 Bristol Road](image)

Crossing facilities were improved along its length and pedestrian waiting times at signals were reduced. Towards the southern end traffic speeds were unacceptably high so vehicle speed activated warning signs were installed to reduce speeds. These signs were triggered when a vehicle exceeded a predetermined speed. The signs displayed a speed roundel (see Figure A4) and a variety of messages including:

- **SAVE LIFE** followed by **SLOW DOWN**
- **KILL YOUR SPEED** followed by **NOT A PERSON**
- **SPEED KILLS** followed by **SLOW DOWN**
- **TOO FAST** followed by **TOO FAST**
**Inner Relief Road**
The inner relief road (800 metres in length), whilst important for the free flow of motor traffic produced a significant barrier to pedestrian movement. There are three major junctions along its length where the timings of the signals were altered to make waiting times for pedestrians shorter. In addition the pedestrian holding areas in the centre of the carriageway were rather small so they were increased in size. It was acknowledged that there would be increased traffic congestion as a result of some of these measures but a survey of drivers showed that they were willing to accept this.

![Image](image1.png)

**Figure A25** Signals at B&Q

**Northgate / Southgate**
Northgate and Southgate are two of the original Roman roads in the city centre. They are now the main shopping streets and had a poor pedestrian accident record. During the course of the project both these streets were pedestrianised.

![Image](image2.png)

**Figure A26** City centre pedestrianisation
Painswick Roundabout

This roundabout is on the dual carriageway outer relief road where a single carriageway road crosses it. It had a poor accident record, in particular for those involving cyclists. The initially chosen solution was to signalise the roundabout. However on investigation this proved to be too expensive. Instead the entrance geometry was altered to force vehicles to deflect more sharply and hence travel more slowly as they entered the roundabout. Crossing facilities were also provided on all four approaches. On the dual carriageway these are toucans and on the other arms zebras.

Figure A27 Painswick Road roundabout

Figure A28 New toucan on approach to Painswick Road roundabout
Painswick Road / Heron Way traffic signals
A new traffic signal controller was provided at this junction. The phasings were changed so as to reduce vehicle/vehicle conflicts and to give more time for pedestrians to cross the road.

Park Road / Brunswick Road
These roads cut through a small area of housing close to the city centre creating a high level of rat-running traffic on what were unsuitable roads. There was also a high level of pedestrian activity. Treatment was a simple scheme of road humps and speed cushions, with the aim of slowing vehicles down and making it unattractive as a through route.

Figure A29 Cushions and zebra on approach to Painswick Road roundabout

Figure A30 Park Road raised junction and zebra
Abstract

In 1996, the Department for Transport (DfT) embarked on a ‘Safe Town’ initiative, to demonstrate that it was possible to substantially reduce urban road accidents and casualties by implementing a coherent range of actions for road safety according to a well-defined strategy. This strategy was intended to bring together all the activities of a local authority as an education authority as well as a highways and planning authority. £5m was provided through the Local Roads Capital Settlement to treat a whole town in a strategic manner, and with safety integrated into other town policies and activities. The report describes how the project was planned, designed, implemented and monitored and what the achievements in accident and casualty reduction were.

Related publications

TRL548  Vehicle activated signs - a large scale evaluation by M Winnett and A Wheeler.  
2003 (price £25, code AX)

2001 (price £35, code H)

2000 (price £35, code H)

TRL423  Remote sensing of vehicle emissions near two traffic calming measures in Gloucester by P G Boulter.  
1999 (price £35, code H)

TRL421  The effect of drivers’ speed on the frequency of road accidents by M C Taylor, D A Lynam and A Baruya. 2000 (price £35, code H)

TRL177  Traffic calming - vehicle activated speed limit reminder signs by D C Webster. 1995 (price £25, code E)  
Trends in speed, emissions and air quality during the Gloucester Safer City project by P G Boulter, J Green and R E Layfield. (2003) (In press)  

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