# Department for **Transport**

Traffic Advisory Leaflet 8/99 April 1999



# Urban safety management: using SafeNET

### Introduction

Urban Safety Management is a structured approach to accident and casualty reduction on urban roads. The principles of urban safety management are set out in the Institution of Highways and Transportation publication "Guidelines for Urban Safety Management" and in Traffic Advisory Leaflet 3/90. The Department of the Environment, Transport and the Regions (DETR) supports the use of urban safety management principles as an effective means of increasing road safety. The Gloucester Safer City project has been supported by Road Safety Division (RSD) of the DETR to demonstrate the thorough application of urban safety management techniques.

One of the key features of the urban safety management approach is the consideration of the total effects of a scheme across the whole road network. For instance, a measure introduced to improve safety at a junction might also lead to a reduction in capacity. If this in turn were to lead to an increase in congestion in the locality, then that could cause traffic to re-route onto surrounding roads which might be less safe. Taking a strategic view, it is possible to assess whether there would be an overall increase in accidents even if there were a reduction at the location where the measure was introduced.

When developing schemes, it is important that every effort is made to assess all their likely effects. This means considering the safety implications of a scheme alongside its local and wider strategic impacts on congestion and delay, on noise and local air quality, and on severance and pedestrian and cyclist journey times. The Government's new approach to appraisal provides a useful framework for this assessment. In this way, the full impact of the scheme at the point of implementation is assessed, together with any wider changes in the overall position, for example, due to rerouting. (The term "scheme" is taken here to mean anything from a simple modification at a junction, to major changes such as the pedestrianisation of a town centre.)

Traffic assignment programs such as CONTRAM indicate the effects of a scheme on congestion and estimate resulting changes in routes, though they take no account of safety issues. Design programs such as ARCADY, PICADY and OSCADY are capable of estimating both queues and delays, and numbers of accidents for isolated junctions. However, they only look at a specific junction and can take no account of possible interactions between different junctions. To take full account of changes across a whole network they must be used iteratively with an assignment program.

# A New Approach

A more comprehensive approach to assessing the effects of a scheme has been developed through research commissioned by RSD/DETR and carried out by the Transport Research Laboratory (TRL). There have been two main strands:

- developing models to predict accidents
- applying them for area-wide assessment.



Pedestrians and cyclists at risk in traff

#### Area-wide assessment

This can now be carried out assisted by a new software package that has been developed by TRL on behalf of RSD. This software, known as SafeNET (Software for Accident Frequency Estimation for Networks), includes appropriate versions of the accident predictive models for all common types of junctions and links. On its own, this provides traffic engineers with a new design aid that allows the safety of a whole road network to be predicted within a single computer program. In addition, an interface with an assignment program makes it much easier to produce fuller estimates, looking at safety and congestion issues on an equal basis. SafeNET facilitates the extraction of traffic flow information from the CONTRAM traffic assignment software.

The combination of the safety assessment software and traffic assignment software provides:

- a prediction of how traffic will re-route,
- estimates of resulting accident patterns.

This in turn allows:

- rapid optimisation of the scheme
- a reduced risk of wasting resources on unsuccessful measures.

Prototype versions of *Safe*NET have been used on a trial basis by a number of local authorities and their experience has contributed to the version that is now being made available. It has also been validated against observations in two major studies. More details of the *Safe*NET program are given in the *Safe*NET User Guide.



# Accident predictive models

These have been produced for all the main components of an urban road network including roundabouts, mini-roundabouts, traffic signals, major/minor priority junctions and the road links between them. The models estimate the number of accidents that can be expected, on average, given information about the flow of traffic and pedestrians and the design of the junction or link.

Models have been developed at a number of different "levels" with different input requirements. The most basic levels need simple traffic inflows averaged over the whole day. More detailed levels require additional information such as turning flows for traffic, pedestrian flows, and broad descriptions of major features such as the presence of islands and pedestrian facilities. The highest levels require detailed information about the geometric design of the junction or link and other information such as land use, and proportions of different vehicle types.

Depending on the amount of detail supplied, the models may be used to predict:

- the total numbers of accidents at a location
- vehicle and pedestrian accidents separately
- accidents of specific types for example 'right turn from minor arm', 'rear shunts', 'pedestrians crossing major arm'

The models within *Safe*NET take appropriate account of the flow of pedestrians, cyclists and motorcyclists in the calculation of the overall number of accidents likely to occur. In addition, *Safe*NET can separately estimate the number of accidents that would involve pedestrians.

Results of this type are already produced by ARCADY, PICADY and OSCADY, but these programs are only suitable for indicating the performance of individual elements of a road network.

# Using SAFENET

The network shown in Figure 1 consists of two east-west routes into a town centre and a number of connecting north-south roads. The more northerly of the east-west routes is a wide single carriageway A road, whereas the more southerly is a B road with a number of shops, a school and some residential sections. The north-south routes are also largely residential. The main problem in the area is that the B road, in addition to local traffic, carries a substantial flow of traffic to and from the town centre which would be more suited to the A road. Much of this traffic also uses one or other of the residential north-south roads. As a result, the speeds and flows through parts of the network are inappropriate to the character of the roads concerned. The main treatments that have been suggested for the network are:

- to close some of the junctions between the north-south and the east-west routes to reduce the opportunities for "rat running", and to traffic calm those north-south roads which would remain fully open;
- to install traffic calming on the B road near the shops and the school;
- to convert a number of junctions from major/minor priority junctions to miniroundabouts.

One of the key aims of the scheme is to achieve a re-allocation of traffic to more suitable routes. It is therefore appropriate to use a traffic assignment model. Generally the assignment model would only cover the peak periods, but this can be extended (at a coarser level of modelling) to include the off-peak periods as well, allowing the assignment program to estimate total daily flows. For the CONTRAM assignment program, SafeNET can extract the total daily flows from the model outputs. Having built and validated an assignment model of the current situation in the usual way, it would then be modified to represent the proposed scheme with the relevant closures and changes in junction control.

The impact on safety of the scheme can then be assessed using SafeNET. In practice, it is unlikely that the first proposal for a scheme will be completely satisfactory. Frequently it will become apparent that some modifications to the scheme are necessary. These may be needed to reduce congestion, cause a further re-distribution of traffic, or to achieve greater safety. A modification for one purpose might have unintended, possibly undesirable, effects on other aspects of performance. The link between the traffic assignment and impact on safety makes it easy to take account of these interactions. In particular, the process allows rapid adjustment of the flows, which form the key inputs to the accident prediction models.

In the example illustrated here, the initial proposal proved to be flawed due to a significant number of vehicles using an alternative route to avoid traffic calming installed outside the shops. The extent of this fresh "rat running" was apparent from the CONTRAM run and the accident predictions from SafeNET showed the expected effect on safety. When additional measures were included in the scheme and modelled by CONTRAM, the revised flows were immediately available to SafeNET, which could then predict the safety effects of the change.



Figure 1: A typical scheme for which SafeNET might be used. This diagram is based on the screen used to input network details to SafeNET

# The Package

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Figure 2: Screen input



Figure 3: Typical output fron SafeNET

SafeNET's graphical interface allows users to build their network on the screen (see Figure 1). On completion, the software automatically creates data entry templates for each junction and road link. Users can then simply select a network feature and enter the appropriate data. Each data requirement is described on the screen (see Figure 2) and further details are available via the on-line help. Results are calculated as soon as the data requirements are satisfied. The package can display the results graphically or in a text format (Figure 3 shows a graphic output). A detailed account of the predicted number of accidents per year can be obtained. The package is capable of producing a tabulation of the accidents at each junction and road link into categories such as "single vehicle accidents" on a 4-arm roundabout.

#### Availability

SafeNET is available by direct application to TRL. It requires Windows 3.x or later, a 486 or higher processor and at least 4MB of RAM.

#### Contacts

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