Urban Safety Management in Europe

An overview of current practice in nine countries in the context of the DUMAS project

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Executive summary

The present study concerns the initial stage of the DUMAS project: 'Developing Urban Management and Safety', a project of the research programme of the Directorate General for Transport of the European Union. The objective of DUMAS is to produce a framework for the design and evaluation of urban safety initiatives and its first stage has been devoted to preparing a state-of-the-art review on existing practice and experience in the field.

The report offers an overview and an analysis of the national state-of-the-art reports of each of the nine countries involved in the project: Austria, the Czech Republic, Denmark, France, Germany, Greece, Italy, The Netherlands, and the United Kingdom. It focuses on 'local' traffic safety related problems. 'Nation-wide' problems like age and gender related problems, drinking and driving, etc., are firstly to be dealt with at the national level.

The report addresses four subjects on which the national reports the requested to gather information. These subjects are:
- Problem analysis and problem statement: "what are the safety problems and how have they been stated ?"
- Policies: "what policies and/or strategies are entailed and applied in dealing with such problems ?"
- Design and implementation: "into what measures and/or tactics are such policies / strategies 'translated' and how are such measures or schemes implemented in practice ?"
- Evaluation and monitoring: "how are the safety effects of such measures assessed and monitored (product evaluation) and how is the urban safety initiative appraised (process evaluation) ?"

The extent of the safety problem differs considerably among the countries involved in the study, as does its development over the last decades. These days, traffic results in a yearly toll of 35,000 fatalities in the nine countries in this project. The number of fatalities per 100,000 inhabitants varies among these countries by a factor 3. In the last 20 years, the number of fatalities decreased in most countries by some 30 - 45 %; it increased however by 50 - 80 % in the Czech Republic and Greece.

In each of the countries, between half and three-quarters of all injury accidents occur in built-up areas. For understanding and, thus, for effectively treating the urban traffic safety problem, however, quite an effort still has to be made in creating, organising and applying databases which offer reliable information on the local situation. In that respect administrative improvements seem a major requirement.

Knowledge on virtually all traffic safety management policies and specific measures turned out to be widespread among the countries in the study and applied in practice, albeit sometimes on a minor scale. So, lack of knowledge 'as such' cannot solely explain differences in accident records.

However, reviewing the national reports, the central role of policy and decision-making became obvious. After all, it is at this level that problem solving is getting priority, legal embedding, funding and implementation,

the 'top-down' raising of public awareness, etc. Adequate organisational structures are part of it. They play a key role in structuring and organising the co-operation of the many different partners to be involved in safety initiatives, in monitoring the processes, the information transfer, and so on.

The strategies of 'sharing interests' and of 'goal setting' turned out to be successful safety policies. At the same time, they appeared to be effective in getting and, if necessary, keeping the traffic safety issue on the political agenda or priority list. In the 'sharing interests' strategy, common goals of different policies are intended to be achieved by combined and attuned efforts. The forming of such coalitions was especially successful in alliances with environmental and well-being policies. In the 'goal setting' strategy, the responsible authority commits itself to achieve a fixed traffic safety target within a certain period of time. The strategy turned out to be effective in achieving previously set targets. Indirectly, some other results of the strategy seem to be at least as important, for they will have a profound impact on future safety initiatives, in setting the scene and conditions for their approach. The strategy requires, among others, long-range comprehensive action programmes, reliable organisational structures, monitoring procedures and information transfer. Importantly, the role and responsibilities of all actors involved also have to be established. 'Safety audits' and 'safety impact assessment' - in which the impact on road safety should, like the environmental impact, be systematically assessed at the decision stage - might be supportive to both aforementioned strategies.

Some urban traffic safety concepts have been developed over time and have become generally accepted. In this context, the 'area-wide safety approach' is of particular interest. The approach, being an integrated traffic safety management philosophy, embeds past beneficial experiences in the field of traffic safety, taking into account other local interests and related policies as well.

New developments regard the so called 'sustainable traffic safety concept' and the 'zero-vision approach'. The starting point of the 'sustainable traffic safety concept' is the principle that man is taken as the reference standard. The probability of accidents should be reduced in advance, by means of the infrastructural design. And where accidents still might occur, the process which determines the severity of these accidents should be influenced such that death and serious injury is virtually excluded. In the 'zero-vision approach', it is essential that the traffic system has to be dimensioned in such a way that possible conflicts or incidents which might cause injury, never result in a pre-defined level of unacceptable loss of health to be exceeded.

Urban traffic safety concepts have been elaborated into a wide range of measures and schemes, and adapted to and implemented in practice.
The main and generally accepted concept of relevance here is the 'hierarchical network structure', in which the design of the road and its place in the hierarchy corresponds to its functions of respectively:
- rapid processing of through traffic;
- distributing traffic for rapid accessing districts of built-up areas; or
- providing for local access.

Its leading safety principle is that road users are able to recognise the function of the road - and thus the kind of traffic conditions they will have to deal with - enabling them to adjust their behaviour accordingly.

With regard to residential areas, the access function of making destinations along a street accessible is combined with making a street as safe as a meeting place. In residential areas the 'habitat' function of the public space has to be of major importance.
Traffic calming measures turned out to be most valuable in residential areas, mainly due to their impact on speed reduction and diminished exposure of motorised vehicles. Among these, the '30 km/h speed limit zone' type of measure has been elaborated extensively over the time. Positive experiences in practice were also gained. This most cost-effective traffic calming measure can be considered as 'mature' and, thus, suitable for further application.

Implementation of the hierarchical network structure in the traffic areas of municipalities is often complicated, as it requires taking into account a variety of different interests and aspects. Yet, as shown in many projects, local professionals could maintain basic safety principles in compromises between various considerations. In this context, some more or less specific measures have also been addressed here, especially the use of the 'urban boulevard' and the application of 'roundabouts'.

Moreover, some aspects of 'separate' cycling networks have been discussed. Together with walking, cycling is one of the most healthy and ecologically sound travel modes, not causing congestion, parking problems, etc., and - importantly from a traffic safety point of view - not seriously threatening the safety of other traffic participants. So, promoting bicycle use, as well as walking, is often an objective of national and local policies. It demands, however, safe and attractive facilities, given the vulnerability of these categories of road users.

Public awareness of the traffic safety problem and public acceptance of traffic safety measures can both be considered as a 'conditio sine qua non', for awareness is a major stimulus for safety action and measures will not be observed and cannot be enforced either, without acceptance. Involvement of the citizens at the local level is most crucial since the measures are directly meant for their benefit, and at the same time, have an impact on their surroundings. Creating appropriate links between local authorities and the citizens is becoming increasingly complicated in larger municipalities. It is partly a general administrative predicament to be firstly addressed at the national level, but it can be argued that it is also very worthwhile to support this locally as well.

Evaluation studies of traffic safety schemes are rather scarce. Yet, evaluation is of importance, for the sake of a scheme itself, as well as for the sake of future traffic safety initiatives. Reliable stated effects and information on it might encourage more widespread application. Studies of this kind do not necessarily have to focus on accident occurrence alone, but studying 'intermediate' variables for instance might also be of value in appraising objectives of safety action , e.g. speed reduction, less through traffic, etc. The effectiveness of several of these traffic safety schemes have been reported. With regard to traffic calming measures, for instance, evaluation studies showed accident reductions between 15 - 80 %.

In the final chapter on 'Conclusions and recommendations', special attention has been given to what is seen as the crucial general outcome of this review: it is the question 'how can we elevate the exception - of only applying measures of proven effectiveness on an incidental scale - to the general rule'.
In that perspective, the individual outcomes of the review were considered once more and combined.

The conclusion can be drawn that the use of Urban Safety Management frameworks is understood but underused. These should be promoted on a national as well as a local level. The value of the DUMAS project is to point out how different national approaches to the issue allow the development of a fairly uniform framework which would assist in encouraging the changes in political decision making which will be required.

Contents

1. Objective and scope of study

The report deals with the current practice of urban safety management in nine European countries. The study is part of the DUMAS-project, a project of the research programme of the Directorate General for Transport (DG VII) of the European Union. The name DUMAS stands for: 'Developing Urban Management and Safety'.
The overall objective of the DUMAS-project is to produce a framework for the design and evaluation of urban safety initiatives.

The project is carried out by an international consortium of research institutes, consisting of the Transport Research Laboratory / TRL (UK), Institut National de Recherche sur les Transports et leur Sécurité / INRETS (Fr), Road Directorate of the Ministry of Transport (DK), Development and Engineering Consultants Ltd / DENCO and Aristotle University of Thessaloniki (Gr), University of Brescia (It), Bundesanstalt für Straßen-wesen / BASt (G), Kuratorium für Verkehrssicherheit / KfV (Au), Transport Research Centre (Cz), and SWOV Institute for Road Safety Research (NL).

The project's field of interest is many-sided. Therefore, the project is divided into a number of distinct studies or 'work packages'.
One of these work packages is devoted to the objective of preparing a state-of-the-art review of existing practice and experience in the field of the design and evaluation of urban safety initiatives.

For this purpose, the consortium-partners prepared a state-of-the-art report for the situation in each of the nine countries they represent. In view of this, a common structure for information gathering and a format for reporting was developed in advance.
These national reports constitute research products of the DUMAS-project in their own right. Their titles can be found in the list of references (e.g. the references: (* 1) up to and including (* 9)).

The present study is based on the national reports. Its objective is to offer an overview and an analysis of the current practice of urban management and traffic safety in these nine European countries.
As such, it also supports elaborating other work packages of the DUMAS-project.

2. Working method

As already stated, the national reports were written using a common structure for information gathering and a format for reporting. This so called 'Initial Framework' is added to the report as *Appendix 1*. For reasons of a clear understanding, some elements of this framework will now be briefly described.

Firstly, existing knowledge and practice at the end of the 1980s as summarised in two specific studies, were considered as the starting point in elaborating the current national state-of-the-art practices.
These studies were respectively:
- *Integrated traffic safety management in urban areas*, an OECD-report (* 10); and
- *Guidelines for: Urban Safety Management*, a report produced by The Institution of Highways and Transportation (* 11).

Secondly, in describing the national situation of the nine countries involved, insights from the past were to be complemented by information on current practice and knowledge in order to get a clear picture of the strengths as well as weaknesses of the present urban safety initiatives there.

Thirdly, for this purpose the DUMAS partners were requested to address each of the following subjects, which were also formulated in terms of questions:
- Problem analysis and problem statement: "which safety problems exist and how have they been stated ?"
- Policies: "what policies and/or strategies are entailed and applied in dealing with such problems?"
- Design and implementation: "into what measures and/or tactics are such policies / strategies 'translated' and how are such measures or schemes implemented in practice ?"
- Evaluation and monitoring: "how are the safety effects of such measures assessed and monitored (product evaluation) and how is the urban safety initiative appraised (process evaluation) ?"

These subjects were further elaborated in the 'Initial Framework'.

This report summarises the current practices of Urban Safety Management in the nine countries involved in the DUMAS project.

3. Problem analysis and problem statement

This chapter is devoted to the specific safety problems occurring at the local level and the current practice in analysing and stating such problems.

It is a widely accepted notion that the mass-motorisation of societies in industrialised countries is at the basis of the traffic safety problem in cities, towns and villages, as the traffic infrastructure was not developed for such large scale motorisation. Within this general context, the objective here is to trace the factors particularly contributing to the urban safety problem. Part of this is the aspect whether such factors are common to the European Community countries or whether a factor is perhaps specific to a certain country.

3.1. The local safety problem

In reviewing the national reports, it is important to realise in advance that not only the extent of the safety problem substantially differs among European countries, but also its changes in the level of the problem over the last decades.

As might be supposed, such differences have originated for the greater part from national differences in mobility growth and in effectiveness of coping with its effects on traffic safety. In this regard, differences in safety problems are not directly relevant in revealing specific urban problems, nor in indicating particularities between countries. However, they are relevant in stating the importance of the traffic safety problem and in establishing priorities in dealing with it. One such priority concerns allocating the effort for solving the safety problem at the local level.

It is not the objective of this study to compare the traffic safety situation between different countries in statistical terms. A subject like that is more in the realm of analysing data on accidents, casualties, population, vehicles, road-length, exposure, etc., which can be found in international databases. Yet, it might be worthwhile to quantify the differences in the extent of the safety problem and its developments for the purposes as mentioned above.

With regard to the extent of the safety problem, the number of traffic fatalities (within 30 days), the number of traffic injuries, the percentage of injury accidents in built-up areas, (source: IRF, (* 12)), the population in thousands (source: UN, (* 13)) and the resulting ratio of the number of fatalities per 100,000 inhabitants are summarised in *Table 1* for each of the countries involved in this study with regard to the year 1995 (or 1994, if marked with *).
As the data shows, in a yearly total of 35,000 fatalities, the number of fatalities per 100,000 inhabitants ranges from 6.2 (UK) up to 18.3 (Gr); i.e. it differs by a factor 3. Another telling indicator is that the majority of the injury accidents occur in urban areas. The percentage varies between half (NL) to three quarters (UK), as shown in *Table 1*, but we need to recognise that percentages based on all injury accidents will vary according to the different reporting rates in the different countries.

Country	fatalities	injuries	% inj. acc. b-u areas	population (1,000)	ratio fatal/ population
Austria	1,216	51,974	60	8,050	15.1
Cz Repub	1,588	36,967	69	10,330	15.4
Denmark*	546	9,757	62	5,230	10.4
France	8,412	181,403	68	58,140	14.5
Germany*	9,814	516,400	63	81,640	12.0
Greece*	1,909	30,297	72	10,460	18.3
Italy	6,512	259,571	73	57,270	11.4
NL	1.227	10,210	54	15,460	7.9
UK*	3,650	315,189	74	58,605	6.2

Table 1. *National numbers of traffic fatalities (within 30 days) and injuries, the percentage of injury accidents in built-up areas (source IRF), the population (1,000) (source UN) and the calculated number of fatalities per 100,000 inhabitants.*

Referring to the second topic of changes in the level of the safety problem, it is noted that the total number of road fatalities decreased by some 30 - 45 % in the period 1975-1994 for most countries involved in our study. This is shown in *Table 2*, based on the 'International Road Traffic and Accidents Database' (IRTAD). Generally speaking, the related trends in the 'local' data are more or less similar. This overall decrease, however, has slowed down or stopped during the last few years.

In contrast to the developments in most countries, however, the national data of Greece show an increase in road fatalities by 80 % during that period. Moreover, an increase in mobility, and thus in exposure to traffic hazard, might be expected, since Greece still has the lowest car ownership per population-unit in the European Union (* 6). Another worrying development concerns the Czech Republic (not included in *Table 2*). After a rather stable period in 1980 - 1989, it is reported (* 2) that the number of fatal plus injury accidents have increased up till now by some 50 %, nation-wide as well as in built-up areas.

Strikingly, the national reports of both Greece and the Czech Republic contain statements which might indicate lack of political will and co-ordination among authorities on the one hand and public awareness on the other in tackling the traffic safety problem. For instance, a study on public opinion in the Czech Republic was referred to, leading to the report's conclusion (* 2): "Road safety problems were considered as negligible". And, another example, the Greek report mentioned the existence of significant national thinking in the field, resulting in some important proposals up to the level of the Ministry of Public Works, which "were never promoted into a national road safety policy" (* 6). At the same time, many statements in the other national reports can be found stressing the vital need for partnership of all 'actors' involved, (ways to promote) involvement of the public, the significance of targeted road safety programmes, and so on.

Country	fatalities in 1975	fatalities in 1994	trend (%)
Austria	2,533	1,338	53
Denmark	827	546	66
France	14,355	9,019	63
Germany	17,332	9,814	57
Greece	1,219	2,195	180
Italy	10,272	7,104	69
NL	2,321	1,298	56
UK	6,679	3,807	57

Table 2. *National numbers of traffic fatalities in 1975 and 1995 respectively, and trend in percentage (1975 = 100).*

Although interpreting the data shown in terms of comparisons between countries is quite complicated, their message ought to raise awareness of the traffic safety problem and its share in affecting the local situation.
The differences in the data also clearly indicate a potential for substantially improving traffic safety, nationally as well as at the local level.

3.2. The nature of the local safety problem

In general, the traffic safety problem is partly a 'nation-wide' or 'central' problem, which also manifests itself in built-up areas. Partly, it is a more or less specific 'local' problem.

Problems of the first category are for instance the growth in traffic and transport, the violation of rules and regulations like speeding, alcohol and drugs abuse, age and/or gender related problems, poor infrastructural design and maintenance, unsafe vehicle conditions, etc. Perhaps a bit overstated as it is put in one of the reports (* 1): "Cynically speaking, the European road safety problem is between 18 and 24, male and drunk... ", yet we agree here with the essence of the conclusion added: "... this should be the central target for treatment. In the context of urban safety management concepts these topics are hard to tackle". In other words, this kind of problem can best be handled by large scale, national measures or schemes in the field of infrastructure, education, enforcement, and the like.

This report focuses on the specific local issues and measures used to handle them within particular urban areas. There are, however, some topics at national level which were discussed in all the national reports: e.g. accident reporting, road functions, etc.

Knowledge of the characteristics of accidents and of accident occurrence is of basic importance. The reliability of accident registration and, by consequence, the possibilities for analysing accident data and for treatment are closely related to that. In almost every national report, statements can be found addressing these related subjects in one way or another.

A simplified description of the traffic accident phenomenon is that accidents generally occur in a scattered way and that often more than one cause played a role. So, even when accidents occurred more regularly at, for instance, the same place or time, they may be attributable to more than one cause (e.g.

* 9). These aspects are particularly relevant for the local situation, where traffic situations are complicated, 'almost as a rule'. Thus, they are profoundly relevant for 'describing' the local situation in terms of problem analysis and problem statement.

One difficulty is that a major aim of accident reporting is in fact a legal one - that of determining responsibilities of the parties involved in an accident - and not so much an analytical one (e.g. * 4). Accidents causes related to vehicle and road conditions are sometimes only reported in exceptional cases. Consequently human failure is the primary cause of accidents in the official statistics and the influence of deficiencies in vehicles and roads can hardly be traced (e.g. * 5).

Besides these fundamental aspects, quite a number of organisational and practical aspects are important as well. For instance, in some countries different institutions are involved in accident registration but not always in a co-ordinated way (e.g. * 7). In case of a same level of authority, they might act in an independent way, not always having the same scope or using the same methods (e.g. * 3). The degree of registration is generally related to the severity of accidents, often in an undefined way. Even in countries with a relatively high standard in accident recording, a decrease over the past years in the registration degree of injury accidents is reported (e.g. * 8).
In effect, sometimes only data on traffic fatalities can reliably be used for further analyses. Such data are, however, only relevant to a part of the problem. Moreover, their smaller amount impedes statistical analyses.
Accident reports are sometimes considered as being confidential and are, thus, not available to the municipal engineering departments (e.g. * 4).
Local authorities might tend to apply only data and reports from the municipal police, "which are usually incomplete, aiming to demonstrate urban police efficiency", even where urban accident data of better quality are available (* 7). Exposure measures are often insufficient (e.g. * 1) or completely lacking (e.g. * 6). As pointed out in several reports (e.g. * 9), the traditional 'black spot' analyses and treatments, for instance, are of limited value, if at all. In addition, without reliable tools for monitoring, these might even result in unnoticed migration of safety problems.

This description of accident characteristics does not really constitute a new point of view. On the contrary, together with the need for integrating local policies of different kinds - for, after all, traffic safety policy is an 'aspect' policy, which is by its nature part of or has to be incorporated into 'sector' policies - the multi-causal, scattered nature of accidents were among the leading grounds for developing the so called 'area-wide accident reduction approach' in the nineties (e.g. * 10)

What ought to be learned here, however, is that for understanding and treating the local traffic safety problem quite an effort has still to be made in creating, organising and applying databases which offer reliable information on the local traffic safety situation.
There is a strong feeling that the administrative level is at the heart of both the weakness of the current situation and opportunities for improving it. In that, the national as well as the local authorities are involved. This remark applies to each of the countries involved in the study, albeit in a rather wide range of degrees.

In addition to these statements, it is worthwhile to state that the standard of knowledge on accident registration and on investigation techniques seems to be generally sufficient everywhere. This is shown in, for instance, the overall quality of national accident statistics studies and the statistical analysis 'equipment' in use like for instance the utilisation of geographical information systems (or GIS-systems) for localising accidents, software for automatically coupling of databases or exchanging information, computer assisted data analyses, etc. (e.g. * 4, * 8).

Furthermore, in accident recording and analysing deficiencies in data on injury accidents and exposure are bottlenecks, but a shortage in ways and methodologies for analysing traffic safety risk (i.e. attributing accidents to an unit of exposure to traffic hazard) is also of importance. As pointed out in a report (* 4): "There are several reasons for this: the measuring of flows in towns is limited, as it deals essentially with vehicles, and very rarely with two-wheelers and pedestrians; tallies are not comprehensive throughout the network; it is difficult to design a risk measurement at road junctions where most accidents take place."

As already said, mass-motorisation probably is at the basis of most traffic and traffic safety problems in built-up areas. Within this general notion, some problems can be considered as more or less specific for the local situation. For instance, problems can be indicated such as: the incompatibility of motorised traffic and vulnerable road users as pedestrians, cyclists, elderly people, children, etc., the problem of through traffic, the specific traffic safety problems in residential, living and/or shopping areas, insufficient public transport, the accessibility of town-centres, the parking problem, etc. These problems are, however, highly interrelated, since one of the most important properties of urban traffic is the mixture of a variety of traffic participants, divergent use of public space and a diversity of travel and traffic modes.

In this context, it is important to understand and to define their principal link. It is the relation between the function, the design and the use of the infrastructure of the public domain and/or road network. The function of roads refers to the tasks to be fulfilled by the part or section of this infrastructure in facilitating purposes of travel and traffic, and living. The design of the road(-network) has to translate that intended function into traffic and living requirements. And, lastly, traffic rules and regulations are meant to enhance proper use of these facilities by the different categories of traffic participants, i.e. their travel and traffic modes.

'Friction', or conflicts in between these three elements, is to be considered as a generic cause of the traffic safety problem, whether such a problem is called - as we just did - the incompatibility of several traffic modes, the conflict between living and moving and/or between mobility and accessibility, the problem of through traffic, lack of facilities of some sorts, or something different. And, vice versa, avoiding and/or solving such frictions is one of the major treatments of the traffic safety problem.

In reviewing the national reports, statements can be found regarding either potential causes or their results in terms of victims, both mostly reflecting the aforesaid frictions or the way in which a safety problem was mentioned. There is no direct need here to go into further detail on that topic, as it will be addressed in discussing remedies for coping with the problems. Yet, we

would like to make an additional remark on behavioural aspects, in particular 'nationality related' attitudes of traffic participants towards traffic safety (e.g. * 2, * 6). In our view, neglect on a large scale of what was indicated before as the 'frictions' in the travel and traffic system is a much more profound ground for unsafe driver behaviour than 'national particularities'. Anyhow, in so far such deep-rooted characteristics possibly exist, it would be an awesome task to change these. So, from a practical point of view, they can best be treated by treating the points of friction, i.e. by preventing them instead of introducing them.

4. Policies

This chapter is devoted to the subject of the nature of policy-making, as well as to the main concepts or principles of safety policies relevant for local safety initiatives. In that, we are interested here in both operational and effectual aspects of traffic safety policies.

4.1. Nature of policy-making

4.1.1. *The central role of policy-making*

Looking to the national state-of-the-art reports, it becomes clear at first glance that virtually any kind of traffic safety policy in use is well-known in each country and applied there in practice. Differences between countries mainly concern the scale or the systematic way such policies are actually employed. For instance, concepts of segregation versus integration of incompatible traffic modes, principles of a hierarchical road network, the approach of area-wide accident reduction schemes, traffic calming measures and schemes, etc., they are all known and utilised to some extent. One of the national reports explicitly stated (* 2): "It appears ..., that all tools for improving traffic safety are known and implemented ... ", at the same time as it demands a substantial increase in safety initiatives. Or, as indirectly stated in another report (* 5): "..., integrated safety programmes at the local level are still an exception".

In a way, a remark like this is rather trivial. Among our 'information societies', rapid exchange of knowledge and experience might be expected, particularly in cases where we are dealing with fundamentally the same kind of problems. On the other hand, the observation enlightens the key role of policy and decision-making in improving traffic safety, (among other subjects of national and/or local concern). Thorough knowledge might be essential in problem stating and treating. However, it is policy and decision-making, which are essential in actually solving problems. Or, in other words, it is at that level that measures and schemes are eventually effected and implemented in an appropriate way.

Obviously, in explaining differences between countries in traffic safety and traffic safety initiatives, it is not lack of knowledge which is the decisive factor, but rather the political preferences and feasibilities of national, regional and/or local authorities. For it is at those levels that problem solving gets its priorities, its administrative organisation and funding, its legal embedding and enforcement, its implementation and the 'top-down' raising of public awareness, etc. Topics of this kind are frequently alluded to in most of the national state-of-the-art reports as subjects where improvements are required or requested (e.g. * 1, * 4, * 7).

Besides political preferences and feasibilities, characteristics of the organisational structures of a nation might also play a role, as often indicated in the state-of-the-art reports (e.g. * 7): "..., and because of an overwhelming complexity of urban planning rules and administrative roles".
These structures differ considerably among the countries involved in the study. It is not up to us to judge, nor to alter them. Anyhow, it can be argued

that modifications are possible within virtually each national organisational structure in order to facilitate the front-line position of the local authority in accident prevention. Thus, it is of great importance to be alert to adequate competencies and responsibilities, safety management structures, communication, information transfer, etc., between the national, regional and local level: the place where the accidents occur and where local safety initiatives are to be taken.

However, we will have to be cautious about the preceding statement of 'lack of knowledge is not the decisive factor'. In quite a lot of the national reports (e.g. * 1, * 2, * 7), it can be observed that examples of measures or experiments on traffic safety management chiefly involve the bigger cities or towns. Besides mention of causes such as their limited financial resources and/or administrative responsibilities, this might indicate poor information transfer to the smaller municipalities. This is a problem, which has also to be addressed at the national, organisational level.

Finally, some additional remarks. The importance attributed to political action can also be recognised in the emphasis on the evaluation stage in the OECD-report on 'Integrated traffic safety management in urban areas' (* 10). One of the purposes of that stage is to confront local authorities with the outcome of their traffic safety action and, thus, to keep safety on the political agenda in case current actions appeared to be deficient.

A second remark relating to the need for consideration of changing travel mode as a means of making travel safer. Policies within local authorities should be seeking greater use of safer forms of transport. Public transport is declining in all the countries involved in the study while travel by private cars has increased. Policies to support public transport could reduce the use of private cars reducing congestion and increasing safety.

Thirdly we should consider a special category of 'actors' in the playing field of traffic safety policies: the private investors. Private interests are evidently taken into account, particularly in extensive infrastructural measures. As pointed out in the French report (* 4): "This may result in involving investors, sometimes on a large scale, who find an economic advantage in restructuring roads as part of projects to set up large industrial, business or service zones." Understandably, it offers opportunities for realising traffic safety improvements which would otherwise be impossible. On the other hand, it necessitates adequate expertise and political control from the part of the municipalities, which remains problematic for the smaller ones.

4.1.2. *Some successful strategies in traffic safety policy-making*

On the subject of policy-making, a number of national reports refer to two widely applied general strategies for challenging the overall traffic safety problem. We will discuss them at some length because of the success they have already had, and potentially still have, particularly for those countries in which they have not been utilised so far.

Sharing interests and integrating safety into wider policies
The first can be described as 'sharing interests', or 'forming coalitions', of various policies. This approach implies more than just 'integration' of traffic safety and other policies of local concern, (as promoted e.g. in * 10 & * 11). Sharing and integrating interests involve combined and attuned efforts

of different policies for achieving common goals. The strategy turned out to be of great importance, especially in combination with policies on environmental issues and the improvement of the quality of life (e.g. * 1, * 3, * 5, * 7, * 8). In one of the national reports (* 2), it is even concluded that "... there is a need for embedding safety measures in other policies.", because "Traffic safety is not a leading priority issue for local policy-makers or citizens ...".

It is difficult to appraise the strategy on the basis of the national reports alone, chiefly, of course, due to its intrinsically dual outcome. Yet, there is no doubt in stating that environmental and well-being arguments played an essential role in developing and implementing many measures highly beneficial to traffic safety; e.g. traffic restraint and speed reduction schemes, encouragement of safe pedestrian and cycle traffic, improving public transport, etc. In addition, it is noted here that 'bottom-up' public awareness often acted in these examples as a main stimulus for political action.

The other side of the coin is that the formula of sharing and integrating interests asks for consensus, even in situations where conflicting interests are entailed. Reaching consensus is often complicated for the many other linked policies and interests (e.g. * 5). After all, traffic and transport might threaten the safety of inhabitants and affect the quality of life. At the same time, however, traffic and transport are requirements, inherent to urban society. So, reaching consensus generally costs a lot of energy, is time consuming, and so on. This can reasonably be considered as disadvantageous. On the other hand, the profit is that the political decision-making process now provides explicit insight into the weighing of traffic safety and other subjects of local concern.

In some countries, institutionalised methods for assessing the potential impact of activities on the environment before implementing them are in use. Safety effects of national long term transport and traffic policies are separately assessed too. Safety is sometimes one of the points of view in the context of such ecologically oriented audits, albeit mostly safety in the broader sense of the word (e.g. * 8). In some cases, traffic safety audits in their own right are legally required and already successfully practised, also with respect to urban areas (* 3). A group of experts, conducting safety and transport policy audits of measures still in planning phase, is recorded as set up by the municipality of Vienna in 1995 (* 1). The development of the traffic safety analogue of the environmental impact assessment is at the moment put as an activity on the work programme 1997 -2001 of the Commission of the European Union: *Promoting Road Safety in the EU* (* 15). Guidelines are to be decided now regarding a subject, described as: "The impact on road safety should, like the environmental impact, be systematically assessed at the decision stage for infrastructure".

Goal setting

A second strategy can be identified as the 'goal setting' one. The strategy already has quite a long history and a variety of targets have been used. It is successfully applied, albeit up till now still mainly at the national level. In the early and mid-eighties, for instance, the first initiatives of the kind were taken, like the <Objective minus 10 %> or the <Aktion - 10 %> (e.g. * 4, * 5). In some cases, it concerned public initiative (e.g. * 1).

From 1987 on, several European countries, the United Kingdom being the first, introduced so called 'targeted' road safety programmes. The added key element of such programmes is that the responsible authority - at that stage, the government - commits itself to achieve a fixed traffic safety target within a specified timescale. Nowadays, local authorities are more and more involved in this strategy, on their own initiative, stimulated by incentives or by making them responsible for achieving their share of the national target (e.g. * 8). They can also be motivated to set their own targets as part of establishing 'local action plans', which are required or promoted in some countries (e.g. * 3, * 8).

The strategy turned out to be very effective, not only in the direct sense of achieving the previously set targets. Indirectly, some aspects of the strategy seem to be at least as important, for they will have a profound and lasting impact on future traffic safety developments as well. The strategy requires, for instance, long-range comprehensive action programmes, reliable organisational structures and monitoring procedures. It involves regional and local authorities, responsible public and private bodies in the field and, evidently, the traffic participants themselves. It defines the responsibilities and role of all these 'actors'. Last but not least, the strategy apparently generated energy for action and innovative thinking.

The 'goal setting' approach has been extensively addressed in the OECD-study on *Targeted road safety programmes* (* 14). Ways to promote and to support the co-operation of at least the major municipalities have been tried, for instance, by making use of incentive schemes, by establishing local road safety councils or by administrative actions, etc. (e.g. * 3, * 5, * 8). Targets to be chosen and aspects of the target setting process are also still a subject of study. This might concern the setting of sub-targets for instance on mobility restraints and on specific causes of or remedies for the safety problem, like alcohol abuse, speed, or compulsory seat belt use. On the local level, goal setting might raise statistical problems, in particular related to data reliability, the definition of the measurement unit, and the like (e.g. * 4, * 8). Anyhow, it is a widely accepted notion that quantitative targets seem to be favourable (* 14), because, as it is put in a report (* 3): "(They) make it easier to define measures, allocate responsibilities, resources and administrative units which all together are a necessary part of a concentrated and effective attack on road safety problems".

Interestingly, the 'Zero Vision' - concept, of Swedish origin (* 16) and standing for: "a road transport system free from serious health losses", was recently adopted in Denmark (* 3). As its national report accounts: "Parliament understands that the zero-vision as a specific target is Utopian, but the government considers it important that this train of thought permeates road safety work in Denmark". In that, we think, 'permeate' is the crucial word here.

Additionally and/or complementary to both general strategies - described here as 'sharing interests' and 'goal setting', which were considered to be of great importance for traffic safety - many other generally applicable and valuable 'policy tools' exist. Among these one can refer, for instance, to demonstration projects, the use of incentives, improvement of information transfer, financial support, cost-benefit studies, etc. They can be considered, however, as belonging to the standard 'toolbox' of policy-makers and they are, as such, not so relevant in our context.

4.2. Urban traffic safety concepts reviewed

In coping with the local traffic safety problem, some urban traffic safety philosophies, concepts, approaches or leading principles, have been developed over the time or became widely accepted. They can be described, more of less in their historical order, as follows:

To start with, local safety initiatives are frequently prompted by individual accident causes. Such causes are often related to specific features or locations of the road infrastructure and, thus, usually referred to as 'black spots'. Originally, 'the solution is taking away the cause' was the customary treatment philosophy. No attention was paid to the fact that a solution there might cause problems elsewhere or that another solution might solve other problems as well, and so on. In time, the philosophy has been elaborated and is nowadays much more sophisticated, albeit of limited value for obvious reasons. Yet, the method proved efficacious in preventing accidents (e.g. * 3), in particular in cases where it was utilised as the first safety action.

After giving attention to accident spots and mono-causal treatments, safety initiatives became more centred around the divergent and sometimes conflicting 'functions of the urban area'. In order to keep the traffic running, the city
(-centres) accessible, the economic life alive, etc., traffic and traffic circulation became a topic of interest. At the same time, residential and shopping areas had to be defined and secured in order to cope with through traffic in such areas, speeding, distribution of commodities, and so on. In other words, a multi-modal approach was required.

Principles were developed on the segregation and/or integration of incompatible travel modes and/or traffic participants, on a hierarchical road-infrastructure, on pedestrian precincts, car-free city (-centres), etc. The vulnerability aspect is not approached in the same way everywhere. As reported (* 4): "The concept of 'road sharing' is given preference in France and does not favour any specific user category". Among the reasons for this standpoint it is mentioned that prioritising a travel mode is not considered justifiable, for "combatting unsafety entails reducing the number of all victims".

The integrated traffic safety management philosophy was a logical follow-up of the aforementioned developments. It embeds the beneficial experiences of the segregation / integration principles. It is also an area-wide traffic safety approach, taking into account other local interests. Besides the infrastructural measures, it also includes measures in the field of information, education, enforcement, etc.

More recent developments concern the concept of 'sustainable' urban traffic safety (* 8), and the 'zero vision' approach (* 3). It seems useful to briefly introduce some basic elements of these concepts.

The starting point of the sustainable safety concept - as it is being developed mainly in The Netherlands (e.g. * 17) - is that in principle man is the reference standard. In the concept, we should try to drastically reduce the probability of accidents in advance, by means of the infrastructural design. And where accidents still occur, the process which determines the severity

of these accidents should be influenced such that serious injury is virtually excluded. Hence, a sustainable, safe traffic system has:

- a structure that is adapted to the limitations of human capacity through proper design, and in which streets and roads have a neatly appointed function, thus avoiding improper use;
- vehicles fitted with ways to simplify the tasks of man and constructed to protect the vulnerable human being as effectively as possible; and
- a road user who is adequately educated, informed and, where necessary, controlled.

The concept can be 'translated' in some, more practically oriented, safety principles:

- prevent unintended use, i.e. use that is inappropriate to the function of that road or street;
- prevent large discrepancies in speed, direction and mass at moderate and high speeds, i.e. reduce the possibility of serious conflicts in advance;
- prevent uncertainty amongst road users, i.e. enhance the predictability of the course of the road or street and people's behaviour on the road or street.

The 'zero vision' of Swedish origin (e.g. * 16, * 18) takes a different stand in designing the road transport system from the most common safety strategy, which is generally based on designing the system to minimise the number of events that cause injury. Starting point of its safety strategy is that the system has to be dimensioned in such a way that possible conflicts, or incidents which might cause injury, never result in exceeding a politically pre-defined level of an unacceptable loss of health. In achieving the 'zero vision' in reality, the intention is to create a situation in which exposure to violence is minimised. At the same time, the degree of violence has to be kept below the violence tolerance level of an optimally protected human being. So, in this approach too, man is in principle the reference standard. Some provisional elaborations of the concept partly resemble in practice, as we understand it, elements of the sustainable safety concept.

5. Design and implementation

Urban traffic safety philosophies, as described in Ch. 4, have to be elaborated into safety measures and schemes, and then adapted to and implemented in practice. So, the application of theories and insights is our subject here.

We will not address general points of view or specifically national policies and actions such as reduction of exposure to traffic hazard, in particular by facilitating public mass-transport, the required enforcement of measures, and the educational type of actions, though these are important and may form part of area-wide traffic safety schemes (e.g. * 10).

Moreover, we refer to an observation in Ch. 4.1, namely that virtually all traffic safety policies and measures are known in the nine countries involved in this study and applied there in practice. We will therefore focus the discussion here on specific comments made in national reports, rather than consider in depth the measures or schemes themselves.

Another remark to be made in advance is that most traffic safety schemes nowadays incorporate several safety principles and/or measures at the same time. This is, of course, especially true when integration principles are observed. By consequence, a well-defined taxonomy of schemes and measures cannot be given.

So, mainly for practical reasons, we will distinguish - in the customary way - between residential and traffic areas. Moreover, only the most general measures or schemes there will be indicated, and by the name they are usually referred to, no matter what underlying principles were exactly entailed. An outline like this has disadvantages. Besides the complication that some measures do not easily fit in, an important inconvenience is its implicit emphasis on the infrastructural or 'engineering' type of measures. It will be essential that such measures are imbedded in social life and supported by informative, educational and other action. A separate section will address that topic, in so far it regards specific local (and not national) initiatives.

5.1. **Measures and schemes in practice**

5.1.1. *Residential areas*

In municipalities, some built-up areas have a more or less dominant residential or 'habitat' function. Here, activities take place like playing, walking, sightseeing, shopping, and the like, although its roads and streets are also (or still) utilised for traffic and travel purposes. Such areas are to be considered as 'residential areas'; among them living quarters, shopping areas, town or city centres, areas with historical or an otherwise special value or purpose, and so on. In addition to this description, it is noted that 'indicating' or 'defining' such areas seems to cause no difficulties in practice, perhaps in contrast to classifying streets and roads, to be typified by their various travel and traffic functions.

As the national state-of-the-art reports show, the majority of urban traffic safety measures and schemes deal with residential areas. Yet, and interestingly, the majority of all fatal and injury accidents inside urban areas presumably occur in the traffic areas of municipalities: on their distributor roads and arterials. A recent estimate for the Dutch situation concluded, for example, that 70 % of all urban injury accidents occur on the 30 % of the latter kind of streets and roads (* 19). Such data are not available for each country in this study. It can, however, easily be argued that an outcome like this is also valid there to the greater extent, for the underlying mechanism of accident occurrence will be the same everywhere. After all, the speed and mass of motorised traffic generally is a major factor in accident causation and in inflicting injuries, while the traffic volumes there - and thus exposure to traffic hazard - play a predominant role at the same time.

Consequently, the focus in attention on residential areas cannot be solely explained in terms of objective traffic safety data. We can only speculate on the origins of the phenomenon. It can be taken for granted, however, that often - besides aspects of the quality of the life, problems of traffic noise and air pollution, congestion, and so on - feelings and experiences on hazardous traffic conditions in, for instance, one's nearby vicinity might have played a role in motivating safety action. In other words, as it is formulated in a report (* 4): presumably "the power of associations, in particular residents associations" at least partly raised the attention.

As pointed out in one of the reports (* 3), such feelings and experiences might also specifically be of value in indicating 'hidden' problems, of which authorities were otherwise not aware of. A 'subjective source' like this is to be taken seriously and the information from it has thus to be carefully analysed 'in an objective way'.

In a broader perspective, however, target setting - nowadays the starting point of traffic safety policies in a number of countries - implies that objectively stated targets have to be reached. Consequently, it might be expected that the attention on residential areas will shift towards measures where - at least in principle - a larger amount of safety profits can be gained. In a way, that would be a reasonable decision. On the other hand, application on a larger scale of measures of proven (cost)effectiveness - a subject to be addressed in the next chapter - can be argued as well.

In the context of traffic safety, the effectiveness of the traffic calming type of measures in residential areas can mainly be attributed to motor vehicle speed and exposure reductions. The type of measure ranges from '30 km/h speed limit zones' or '20 Mph zones', through 'silent roads' (with a 30 km/h recommended driving speed (* 3)), 'shared areas' (with the-right-of-way of pedestrians over drivers and a recommended driving speed of 15 km/h (* 3)), the 'Woonerf'- type of solution (e.g. *8), pedestrian precincts for various purposes, etc., to car-reduced or even car-free towns or resorts.

In this range, the upper speed limit of 30 km/h is a fundamental condition from the traffic safety point of view. This is the speed at which the probability that an impact of a car on a pedestrian will result in a fatal accident, or an accident with severe injury, is statistically minimal. Where the integration of such incompatible travel modes is aimed for, the 30 km/h speed limit acts as the prerequisite for avoiding detrimental effects of the speed and mass of motorised traffic.

Probably, the '30 km/h speed limit zone' generally is nowadays the most widely implemented traffic calming measure. The French report states "... , there are remarkably few 30 km/h zones" (* 4), and a national organisation there decided to promote the concept - which is, by the way, in line with the nationally preferred concept of 'road sharing' - in order to achieve a substantial increase in application.

The '30 km/h speed limit zone' concept has been elaborated rather extensively over the time and experiences in practice were gained (e.g. * 5, * 8). Detailed studies on effectiveness and specifications of speed reducing features and measures at the boundaries and inside such zones, like road humps and bumps, raised junctions, chicanes, adaptations to the needs of special groups of traffic participants like disabled people, etc., were carried out (e.g. * 3, * 5, * 9). Therefore and as a conclusion, the concept can be considered as 'mature'.

The preference for applying the '30 km/h speed limit zone' measure can partly be ascribed to some of its advantages, as referred to in a number of national reports (e.g. * 5, * 8). For instance, this traffic calming measure can be implemented in existing urban areas, covering rather large parts of it, without transforming too extensively the (existing) physical layout and thus also at limited costs, reasonably without impeding the inhabitants there in motorised travel to and from their homes and in parking their private cars, yet effectively diminishing the amount of traffic by cutting through traffic and thus minimising ecological problems as well, and so on.

In terms of comparison with some other traffic calming measures, the measure is, for instance, almost as effective in accident reduction as the 'Woonerf'-type of solution. At the same time, implementing '30 km/h speed limit zones' is much more cost-effective, for larger areas can be covered at lower costs. In contrast to measures at the other end of the range: the - still scarcely implemented (e.g. * 1) - idea of car-free towns or resorts have high costs and complexity, requiring door-to-door public transport, etc., and might be favourably implemented only in newly planned locations.

Or, in order to put this kind of considerations about traffic calming measures into a summarising statement, it can be said that:

- the '30 km/h speed limit zone' measure is effective from both a traffic safety and an economical point of view and preferable as a rule;
- the remaining traffic calming measures in the range are beneficial for traffic safety as well;
- some measures of the latter category like the 'Woonerf' and pedestrian precincts are to be preferred if additional safety action is needed, particularly to protect areas where younger children, elderly people and/or physically handicapped persons are concentrated (e.g. * 5); and
- for the rest, such measures might be in favour too in cases where other aspects than safety also play a role.

5.1.2. *Traffic areas*

One of the main objectives of urban safety management - as, for instance, defined and elaborated in guidelines (e.g. * 11) - is to provide a hierarchical network of roads in which the design of the road and its place in the hierarchy corresponds to its functions of respectively:

- rapidly processing of through traffic;
- distributing traffic for rapidly accessing districts of built-up areas; or
- providing for local access.

With respect to the latter type of access road, its function of making destinations along a street accessible is combined with making a street as safe as a meeting place. The subject has been addressed before in discussing the benefits of traffic calming measures in residential areas.

Traffic flow and circulation as such is not an issue for discussions here, neither is the distribution of traffic over parts of a municipality. It speaks for itself, however, that some of their functional - traffic oriented - design characteristics are also intended to ensure the safety of road users.

The first and principal characteristic among these, and, as a matter of fact, a leading safety principle of the hierarchical network structure, is that the traffic participants are to be able to recognise unambiguously the function of the road - and thus the kind of traffic conditions they will have to deal with - enabling them to attune their driving behaviour.
Important design characteristics for roads with a flow function are, for instance, aimed at creating a steady flow of vehicles at higher - within prescribed limits, of course, - harmonised driving speeds and a continuous traffic stream in which 'through' and 'destination' traffic are clearly distinguished, on conflict-free crossings and accesses, etc. Traffic modes incompatible in terms of vulnerability, are to be (and often already are) segregated as a rule.

On the other hand, the distribution function of roads is related to the frequency or density of discontinuities like intersections, connections and parking places, variations in speed in between these, and, notably, often by the presence of different traffic modes at the same time. In principle, the distributor function will be performed better if vehicles move at lower speeds. Traffic calming measures, and the segregation and/or integration of incompatible traffic modes are valuable safety principles here. Apart from the road network for 'at least' motorised traffic, physically separated networks for pedestrians and/or cyclists have been developed and are in use. Obviously, segregation is the leading principle here. In situations where such networks for vulnerable road users and the other network 'cross' each other, special solutions for potential conflicts have to be employed.

In reviewing the national state-of-the-art reports, the concept of a road network hierarchy apparently is broadly accepted in one way or another and is getting increasingly implemented in urban areas.

Considerable differences, however, exist with respect to the extent of actual utilisation between the countries involved in this project. Accounts, for instance, are reported (e.g. * 2, * 6, * 7) on requests for speeding up the interventions for improving the infrastructure of urban road networks, on lack in renewing technical concepts of road layout, and on implementation of design principles in mainly demonstration type of projects only, etc.
Road and speed classifications are generally accompanied by substantial infrastructural measures which can only be executed over a longer time span: not only for reasons of costs and investments - notably influential if reconstruction is required -, but also because of learning and acceptance processes. This aspect is clearly expressed in a report (* 3): "The thoughts

and ideas behind the road classification have been used ... for the past 15-20 years and therefore, the methods are well known and accepted among all road authorities." The actual outcome is recorded as: "Today, approx. 70-80% of all municipalities ... have divided up their road network ... , but a proper comprehensive implementation of the speed-classification and pointing out of traffic reconstruction of the roads ... have been carried out in only a few individual municipalities."
Therefore, and unfortunately, quite a lot of time and energy will be taken in catching up any differences in implementation level.

Although widely accepted in one way or another, the way the 'hierarchical network' concept is implemented is now and then the subject of thorough public discussions. After all, the concept is not just a rigid recipe. As it has been expressed in a report (* 4), local considerations sometimes "have clearly gone beyond a functional analysis", ending up in adapting the layout of the road to "its actual complexity", and no longer to its intended function alone. Examining a number of demonstration projects on residential and traffic areas, the topic of 'relations between safety and other measures' led to the conclusion in a report (* 7) that: "... one of the main themes of research and analysis is about the side-effects of measures, especially in a context of elimination of architectural barriers.". In other words and more generally stated, functionality understandably is not always agreed upon as the one and only point of view.

A compromise of various considerations - also comprising aspects like user comfort, aesthetics, being fitted into surroundings, and phrased in a report (* 4) as "the concept of urban quality of installations" - is clearly not 'as such' detrimental for traffic safety interests. For, it is not the 'hierarchical network' concept which is inviolable, it is the vital safety principles which are underlying the concept and which have been implemented in it. In this respect, local professionals are therefore among the first in line to put forward the safety interests and to adapt safety principles of proven value to the specific local situation. Consequently, design manuals, handbooks and the like for local use, also have to pay extensive attention to the underlying principles of measures, potential side-effects, etc., and not just to layout related specifications.

The aesthetic aspect, or "the appearance of the road and the road space, affecting their immediate environment" for instance, is also addressed (* 3) in a statement that "... it is the planner's task to ensure that journeying through a community is a pleasant experience ...". As reported, methods are developed for systematic visual examinations of layouts in advance.

Road and speed classifications in themselves, as well as adapted design characteristics, are not exactly the same everywhere in the nine countries of the study, neither are such connected subjects as nationally prescribed vehicle classifications and other traffic rules and regulations. On the contrary, with regard to most of these countries, one might better speak of ongoing processes in defining them and in developing design configurations supporting the hierarchical structure. Much effort is also put into elaborating and optimising design elements or subjects like measures to be taken at the boundaries of built-up areas, on roundabouts and other type of junctions, cross-sections of thoroughfares, signalling devices, the pavement, lighting and other facilities or requirements. Some of these issues will be addressed later in this report.

As an alternative for the urban throughway, the 'urban boulevard' was introduced in France in the 1980s (* 4). The type of road is made up of a central lane and a system of lateral alleys, providing access to local housing and intersections with secondary roads. Interestingly, according to the national report, the type of road "proved useful in re-enhancing the urban fabric, in particular in the outskirts of urban areas". At the same time, it "provides for a mix of uses and functions" and it is considered as "a qualitative response to the inflow of heavy traffic into urban areas". Unfortunately, at the moment results of safety evaluations seem not yet available.

Roundabouts are reported of being increasingly implemented in a number of countries (e.g. * 1, * 3, * 4, * 8). A rather wide range of layouts of this type of junction is in use, for instance with respect to the number of lanes, with or without separated or non-separated bicycle lanes and/or footpaths, the kind of access design and access facilities, and so on. There are also differences in applied rules and regulations, in particular with the regard to right-of-way. Therefore, one cannot speak about a 'settled' traffic facility. Yet, and importantly, it has become clear that this solution is beneficial to traffic safety in diminishing the number of accidents and their severity, without resulting into disadvantages like traffic-capacity loss.

In some countries, cycling traditionally is a much used travel mode among all age groups, especially for daily, medium-range trips to and from school, work, shops, etc., and, clearly, for recreational purposes too. Being one of the most healthy and ecologically sound travel modes, not causing congestion, parking problems, etc., and - important from a traffic safety point of view - not seriously threatening the safety of other traffic participants, promoting bicycle use is often an objective of national and local policies, as referred to in many national reports. Besides that, bicycling is encouraged by numerous associations and pressure groups. Much of this is, of course, applicable to pedestrians too.

Bicyclists are, however, extremely vulnerable. So, bicycle use and the promotion of it demand safe and attractive cycling facilities. Measures in the field range from - physically and/or otherwise separated - cycle tracks, lanes and paths, special bicycle routes, among them school routes, and cycling networks, to 'cycle-friendly towns'. The latter is, for instance, promoted in an annual contest (* 1), by a 'Bicycle-friendly Club' of 170 towns (* 4), is an objective of the 'Master Plan Bicycle'-project (* 8), etc. Some design aspects have been addressed in several national reports (e.g. *2, * 3, * 4, * 8, * 9). For a comprehensive review of existing knowledge and experiences, reference should be made to a design manual on cycle-friendly infrastructures and facilities (* 20).

In situations where mopeds and other light motorised two-wheelers are allowed to make use of bicycle facilities, practical problems might arise from this mix, which are difficult to solve (e.g. * 4). As said previously, national rules and regulations on road, speed and vehicle classifications cannot easily be compared. However, some experiences (* 21) might be of more general interest. Dutch law prescribes that moped riders (cylinder capacity up till 50 cc; speed limit 30 km/h within built-up areas) should drive on the cycle track if there is one present, rather than on the carriageway. In a field trial, safety effects in terms of moped accidents involving injury in a before and after period were investigated on locations inside the built-up areas where moped riders used the carriageway

designated for motor vehicles (speed limit 50 km/h) in the after period. As a result, the introduction of the measure: 'moped on the carriageway' on a larger scale was recommended.

In addition to the latter topic, a final remark. In the national state-of-the-art reports, little attention has been paid to the safety of motorised two-wheelers. This is remarkable in the light of the high casualty risk of motorcyclists in traffic. As for instance reported (* 6): "... in Greece, motorcyclists are exposed to accidents almost nine times more than users of passenger cars." The quoted outcome reflects the nation-wide situation, but will partly also be of relevance for traffic areas of municipalities. One might wonder whether specific local measures can contribute in solving the vulnerability problem of this category of road users.

5.2. Traffic safety measures and the citizens

The topics of public awareness of the traffic safety problem and public acceptance of traffic safety measures have been addressed in most national reports. It has already been mentioned in different ways in previous chapters.

It might be argued that these aspects can be considered both as a 'conditio sine qua non'. Awareness is a major stimulus for safety action; without acceptance of the remedial action ultimately chosen, measures will not be observed and cannot be enforced either. Such views are expressed in reports, for instance, in a conclusion (* 2): "The number of accidents has increased and there is no sign for a change. The public awareness of the safety problem is low". And, (* 1):
"The involvement of citizens has shown to be a central factor for the successful implementation and operation in the course of (integrated) programmes."

Obviously, reliable information on the safety problem and effective information transfer on the problem and its remedies are at the basis of their public awareness and acceptance. The sometimes inadequate facts and figures on the local safety problem have already been discussed. Evidently, this may frustrate democratic processes in between local representatives and their electors, or, more generally, in local policy and decision making. The latter subject can also be addressed in a somewhat different point of view. Laws recently come in effect in Italy (* 7), oblige authorities to monitor and evaluate traffic measures. As put in the national report: "Anyway, this new trend should bring about a growing traffic safety consciousness, which is the only way to increase a technical culture and administrative policies".

Information transfer firstly concerns the transfer of information as such, which can be done by traffic education, information campaigns of some sort, etc. (e.g. *1, * 3). Among these, the 'Children's Town Campaign' in Wiesbaden (* 5) is of special interest. One of its results is recorded as: "... parents and children worked out a 'schoolway plan', that considered the real mobility customs of children and which was taken over by the school office."

At the local level, involvement of the citizens is the more crucial, for the measures are directly meant for their benefit, and, at the same time, have an impact on their nearby surroundings as well. As reported on this part of the

information transfer (e.g. * 1, *3, * 4, * 8), opinion polls, public hearings and other types of consultations of the inhabitants and/or their delegates or representatives are advisable - and instrumental as well - in a search for the best solution, in looking for participation and co-operation and in ultimately reaching acceptance and agreement with the future users.

Creating appropriate links between the local authority and the citizens is becoming increasingly complicated when it concerns medium and larger sized towns or cities. This is, evidently, a general administrative predicament and, as such, sometimes legislation and other type of solutions are already attempted at the national level. As a matter of fact, civil participation sometimes has already got a legal basis (e.g. * 8). Initiatives from the part of the local administration are mentioned in the national reports as well, among these the very practical 'toll-free telephone service' for contacts between the citizen and the responsible authority (* 4).

On the other hand, a tendency can be observed that organisations of citizens of various kinds are becoming more professional, making use of expert-knowledge, etc. As an example of this, there is a governmentally sponsored initiative in The Netherlands in setting up a 'handbook' (* 22): "The 'handbook' covers all older road users - pedestrians, cyclists, users of public transport as well as drivers - and is intended to be a source book of ideas and methods aimed at enabling local organisations for the elderly to improve the safety of older road users in their own local environments."

The difficulty is, however, one that is particularly relevant for improving traffic safety and implementing safety measures. As pointed out in a report (* 4), one of the aspects in that is: "Collaboration ... can be both the managing of social demands and the preventing of conflict."

6. Evaluation and monitoring

There are various reasons for evaluating and monitoring traffic safety initiatives and projects. As expressed in a report (* 3): "firstly, for the sake of the project itself". It has to be ascertained whether intentions, goals, targets, etc., still can be or are fulfilled, whether unforeseen complications have arisen, and whether plans have to be adjusted or errors are to be rectified. And, "Secondly, for the sake of future schemes, such studies enhance a municipality's (and other parties') general knowledge of the consequences of individual initiatives".

In the context of the present study, we are interested most in the latter aspect. After all, reliably stated effects and information on it might encourage more widespread application.

6.1. Limitations and opportunities

Evaluations of traffic safety schemes and measures are rather scarce. This is partly due to the complexity of the subject and a shortage of data. Such deficiencies affect in particular accident evaluations in residential areas, where relatively few accidents occur with relatively few casualties. Evaluation studies are also hindered by some methodological problems, as pointed out in a report (* 8):

- "a lack of sufficient measurable and quantifiable data concerning the before-period as well as the after-period;
- a lack of data concerning comparable control areas, for excluding autonomous effects;
- a lack of insight into relevant area characteristics."

Moreover, there is often a preference for taking measures on those locations where problems have (already) been stated and/or for determining priorities on that basis. 'Black spot' treatment is an example of this. In evaluation studies, the 'regression to the mean' phenomenon will then arise.

Evaluation and monitoring do not necessarily have to focus on accident occurrence alone. In some cases and mostly related to specific objectives of a scheme, so called 'intermediate' variables - or variables related to accident causation and/or exposure to traffic hazard - can effectively be studied as well, resulting in valuable and convincing conclusions. These might relate to driving speed, the amount and kind of through traffic, the chosen travel modes, particularly the utilisation of less hazardous traffic modes like walking, cycling or public transport, etc. Obviously, measuring and monitoring of 'conditional' behavioural variables like public awareness, public acceptance, etc. might be highly relevant as well.

6.2. Effectiveness of schemes and measures in practice

Some results of evaluation studies will be presented here in order to give insight into the amount and the way certain schemes and measures affect traffic safety. First, however, we will emphasise once more that it is generally difficult to compare schemes, for their packages of measures and supporting activities, as well as the local situations in which they have been

implemented, vary widely. Consequently, large variations in safety effects are to be expected in evaluation studies.

We will start the discussion with traffic calming schemes in residential areas, in particular the 30 km/h zones, on the basis of an arbitrary sample of evaluation studies.

A larger scale evaluation study in The Netherlands, involving 151 30 km/h zones of widely varying sizes, resulted in an average reduction by 10 to 20 % in accidents of all kinds. The reduction of accidents with injury was estimated by approximately 30 %, as accounted in the national report (* 8), which emphasises the great dispersion of effects recorded. The latter can partly be explained by the fact that the areas were not homogeneous and that diverse packages of measures of different impact and concentration were employed. These results confirmed the outcome of a previous evaluation study on 15 (other) experimental areas. A concluding remark in the report (* 8) concerns the observation that: "... it seems that area-wide infra-structural measures have in general a stronger effect than isolated interventions at separate locations. The last type of measure is often seen as 'low-cost', but this is not the same as cost-effective!"

At the moment, the number of 30 km/h zones in The Netherlands is estimated at more than 1,300, covering 20,000 ha and a road length of 5,000 km. Implementing the measure on an even wider scale in the near future is an objective of the national 'sustainable safety' policy. An agreement between the government and the association of municipalities on further implementing that policy has recently been reached. The number of 'Woon-erven' in The Netherlands is now reported to be 6,600, covering 2,000 km. Their safety record turned out to be within the range of the 30 km/h zones outcomes (* 17). They do indeed offer 'liveability' profits, but, as already discussed, there are also disadvantages associated with the approach, such as high construction costs, the extra space needed for realisation, etc., especially where they have to be realised by adapting existing residential areas.

An evaluation study in Great Britain on 20 mph zones stated (* 9) that the accident frequency fell by 60 % and accidents involving child pedestrians and cyclists by 70 %, both at a statistically significant level.

A comprehensive integrated traffic safety scheme in the city of Freiburg involves a large pedestrian area in the historical city centre, substantial improvement of public passenger transport, a cycling network, and the implementation of 30 km/h zones in the remaining living quarters. It is reported (* 5) that the use of public transport has considerably increased. The city now "takes a top position among German metropolitans" with yearly 210 public transport journeys per inhabitant. Cycling has increased too. In a (recent) period of four years, the number of accidents and injured persons decreased about 20 %, the number of seriously injured and killed persons about 30 %.

Cycling networks are not always as successful as in the Freiburg case. One of the results of an evaluation study on effects of installing a cycling network in the city of Delft (* 8) was that no significant effect on bicycle use could be stated in comparison with other cities. The number of cycle trips remained more or less the same, albeit that the average travel distance

increased slightly. The number of cycle accidents decreased somewhat, but not permanently. As explained in the national report, one of the lessons to be learnt from this experience ought to be: "A cyclist policy only aimed at the design of the road network has no long term effect: no significant increase in the use of the bicycle with a decrease in the use of the car. So continue both push and pull." Related to the latter, it is concluded that publicity campaigns are required to encourage more conscious choice of the bicycle. In the meantime, several cycling projects have been completed in other Dutch municipalities; one entailing an infrastructure in which public transport and bicycling get priority above motorised traffic. They have not been evaluated so far.

As already mentioned, most national reports address the re-design of thoroughfares and the implementation of the roundabout on a far larger scale. Experiences in Austria with re-designing thoroughfares of 11 programmes are reported (* 1) to result into considerably reduced speed choices, as well as a substantially improved traffic safety record of minus 26 % fatal plus injury accidents in comparison with the 'before' situation. In replacing a crossroad by a roundabout in The Netherlands, a reduction in the number of accidents of about 50% is reported, as well as a reduction of victims of about 70% (* 8). It made little difference whether the roundabout replaced a regulated or unregulated crossroad in the 'before' situation.

Experiences on the effects of traffic calming in residential areas and related measures in traffic areas are also described in the other national state-of-the-art reports. For practical reasons, it is, however, worthwhile to refer here to a recent and more detailed overview report (* 23), which concluded (* 3): "The overall results from several studies in Denmark, France, Germany, The Netherlands and Great Britain during the last decade have been very positive showing accident reductions between 15 - 80 % by use of traffic calming solutions. In many cases the reduction is around 50 %."

7. Conclusions and recommendations

There are around 35,000 fatalities per year in the nine European countries involved in the present study.

Between half and three-quarters of the injury accidents occur in their built-up areas. Therefore, urban traffic safety management is of major importance.

The safety problem and its developments over recent years is considerably different among the countries in the study. For instance, the number of fatalities per unit of inhabitants varies among them by a factor of 3. At the same time, it has been established that virtually all traffic safety management policies and specific measures for remedial action are known in each country. They are also applied there in practice. There are only differences in the scale and orderly way in which they are actually employed. Evidently, lack of knowledge 'as such' cannot explain these differences in accident data.

- Accident levels can be substantially improved by implementing integrated, area-wide traffic safety schemes, both in the pedestrian areas and the traffic areas of the municipalities.

Schemes of this kind and their underlying principles have been discussed. Among them, the hierarchical network of roads and traffic calming measures as in particular the '30 km/h speed limit zone' are of great importance. The effectiveness of such schemes and measures has been assessed in evaluation studies. With regard to traffic calming measures, for instance, they showed accident reductions between 15 - 80 %. In general, the relation between the extent schemes are realised in practice and accident records seems quite direct in the state-of-the-art reports.

- Applying urban traffic safety schemes on a wider scale is strongly recommended as a cost effective way of reducing injury accidents.

It is crucial to try and understand the reasons why such schemes of proven effectiveness have not already been applied on a wider scale. Or, from the practical point of view, *how can we elevate the exception - it is the incidental application - to the general rule.*

Analysing the national state-of-the-art-reports, it turns out that some related factors are at the heart of getting - and, if necessary, keeping - priority for solving the urban safety problem. Political preferences and feasibilities, as well as public awareness of the traffic safety problem and public acceptance of measures, both play a key role in the democratic processes involved. Reliable information on the safety problem and remedial action has to be at the basis of such processes.

- Adequate organisational structures to support problem assessment, monitoring the results of safety action, and the design and implementation of effective safety initiatives are vital.

It might be concluded that improvements on these factors - which are partly of constitutional and/or administrative nature - are required. In that, some strategies in policy and decision-making can be supportive.

'Sharing interests' and 'goal setting' turned out to be effective strategies in promoting traffic safety. The strategy of sharing and integrating interests and of forming coalitions among various policies involves combined and attuned efforts for achieving common goals of safety and other policies. It proved to be successful, especially in combinations with policies on environmental and well-being issues. In the goal setting strategy, the responsible authority commits itself to achieve a fixed traffic safety target within a certain period of time. The strategy proved to be effective in achieving previously set targets. It might also have other, lasting effects as well, for the strategy requires long-range comprehensive programmes, organisational structures, monitoring procedures, etc., and it involves all 'actors', defining their role and responsibilities. In other words, the strategy implicitly copes with some of the previously discussed 'related factors' as well.

- Integrating and goal-setting strategies are worthwhile to apply on the national level. It is also recommended that the state should promote their use on the local level as well.

As is already current practice in some countries, the impact on traffic safety might, like the environmental impact, favourably be assessed in a systematic way at the decision stage for infrastructure.

- With regard to the goal setting and safety impact assessing, the topic of realistic goals and measurable criteria for monitoring and evaluation deserves further attention, especially in applying these at the local level.

The organisational aspect already briefly mentioned above, presumably constitutes a key element in the success or failure of traffic safety initiatives.

- Many different participants have to be involved, from the national to the local level, within the local level, from responsible authorities, politicians, to the individual citizen and their organisations. Their co-operation is required and has to be facilitated. A relevant part of the latter aspect is the transfer of information on policies and design principles to all levels, and in particular the local level.

- Traffic safety initiatives need to be based on an understanding of the safety problem and related remedial actions.

In this overview report, however, it is concluded that quite an effort still has to be made in creating, organising and applying databases which offer reliable information on the local situation. In that respect, the feeling was expressed that in particular administrative action is required.

- Reliable information on traffic safety is an essential prerequisite for fostering public awareness of the problem, as well as raising the political will to cope with it. Therefore, information is also fundamental in democratic processes.

In combination with a goal setting policy and monitoring instruments, authorities can be confronted with the outcome of their safety actions in case

they appear to be deficient, thus keeping the subject of safety on the political agenda.

- Finally, in addition and/or complementary to implementing urban traffic safety schemes of proven effectiveness on a wider scale, attention is recommended to the newly developed concepts of 'sustainable safety' and the 'zero-vision' approach.

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Appendix 1 Initial Framework

1. Introduction

This so called 'Initial Framework' should be read in the context of the Technical Annex of the DUMAS- project, version November 1996, in particular with reference to Workpackage 1 (WP 1) on 'Existing Experience', described in Ch. 4.1. It concerns Activity 1.1.

WP 1 will result in two types of products. The first concerns a state-of-the-art on existing experience for each of the countries participating in the DUMAS-project. These - nine - national reports constitute research products in their own right. The second type regards an overview report on the outcomes of the national reports.

Related to these products, *the aim of Activity 1.1 is to create a common framework for information gathering and a format for reporting*

The framework will mainly be based on the OECD-report: "Integrated traffic safety management in urban areas", Paris, 1990. As proposed, the reviews should cover the safety point of view in each of the following areas: 'Problem analysis and statement', 'Policies', Design and implementation' and 'Evaluation and monitoring'. Suggestions were made for the topics of interest to be addressed in case of and in so far information is available.

2. Objectives

The overall objective of the DUMAS-project is to produce a framework for the design and evaluation of urban safety initiatives.

It has to be notified that 'safety initiatives' normally imply the integration and co-ordination of traffic safety objectives and other objectives of local concern. Therefore, not only integration of safety measures of various kinds into traffic safety schemes, e.g. the design and evaluation of such initiatives, are of interest here, but also the local policy and decision-making process, the relations in between problems of different nature, and aspects like the diverse authorities and professionals involved and, last but not least, public acceptance.

In connection with the project-objective, *the first objective of WP 1 on "Existing knowledge" is to produce a state-of-the art on the design and evaluation of urban safety initiatives, for each participating country, as well as generalised over these countries.*
In that, the attention is not merely focused on the design and evaluation of urban safety schemes themselves, but also on their implementation in society.
Being part of the DUMAS-project as a whole, *the second objective of WP 1 is to support remaining work packages with information.*
In view of that, one of the aims of the kick-off meeting is to attune the work packages to one another, where information gathering and reviewing on topics of general interest are dealt with.

3. Working method

At the end of the 1980s, good practice, experience, understanding and research on urban safety initiatives were reviewed in several studies. These then up-to-date summaries of existing knowledge were elaborated into guidelines for safety management, requirements for their successful implementation, and so on. In this respect, we particularly refer to the already mentioned OECD-report on integrated traffic safety management, as well as to: "Guidelines for: Urban Safety Management", The Institution of Highways and Transportation, London, 1990. Both reports are in line with each other.

As *a working method*, it is proposed *to take the practical and theoretical insights described in both studies as our starting point.* These insights can be *confronted with information on the current practice and existing knowledge of to-day, as present in ((case-) studies on) urban safety schemes, design philosophies, measures, statistical tools, etc.* In such a way, *successes, failures and their causes, as well as gaps in required knowledge might be traced, in order to get a clear picture of the strengths and weaknesses of present urban safety initiatives.*

Some extra benefits go together with taking these studies as a starting point. The first is, of course, that they contain the best practice and accepted knowledge of that time, so reviewing that once again is no longer necessary. Another is a practical one: we, as a consortium, will have a starting point in common, to which we can refer, conceptually as well as in terms of definitions, choice of words, etc.

4. Main subjects

On the basis of the studies of our common starting point, four - different, however coherent - subjects can be distinguished within the complex field of the 'design and evaluation of urban safety initiatives'.

These main subjects will be shortly described now by a keyword and the kind of problem area they are dealing with. The latter has been formulated in terms of questions. In answering these, a picture will arise on the safety problem municipalities have to cope with, how the problem is approached, what solutions are applied and whether the problem has been solved in the end.

- Problem analysis and problem statement:

"which safety problems are to cope with and how have they been stated ?"

- Policies:

"what policies and/or strategies are entailed and applied in dealing with such problems ?"

- Design and implementation:

"into what measures and/or tactics are such policies / strategies 'translated' and how are such measures or schemes implemented in practice ?"

- Evaluation and monitoring:

*"how are the **safety** effects of such measures assessed and monitored (product evaluation) and how is the urban safety **initiative** appraised (process evaluation)?"*

All DUMAS-partners are requested to address each of these subjects in their national state-of-the-art reports.

In the next sections, the four subjects will be elaborated in terms of suggestions for the kind of topics which might be of relevance in describing current practice. It has not been aimed to present a complete listing of topics.

5. Problem analysis and problem statement

As already said, the purpose of the national state-of-the-art on this subject is to describe the safety problem municipalities are dealing with and opportunities for remedial action. In that, important aspects are, for instance, the scale and proportions of the safety problem, underlying causes, targets for treatment, pursued level of problem solving, etc., as elaborated hereafter:

- Problem diagnosis

The natural starting point of all traffic safety action is, of course, analysing and stating the safety problem by studying the characteristics (e.g. the amount, risk, severity) of accidents and resulting human casualties and material damage (taking into account aspects like population characteristics, exposure to traffic danger, etc.).
During this 'problem diagnosis' stage, it is tried to assess the (relative) importance of safety problems, as well as to reveal causes and contributing factors of the safety problem.

- Assessment of likely targets for treatments

Not all causes and contributing factors can be treated. Some can be handled in a more effective or more efficient way than others. In that, it is of importance to take into account other sectors of community life, especially those which might affect travel (-patterns), (also public) transport and traffic(-infrastructure). So, targets for treatments have to be chosen in a deliberate way.

- Goal setting

Goal setting makes clear on what safety - related - problem the urban safety initiative is focused and, in particular, what outcome is wanted. It might directly regard traffic safety issues like, for instance, the number of fatalities, in general or concerning a special group of road users, etc. It might also regard so called 'intermediate' variables or factors contributing to the traffic safety problem, for instance speed driven, traffic mix of vulnerable road users and motorised traffic, the amount of through traffic, etc.

NB
First two aspects concern necessities for a successful urban safety initiative. However, recording and documenting their 'facts and figures' is not only relevant as such. It has to be stipulated that this is also required in view of assessing the outcome of such initiatives (like demonstration projects and other real-world cases); in other words with the subject of 'Evaluation and monitoring'.

6. Policies

In describing the knowledge and experiences on this subjects, the following points of view might be of interest:

- Nature of policy-making

As already emphasised, urban safety initiatives generally require co-ordination of traffic safety actions themselves, as well as integration with actions or policies in other fields of local concern. Depending on local politics and decision-making, traffic safety is either the leading theme or a reactive action in such integration processes. The distinct situations ask for different strategies in policy-making:

- an active strategy, in which safety is at the heart of the initiative and other policies are to be incorporated in a safety oriented scheme; or
- a reactive strategy, in which safety action is in response to other urban activities when these activities have consequences for traffic safety or offer opportunities for safety action. In order to react in a consistent way, an in advance developed area-wide safety plan is often a prerequisite.

The relative priority of safety in urban initiatives is an aspect worthwhile to be understood in a more comprehensive way.

- Principles of safety policies

General or leading principles in traffic safety problem solving are of crucial interest for the state-of-the-art reports, for such principles are often at the basis of much safety action and distinct measures in practice. In that, the widespread feeling, also expressed in the DUMAS-project, is that much could still be learned from one another's ideas and experiences what could be adapted to someone's particular situation.
Examples are the concepts of 'sustainable safety', 'segregating or conditionally integrating incompatible traffic modes', 'hierarchical road networks', and so on.

- Focus of safety policies

Related to 'Problem diagnosis' and 'Assessment of likely targets for treatments', safety policies might focus on distinct subjects like, for instance, (specific groups of) traffic participants, or respectively infrastructure, traffic circulation, rules and regulations, and human behaviour.

- Scope of safety policies

Obviously, the scope of safety policies can vary widely, not only in terms of the just mentioned focus, but also in the literal sense of public space: e.g. area-wide policies, specific zones like town centres or residential areas, the road network, and so on.

7. Programme design

The focus in this subject is on the level of the actual design of integrated traffic safety schemes and their implementation and realisation in practice, e.g. the current practice and experiences related to that. Obviously, in this stage the scene has been set by the outcomes of the former subjects in which the problem was stated, as well as the general approach of solving it.

Points of view, worthwhile of addressing them in national state-of-the-art reports when information is available, might be:

- Appropriate measures and their *effect(iveness)*

These topics are related in a practical way with those of the 'Focus of safety policies' and the 'Scope of safety policies'. In that, experiences from and studies on cases, experiments, demonstration projects, etc., are of relevance, as well as knowledge on assessed safety effects (see also 'Evaluation and monitoring), regarding for instance:

. integrated area-wide / city / town schemes,
. residential / traffic areas, 30 km/h zones, traffic calming,
. facilities for pedestrians and bicyclists like routes and paths(networks),
. etc.

- Relations between safety measures and other measures

Some combinations of measures might enhance the safety effect; other combinations can be needed to avoid detrimental side-effects, and so on.

- Implementation and operational aspects, e.g.

. local politics and decision-making versus the citizens: the democratic processes
. maintenance, control, etc. of once taken measures

- Design of an integrated programme

The former mentioned aspects are the bits and pieces that will have to be fitted and adapted by the local professionals in eventually designing an integrated programme.

8. Evaluation and monitoring

Thorough evaluations of traffic safety approaches and (even of more specific) measures are often lacking. For the greater part, it is due to the complexity of the subject and a shortage of methodologies and data. In spite of this, evaluation has to be seen as an essential step in developing urban management and safety: the final objective of DUMAS. Besides, reliably stated effects and information might enhance more widespread applications of such remedial actions. Apart from this, monitoring the urban safety situation in a systematic way is of great value and ought to be supported by suitable methods and tools.

So, important aspects might be: available knowledge and experiences with regard to:

- Evaluation on:

. safety effects, or product evaluation
. design of the integrated safety programme, or process evaluation
. related methodologies and required data

- Monitoring of:

. safety trends
. related methods, tools, handbooks
. safety related developments

- Information transfer, e.g. by:
  - incentive programmes
  - demonstration projects
  - manuals, guidelines
  - education, publicity.

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