

Pedestrian safety problems and implementation of countermeasures

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Abstract

This research, based on an extensive review and assessment of pedestrian safety problems and countermeasures found today in the European countries, aims to examine the implementation implications for the introduction of pedestrian safety measures into the "traffic culture" of Europe. The framework, the different levels and the organisational requirements for the implementation of a large list of more than one hundred pedestrian safety measures have been discussed. The results of this research point out the importance of the relatively new concept of promoting pedestrian mobility. Through its stress on non-restrictive safety measures, this new approach has been aimed to highlight the multiple benefits that can be achieved through a persistent and consistent pursuit of pedestrian-friendly environments. Furthermore, one particular characteristic of this new approach is the avoidance of "recipe-type" countermeasures to pedestrian safety problems as it is considered more advisable to adapt the selected measure to the specific case examined - and to go for balanced and comprehensive solutions as far as possible. This new approach is reflected in the proposed framework with all necessary actions for successful implementation of technical non-restrictive measures aiming to improve pedestrian safety and mobility at the European cities.

Key words: Road safety, Safety measures, Pedestrian safety, Traffic engineering

1. About pedestrian safety problems and countermeasures

Post-war traffic engineering in European countries has resulted in conditions (urban sprawl and "car culture") that discourage walking, and pedestrian mobility has decreased accordingly. The steady reduction in absolute numbers of pedestrian accidents, observed in all countries surveyed, is mainly attributed to the reduction in exposure; however, exact exposure data are not always available (travel surveys, where applied, do not record pedestrian mobility in comparable ways)¹.

Pedestrian accidents occur mostly in urban (built-up) areas - typically, in 9 out of every 10 cases². They most commonly involve people crossing a stretch of carriageway. Accident severity is higher in rural (non-built-up) areas, however, where a significant proportion of accidents involves pedestrians moving along the road, rather than crossing. Elderly pedestrians (over 65 years) run greater risks of fatal accidents, and younger people (under 15 years) are those most likely to be injured in pedestrian accidents³.

Legislative and regulatory frameworks of European countries include highway codes and design standards. Recent amendments to those frameworks foresee improved consideration to pedestrian needs. It is hoped that this can compensate for what has been recognised as a long

period of disadvantageous treatment of pedestrians in urban planning and traffic engineering. Pedestrian safety measures and initiatives are increasingly being included, respectively, in packages of measures at a municipal level and national accident-reduction policies. However, it is not unusual to witness application of individual measures in dissociation from wider frameworks (i.e. “piecemeal”).

Specific measures aiming to increase pedestrian safety are more and more apparent in the European cities⁴ and world-wide⁵. Based on a survey carried out in six European countries⁸, measures found to be applied for improving pedestrian safety have been put into eight broad categories delimiting respecting types of interventions.

Speed reducing measures: The most widespread measures of this type appear to include area-wide speed reduction schemes, raised junctions and speed humps. Roundabouts are increasingly used as speed reducers; however, in certain countries their use (priority to entering traffic) does not guarantee a speed-reduction effect. Examples of measures that are not widespread include woonerfs, gate effects / narrowed carriageways, and rumble strips.

Measures for eliminating conflicts between pedestrian-traffic flows: The practice of pedestrianisation is still common but tends to be adapted in combination with innovative concepts, such as shared use (not strictly as woonerfs) or parking at the border of the protected area. Measures such as fences and underpasses are nowadays considered outdated, mainly because of their restrictiveness for pedestrians.

Level crossings: Zebra crossings are familiar and commonly applied (although not always respected by drivers if not accompanied by traffic lights with a stop-line). “Unofficial” crossings (achieved through pavement extensions or refuges) are gaining ground. “Smart” crossings (with detectors) are mostly experimental.

Visibility enhancement: Limited and non-systematic use seems to be made of street-design measures of this type (lighting, removal of obstacles). As regards vehicles, the concept of daytime running lights is still not widespread.

Readability of the road environment: Legibility of signs and markings is more often cited as a problem (lacking/deficient) than as a conscious/concerted measure.

Vehicle design: Speed limiters are widely used for larger (professional) vehicles. Other measures are generally at an experimental level.

Special groups: Crossing patrols are common, as are ramps and other measures for wheelchair users. Tactile indicators for the blind are used but not in a uniform/consistent manner.

Education / enforcement: Local involvement in pedestrian safety schemes is either non-systematic or even non-existent. Education *for* pedestrians is commonly limited to school level; education for behaviour *towards* pedestrians is considered inadequate, as is enforcement.

It is worth mentioning that the main cycling safety problems are the result of the same "car oriented" approach, prevailing the last decades in Europe⁶. Even though, cycling safety problems have different characteristics than pedestrian safety problems, their generator is more or less common: a road infrastructure design giving priority to vehicle traffic. In some European

countries like the Netherlands, Denmark and Sweden cycle use and respective infrastructure started gaining space and priority the last decade, providing thus good examples for the improvement of cycling safety⁷. Implementation problems of cycling safety measures are very often identical to the corresponding problems of pedestrian safety measures and several of the findings and conclusions of this work apply to both modes of transport.

Within the above framework of pedestrian safety problems and countermeasures, the objective of this research was to examine the implementation implications for the introduction of pedestrian safety measures into the "traffic culture" of Europe. It was found that implementation strategies were a major missing link between measures and their effectiveness and this research attempted to provide solutions to fill in the gap.

This research analysed in detail the various pedestrian safety problems in six representative European countries (Austria, France, Greece, Italy, The Netherlands, United Kingdom) allowing for the identification of measures aiming to face each type of problem⁸. More precisely, about one hundred measures were identified and classified in categories, having a direct correspondence to the pedestrian safety problems addressed. Special emphasis was given to the analysis of the various implementation implications (framework, levels, organisational requirements) of these measures as proposed below in this paper. Extensive bibliography from each country was used to support this analysis.

2. The actual framework for the implementation of the measures

In the past, road safety policies were based on the fact that motorised vehicles have a right to a priority treatment on the roads and that pedestrians movements — restricted as they must be in such a case — are to be protected through local facilities and regulations that do not introduce unacceptable disturbance to motorised traffic. A new way of thinking has appeared in the 80's and is now developing, both under pressure from the residents in urban areas and because of the need for change in transport patterns necessary to reduce pollution: walking and cycling are considered as two useful transport modes with at least as much rights to exist on the roads as the others, which means that their needs and practical requirements have to be taken into account in the design of infrastructure and the organisation of the traffic and transport system, just as the needs and requirements of car, bus or lorry traffic have always been taken care of. Further progress in pedestrian safety can only be expected from this second approach.

However, to consider pedestrians as full-fledged road users requires a change of thinking, not only among the road engineers and urban planners, but also among the public in general. To move from the old-time policies to new ones more favourable to walking, a learning process is necessary, involving feedback between public attitudes and engineering and planning practice. Education of the road users as well as training of the professionals (creating a pedestrian-oriented « safety culture ») can play a determining role.

Improvement of pedestrian safety according to the old-time approach was essentially limited to the implementation of very local measures, which required the intervention of a relatively small number of actors involved in road infrastructure management, traffic planning or car manufacture. Interactions between the actors involved were few. Focusing on the second approach, it is found that designing policies for pedestrian mobility and safety does not any longer involve simple measures to integrate into the existing environment, but on the contrary

deep changes in infrastructure design, traffic management and road user behaviour. This means very complex processes of action, as illustrated by the following points^{9, 10}:

- At the macro level, physical and legal measures designed to meet the needs and improve pedestrians' safety cannot be designed without some **impact on travel conditions and mobility**, both for the pedestrians themselves and other road users.
- At the micro level, **rights of pedestrians** must be affirmed in infrastructure design and local traffic planning.
- The **extra-vulnerable pedestrians**, i.e., the disabled people, the elderly persons, and the children, deserve special attention. In some instances, their existence may justify measures involving substantial changes in the environment or the expected behaviour of road users.
- The controversial nature of the new and future forms of pedestrian safety policies and the need to come to compromises implies that feasibility of the intended measures relies on some degree of **consensus**: the actors involved must therefore assume collective responsibility for the policies to implement.
- The multi-disciplinary aspects of pedestrian safety policies, and the multi-sectoral aspects as far as implementation is concerned, means that some form of **coordination** of measures and programmes related to road safety is necessary.

It can be seen, especially from the first two points, that new pedestrian safety policies require a sound base of knowledge such as, at the macro-level, a thorough understanding of the trade-offs at stake in the strategic choices made by road users between transport modes and between possible routes, and at the micro-level, in-depth analysis of the behavioural patterns applied to solve traffic conflicts. Complexity of the decision-making and implementation processes is thus increased by the amount of multidisciplinary background research and study necessary to provide strong bases for action. Operational actors cannot rely on their sole experience of the field, but need the support of research and development.

3. Levels of implementation of pedestrian safety measures

Pedestrian safety policies include components implemented at three different levels: international, national (or state level) and local; the local level itself may include sub-divisions, such as region, province, county, city, with different responsibilities, budget, and decision-making patterns. Overall, the distribution of roles and responsibilities depends upon the legal and administrative organisation of each country and, to some extent, their relationships at the international level. At the national level, it is possible to emphasise the importance of attention for pedestrian safety; however, at the local or individual level, safety matters are sometimes not adequately dealt with.

In most European countries, municipal authorities have a large part of responsibility (often full responsibility) in road safety and local traffic and transport matters. Even when subjected to national orientations, they usually keep the initiative in planning and implementing new safety schemes. In some countries, some responsibility and initiative in road safety have been allocated to authorities at other local levels, such as the county (« département ») in France,

who thus need to coordinate their own programme, both with national orientations and with cities' safety schemes. Relationships between local policies and national policies may be quite loose, or they may be strengthened through various means: integration of local initiatives in national policy planning, incentive programmes, pilot demonstration projects, allocation of targeted funds from the national government, provision of scientific and technical support from the national level, etc.

At the national level, improving pedestrian safety is usually one of the targets of a broader national road safety programme and needs to be given some priority in order to help and reverse the « all-car » trend. Specific laws or regulations may contribute to the progressive changes in priorities and balance between transport modes. New pedestrian safety policies can thus be promoted through an incentive framework (as for example in Italy). Targeted road safety programmes often shift the focus towards vulnerable road users as their risk of being killed in accidents is greater than for vehicle users (for example, the « zero vision » adopted in Sweden generates a significant change in the way the urban infrastructure should be designed in the future). Some measures, such as introducing a specific content in driver training programmes or traffic education programmes, improving the Highway code to provide the different categories of road users with a better-balanced set of rights and duties, reorganising police enforcement, etc., need to be homogeneous over the whole territory and are typically to be decided upon and implemented at the national level. Specific regulations complementing new safety facilities for pedestrians, such as 30 km/h zones, are also centralised activities and are often necessary to make local action possible. Safety authorities at the national level are usually also in charge of providing incentives for pedestrian safety policies to the local level, managing experimentation, and offering research capabilities and technical assistance (Mohan et al, 1994).

Technical and non-technical measures with an impact on pedestrian safety, as those identified in this research and presented in the following Tables 1 and 2⁸ can be implemented at one or several of these three levels, national, municipal, and intermediate, and involve therefore different groups of actors. It is noted that the following list of measures is not to be taken as a catalogue: the selection of the best course of action can only be done on the basis of scientific analyses of the particular safety and mobility problems encountered in any situation examined.

Table 1. Implementation of technical measures

Measure	Implementation		
	National level	Intermediate level	City level
(i) Management of vehicle traffic			
Ring road or bypass	Regulations / recommendations	Eviction of through traffic from small towns or villages	Rehabilitation of city centres and surrounding areas
Traffic restraints (including cul-de-sacs, street closures, etc.)	Experimental or incentive programmes		Residential areas and/or city centres
One-way streets			Traffic plans
Speed reduction on through-traffic routes in small urban areas	On trunk roads	On the road network managed at this level	
Roundabouts	On trunk roads out of or within built-up areas	On the road network managed at this level	On urban streets, at entry of the built-up area
Feed-back device	On trunk roads in built-up areas		On the main urban thoroughfares
Rumble strips, jiggle bars, transverse marking	On trunk roads out of or within built-up areas	On the road network managed at this level	For example, on the approach to a roundabout
Speed limiters in vehicles	Regulations		
Urban boulevard	Experimental or incentive programmes	In urban areas, on the road network managed at this level	On through traffic routes in busy parts of the urban area

Gate effect, threshold	Experimental or incentive programmes	At the entry of towns or villages on main roads	At the entry of urban area or residential area
Narrowed carriageway	On trunk roads in urban areas	In urban areas, on the road network managed at this level	In residential areas, city centres, urban boulevards
Alignment change	On trunk roads in urban areas treated as urban boulevards	In urban areas, on the road network managed at this level	In residential areas, city centres, urban boulevards
Speed humps/speed cushions		In urban areas, on the road network managed at this level	In residential areas, city centres, urban boulevards
Raised junction	On trunk roads in urban areas treated as urban boulevards	In urban areas, on the road network managed at this level	In residential areas, city centres, urban boulevards
Planting /landscaping			Where needed to alert drivers or separate flows
Anti-skid surfacing	On trunk roads	On the road network managed at this level	particularly before intersections and pedestrian crossings
Anti-locking brakes	Regulations		
Special tyres	Regulations/ car manufacturing	Regional regulations (snowy or wet areas)	
Softening impact through car design	Regulations/car manufacturing		
(ii) Provision or improvement of pedestrian infrastructure			
Proper physical design of sidewalk / walking track, protection against unwanted usage	On trunk roads through or near villages	On roads managed at this level through or near villages	On the whole network
Pedestrian zones/streets			In city centres, residential, or leisure areas
Pedestrian crossings		Provision of rules	At appropriate locations
Provision of an integrated walking network			Over the whole built-up area
Woonerf/mixed traffic zones in residential areas	Regulations		In city centres, residential, or leisure areas
Sidewalk barriers against crossing	On trunk roads through built-up areas	On roads managed at this level through built-up areas	Only on heavy traffic routes
Pedestrian bridge/overpass, tunnel/underpass	On trunk roads through built-up areas	On roads managed at this level through built-up areas	Only on heavy traffic routes
Pedestrian crossings design so that vehicles change levels to avoid conflicts with pedestrians	On trunk roads through built-up areas	On roads managed at this level through built-up areas	Especially applicable when using natural differences in level
Mini-underpasses for vehicles under junctions	On trunk roads through built-up areas	On roads managed at this level through built-up areas	Only on heavy traffic routes
Refuges on crossings or central reservation	On trunk roads through built-up areas	On roads managed at this level through built-up areas	On wide arteries where pedestrians need to move freely (shopping areas, etc.)
Sidewalk extension, « ear », etc.	On trunk roads in urban areas treated as urban boulevards	In urban areas, on the road network managed at this level	On urban streets with significant traffic and side parking
Diagonal crossing at junctions		In urban areas, on the road network managed at this level	At important intersections on the pedestrian network
Raised crossing	On trunk roads in urban areas treated as urban boulevards	In urban areas, on the road network managed at this level	In city centres, residential areas, on urban boulevards, etc.
Low kerbs			At all pedestrian crossings
Ramp for wheelchair user			Wherever needed to avoid steps and provide accessibility
Kerb cut			At all pedestrian crossings
Electronically-sensed signalised crossing, detectors of pedestrians waiting / crossing	On trunk roads through urban areas	On the road network managed at this level, in urban areas	On arterials with heavy traffic
Adjustment of traffic signal timing (assumption of lower walking speed)			At all crossings
Auditory signal at crossings for ill-sighted pedestrians			At all crossings
Tactile guidance for blind pedestrians			On the main routes of the pedestrian network

Adequate height of button at push button signals, for wheel-chair users			At all push-button crossings
Anti-slippery surface of walking path			On the whole pedestrian network
Removal of obstacles from sidewalks and footpaths			On the whole pedestrian network
Durable walking surfaces			On the main routes of the pedestrian network
Ice tracks for pedestrians			On the main routes of the pedestrian network
Provision of reserved parking spaces for people with reduced mobility			All over town
(iii) Improving road user perception			
Provision of adequate street lighting	On trunk roads through urban areas	On roads managed at this level through urban areas	On the whole urban network
Provision of special lighting at intersections or crossings			On the whole urban network
Removal of visual obstacles			On the whole urban network
Better visibility at junctions, using road-side mirrors			At junctions with low visibility distance
Better lateral visibility in lorries and other heavy vehicles	Regulations/ vehicle manufacturing		
Anti-glare surfacing	On trunk roads through urban areas	On roads managed at this level through urban areas	On the whole urban network
Telematics drivers' aids to detect pedestrians in a conflictual situation	Regulations/ vehicle manufacturing		
Noticeability of electric or other silent vehicles	Regulations (electric car)		Local buses
Improving visibility and legibility of pedestrian crossings	On trunk roads through urban areas	On roads managed at this level through urban areas	On the whole urban network

Table 2. Implementation of non-technical measures

Measure	Implementation		
	National level	Intermediate level	City level
(i) Management of vehicle traffic			
Lorry ban	Regulations		In the whole urban area or in the denser part
Overall speed limit in urban areas	Regulations		(Adaptation of local infrastructure)
Local speed limit (with sign)	On trunk roads through urban areas	On roads managed at this level through urban areas	On the sensitive points of the urban network
30 km/h zones in residential areas	Regulations / recommendations		In residential areas
(iii) Improving road user perception			
Fluorescent/ retroreflective clothing	Regulations		Provision of retroreflective items
(iv) Education and enforcement			
Provisions for pedestrian safety in traffic education	Education programmes	Education programmes (sometimes)	Local initiatives to complement national programme
Introduction of pedestrian safety in safety campaigns	National campaigns	Regional campaigns	Local initiatives
Appropriate driver training	National programme and regulations		
Rewarding safe drivers	Regulations		Initiatives for safe cyclists or moped riders
Changing behaviour of younger traffic participants towards the elderly	National education programmes and campaigns	Regional campaigns (and sometimes education programmes)	Local educative initiatives

Education of pedestrians	National education programmes and campaigns	Regional campaigns (and sometimes education programmes)	Local educative initiatives
Education for older pedestrians			Local educative initiatives
Education, training and publicity for young children	National education programmes and campaigns	Regional campaigns (and sometimes education programmes)	Local educative initiatives
Police control	National directions to the police		Directions to the local police (when relevant)
Legal provisions for the responsibility of drivers in pedestrian accidents	Regulations, laws		
Highway code	Regulations, laws		
School crossing patrols	Directions to the national police		Local initiatives, directions to the local police (if relevant)
Supervision of children in vicinity of busy roads	Directions to the national police		Local initiatives, directions to the local police (if relevant)

Levels of action may slightly vary between countries according to their administrative organisation. For example, education programmes are managed at the national level in some countries, at an intermediate level in others; roads belonging to the national or the provincial network may, inside urban areas, be either managed jointly by the national road administration and the municipality, or entirely by the latter; police forces exist at the local level in some countries.

In actual practice, decisions (and relevant legal considerations) are generally first made at the level of town and country planning. Consequences for pedestrian interests are hardly considered there, although these may be enormous (e.g. severance of residential areas from amenities through a planned arterial road). The next level of decision concerns the types and location of buildings or other land uses. There, the pedestrian network is actually determined, regardless of whether it was explicitly included in the planning. Finally, when details of construction are elaborated, pedestrian provisions are filled in; however, mistakes made in the previous stages cannot be fully compensated. This points out to the need for inclusion of pedestrian considerations at early stages of planning (the “highest” level).

As can be seen by Tables 1 and 2 implementation of a good proportion of safety measures applied in urban areas requires cooperation between local authorities and the national government or administration. In many cases, the central administration may provide support to the local initiatives (through regulations, incentives, expertise, follow up and information gathering). Conversely, local initiatives may complement national action and give it more prominence at the local level (in safety campaigns, educational issues, etc.).

4. Organisational requirements

The above presentation showed that the implementation of pedestrian safety measures requires multiple coordination:

- a) between different levels of authority at the local level, especially for safety measures and programmes addressing the road infrastructure,
- b) between the national government and local authorities (municipal, provincial, regional), so as to build up a pedestrian safety programme at country level, as most of the gains in pe-

destrian casualties should be expected from measures applied in urban area where the safety initiative is local,

- c) between different sectors of administration and between actors with different disciplinary backgrounds and professional practice, both at the national and the local level, in order to be able to implement « packages » of pedestrian safety measures organised and thus increase the overall effect on accidents and control possible unwanted side-effects,
- d) between safety policy-makers from different countries in order to harmonise regulations and walking conditions, in particular in Europe.

Most Western European countries have an intersectional co-ordinating and decision-making agency responsible for defining objectives and priorities, and initiating national road safety programmes¹¹. The road safety authority may include a Parliamentary Committee (as, for example, in Denmark) with decisional or consultative powers, or an Inter-Ministerial Committee, also decisional (as in France) or consultative (as in Finland or in Spain), and legally instituted. In all these cases, there is a need for an executive body to assume daily decisions and promote practical action along the lines set by the higher authority. The executive group can be a permanent secretariat (as in Finland), which may also be joint to a government department (as in France). The road safety authority may also be directly allocated to a government department (as in Sweden or Great Britain); in such a case, it will assume both policy decisions and promotion of action⁹.

Most of these forms of organisation are still tentative and likely to undergo changes, but have succeeded to a large extent in improving road safety conditions in their respective countries. Safety programmes have evolved towards better integration of measures (Finland, the Netherlands, etc.), towards more ambitious targets of accidents reduction (Sweden, Finland, France, Great Britain, Norway, etc.), and towards wider policies on sustainable transport, which are beneficial for pedestrians as they associate objectives related to environmental issues, safety, and energy saving (the Netherlands).

However, with responsibilities in road safety shared between national governments and local authorities, intersectional co-ordination at the highest level is not sufficient. Some co-ordination and links must also exist between the national and the local decision-making structures. On the one hand, national policies need to be relayed at the local level in order to become effective. On the other, effects of local policies need to be assessed and taken into account when formulating new policies at the national level. Some countries have thus organised networks linking the national road safety authorities with some level of decentralised ones (the Region in the Netherlands, the "Département" or county in France, etc.) in order to promote co-ordinated planning and disseminate the necessary information⁹. Such networks usually imply some specific funding, at least for communication purposes, and for incentives to promote pedestrian safety if local authorities do not appear inclined to make a priority of it.

Co-ordination with urban road safety policies is usually a difficult task, at least in countries where municipal authorities have a high level of budgetary and decision-making autonomy. Incentive programmes for local authorities, which may be either full scale programmes over the country or demonstration programmes involving a limited number of towns or cities, are one current way of getting local authorities to adhere to national policies. Incentives include of course at least partial funding of the operations, but may also consist in theoretical or technical help, organisation of exchanges of information or experience, stimulation of communication

between the various territorial authorities involved, etc. Multi-disciplinary teams are usually formed to co-ordinate, give orientations for, and monitor, incentive programmes.

In any case, local authorities must develop the capabilities to diagnose their problems, define their own objectives based on the local problems and/or on national orientations, plan, design, choose the final measures and policies, decide, programme, and implement¹². They must also provide a framework for multidisciplinary communication and intersectional implementation capabilities. For any complex and innovative policies to be accepted and properly implemented, it is essential that a solidarity should develop between all actors, and the best way to reach this is to involve them at all stages of the decision-making procedure, and ensure that the trade-offs that have to be made reflect the best possible consensus¹³.

In urban areas that are too small to keep a permanent staff trained in road safety, it must be possible to call on external scientific agencies able to provide assistance in programme design, decision-making and implementation; these may be at the local or the national level, but the greater utility can be expected from an agency working at the national level and gathering experimental results and evaluations of all pedestrian safety work going on in the various communities of the country.

It appears difficult to gather and assess the effects of local pedestrian safety policies at the national level. Evaluation is usually considered by local actors a lengthy and costly exercise, sometimes providing unwelcome results. The main problem, however, seems to be that there is generally no structure in charge of monitoring local road safety policies in a systematic way, on the grounds that local authorities are fully responsible for their actions and their budget, and the national government is therefore not entitled to more than an overview of their activities. Hence assessment of local practice has usually been performed only in the framework of incentive programmes, where at least some funding from the national level justifies monitoring. There is a definite need for more follow-up studies of safety measures with regards to their effects on pedestrian safety and mobility. This suggests that « neutral » agencies (such as universities or research institutes) should design and supervise « observatories » of local safety policies.

At the international level, opportunities to exchange information and results on pedestrian safety policies are most welcome as comparative studies of initiatives and new measures between country can boost interest and provide know how for pedestrian safety improvement. Cooperation on regulations and measures has still to develop in the pedestrian safety field¹⁴.

Finally, it is clear that the task of professionals involved in pedestrian safety improvement is not easy and requires a vast basis of knowledge (understanding of accident generation processes) and know how (experience in safety measures and programmes). New policies of sustainable transport that should give more prominence to the non-motorised road users are particularly difficult to manage as experience in this field is still light. There is a need for training professionals in road safety matters at all levels, and to keep upgrading the information provided as experience grows and attitudes change. This can only be achieved through setting up networks of professionals that will teach methodologies and know how and disseminate an up-to-date « road safety culture ».

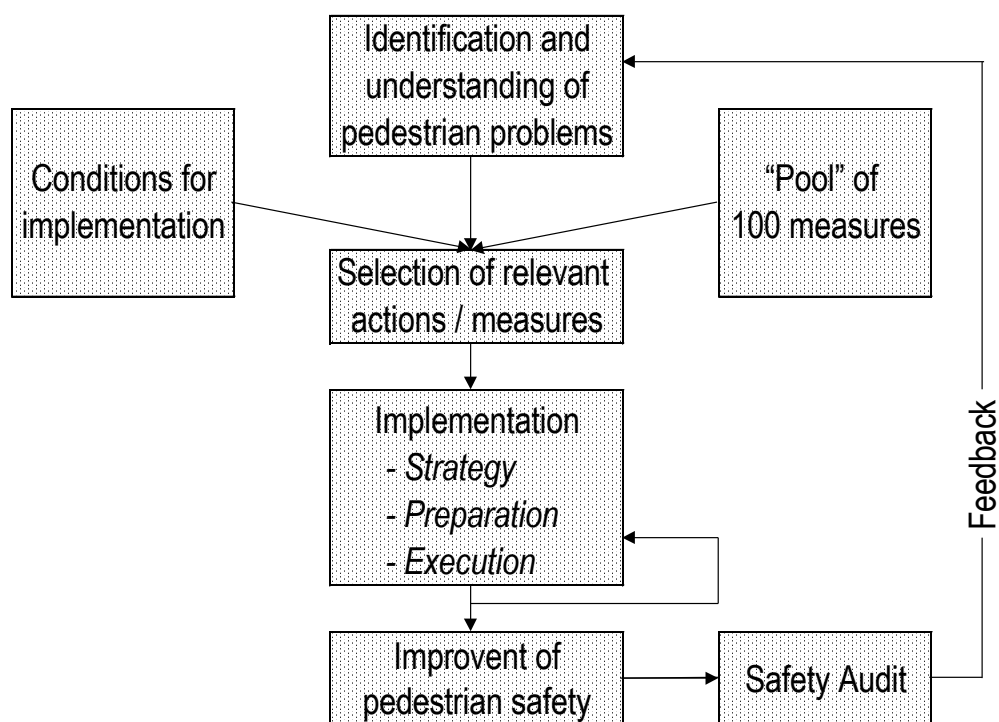
5. Conclusion

The new approach on implementing pedestrian safety measures is about reinforcing, promoting and encouraging trends that can already be observed in European practice as regards pedestrian safety, signalling a shift away from “traditional” techniques. Through these outdated measures, the number of pedestrian accidents had been indeed brought down - but at a price. The tendency to walk less and less, a result of the increasingly car-dependent societies, was apparently accentuated due to a prevailing air of restrictiveness concerning pedestrians’ needs. Thus, people were even more “scared away” from walking; the message heeded by pedestrians was that “safe” *had* to mean “inconvenient” (having to walk to the next protected facility) or even “unfriendly” (using a dark underpass beneath an urban arterial highway).

This work has pointed out the importance of the relatively new emphasis on promotion of pedestrian mobility. Through its stress on non-restrictive safety measures, this work has been aimed to highlight the multiple benefits that can be achieved through a persistent and consistent pursuit of pedestrian-friendly environments. Although the focus is primarily on urban areas, pedestrian safety problems in rural roads - where severity of accidents is higher than in built-up areas - should not be overlooked.

One particular characteristic of the newer approach is the avoidance of “recipe-type” countermeasures to pedestrian safety problems. Pedestrian accidents are scattered in space and time - and are often attributed to various combinations of contributory factors. Isolated safety measures of one single type usually do not go very far in reducing accidents and their severity. Rather than seeking a one-to-one correspondence between problems and countermeasures, it is considered more advisable to adapt the selected measure to the specific case examined - and to go for balanced and comprehensive solutions as far as possible. It is also important to audit the performance of safety measures, as feedback loops in the process of their application - as is already applied in some countries.

Figure 1. The new approach for pedestrian safety



The new approach can thus be described as consisting of the following steps (see Figure 1)⁸:

- *Identification and understanding of pedestrian safety problems*: This may take place at various levels, for example concerning a whole country or a specific part of a town.
- *Selection of relevant safety actions and measures*: This is made from the “pool” of 26 actions and 100 measures for pedestrian safety, identified in the PROMISING project.
- *Definition of implementation conditions*: These arise from case-specific analyses.
- *Three-step implementation process*: It consists of *strategy*, *preparation* and *execution*.
- *Pedestrian safety improvement*: The improvement of pedestrian safety is the final target of the process.
- *Safety audit and feedback*: The improvement of pedestrian safety is evaluated by standard safety audits and if necessary the audit results are fed back to the overall understanding of pedestrian safety problems.

It worth mentioning that several of the findings of this research on the implementation of measures for pedestrian safety apply also for the implementation of cycling safety problems, given that the generator of both types of problems is the same: the car traffic oriented road infrastructure design. Perhaps the specific interventions are different for the two transport modes, but the framework in which they are called to be implemented is the same and certainly what has been presented as the new approach for the implementation of pedestrian safety measures (Figure 1) applies also for the implementation of the cycling safety measures. Furthermore, when combing pedestrian safety measures with cycling safety measures the overall implementation cost is much lower and the overall benefit for road safety much greater than if the two types of interventions were implemented separately.

The results of this research raised quite a few new issues, on which further research is considered necessary, allowing thus transport and urban planners as well as decision makers to choose and implement the most suitable set of solutions to their specific problems. These new issues requiring further research concern basically: a) the advanced comparative analysis of pedestrian safety data (accidents, exposure, countermeasures) at a European level, b) the investigation of the links between the pedestrian behaviour towards safety and the corresponding countermeasures, c) the monitoring and evaluation of alternative combinations of pedestrian safety measures and policies through the quantification of the measures’ effectiveness and specific case studies at national, regional and local level and , d) the development of methodology and guidelines for the selection and implementation of pedestrian safety measures, possibly on the basis of the PROMISING approach (case by case, step by step, non-restrictive measures, etc.).

Acknowledgement

This paper is based on the work carried out in the PROMISING research project, partly financed by the European Commission, Directorate-General VII (Transport).

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