Sustainable Safety

A preventative road safety strategy for the future: 2nd edition

Ministerie van Verkeer en Waterstaat
Directoraat-Generaal Rijkswaterstaat

Adviesdienst Verkeer en Vervoer

Sustainable Safety - A preventative road safety strategy for the future: 2nd edition

G. Schermers
P. van Vliet

Rotterdam, December 2001

Acknowledgement

The author gratefully acknowleges the projectbureau Kop van Overijssel (Ms F. Hellinga) for their permission to use various usual examples of work undertaken in the region in this report. Also the photographic contributions of Messrs. A. van Loon and P. van Vliet are gratefully acknowledged.

Report documentation

Title:	Sustainable Safety. A preventative road Safety Strategy for the Future; 2nd Edition
Authers:	G. Schermers and P. van Vliet
Published by:	AVV Transport Research Centre Ministry of Transport, Public Works and Water Management, P.O. Box 1031, 3000 BA Rotterdam, The Netherlands
Keywords:	Traffic Safety, Infrastructure provision, Planning, Traffic calming, Road Safety Policy, Accidents, Dutch 'Polder' model.
Date:	December 2001
ISBN Number:	903 693 609 8

Table of Contents

1 Introduction

In order to meet the long term road safety policy goals laid down in the 1980's by the by the so called "Meerjarenplannen Verkeersveiligheid" (MPV, long term road safety policy), the Dutch Government launched the comprehensive "Sustainable Safety" (Duurzaam Veilig, SWOV, 1992) programme in the early 1990's. To meet the road accident reduction goals, the programme was designed to be implemented in two phases. The first phase was formally launched in 1997 (Ministry of Transport, 1997).

The basket of implementation measures for phase one of Sustainable Safety were formulated in a document now known as the "Start-up programme - Sustainable Safety" (Convenant, Ministry of Transport 1997). This document sets out 24 implementation goals and strategies. To ensure that these would be realised the government used the "Start-up programme" as the basis for a formal agreement between Central Government and the major stakeholders in road safety in the Netherlands, namely the Association of Dutch Local Authorities (VNG), the Union of Water Management Authorities (UvW) and the Interprovincial Consultation Body (IPO). The agreement to implement the described strategies was entered into in December 1997 and is now well advanced.

The primary effort of the first Phase of Sustainable Safety is on reclassifying the existing road network and adapting the road infrastructure to accommodate the concept of self-explaining roads. However, hand in hand with this, special attention is being paid to enforcement, legislation, information and education campaigns. Also supporting measures are being developed and implemented to enhance the overall effect of the programme on road safety.

This document provides a comprehensive outline of the sustainable safety programme and summarises its progress up until the end of 2001. This document supersedes the earlier publication (Schermers, 1999) which focussed predominantly of the first implementation phase of the programme. This report provides an overview of the latest road safety policy developments and elaborates on the implementation of the second implementation phase of Sustainable Safety.

1.1 Development of traffic safety policy in the Netherlands

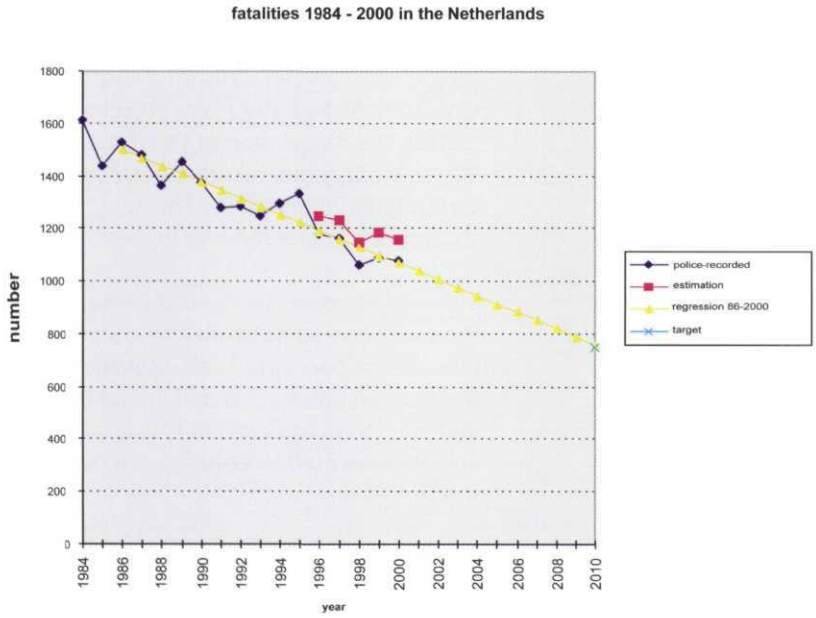
Historically road traffic safety has been a high priority on the political agenda in the Netherlands. Consequently policy has been well supported by focused programmes which now manifest themselves in a continual downward trend in road accident fatalities (Figure 1.1). Serious injury accidents (Figure 1.2) have remained relatively constant over the past nine years.

Since the mid-1980's traffic safety policy was laid down in the long term road safety policy or MPV. The first (MPV-I) was issued in 1987 with the theme "More kilometres, less accidents". This set a goal of a 25 per cent reduction in injury accidents over the period 1985 to 2000. To realise this certain spearheads or focus areas were defined and these targeted alcohol, speed, hazardous locations, children and the elderly and safety devices. In

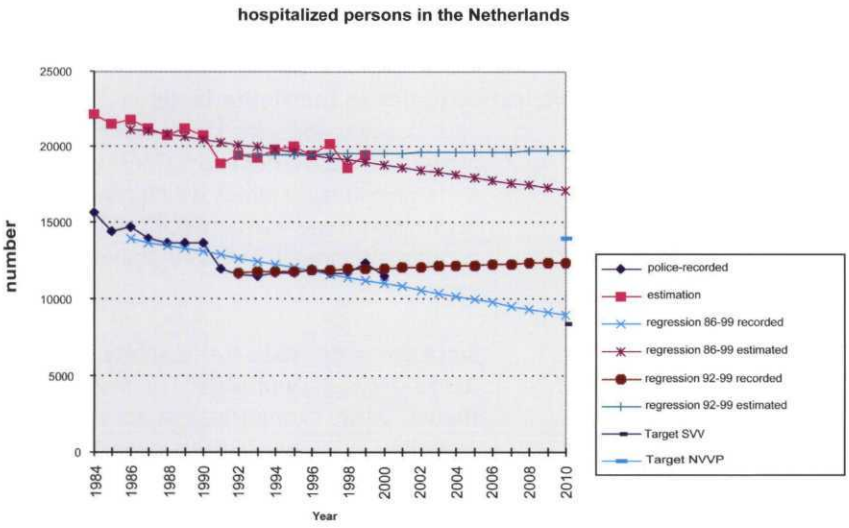
1989 the MPV-II was released with the theme "Ambitious but Attainable". Besides further attention for the focus areas, the importance of participation by local and provincial road authorities and other stakeholders in the policy process was highlighted.

The second Structure Plan for Traffic and Transport (SVV-II) of 1990 laid down the road safety goals for 2010, namely a 50 per cent reduction in fatalities and a 40 per cent reduction in injury accidents over the period 1986 to 2010. However, in the early 1990's doubts arose whether these goals would be met. The spearhead policies were effective but did not adequately address problems at the source. While overall reductions in road accidents were still evident, analysis of accidents on certain parts of the road network reflected that remedial actions were necessary to reduce the large discrepancies in fatality and serious injury accident rates on the different road classes. Whilst freeways in the Netherlands were the safest roads, urban arterials and other urban roads were by comparison highly unsafe with rates almost seven times as high (Figure 1.3). This resulted in thissuing

Figure 1.1
Fatal injury accidents (1984 - 2000)



.Figure 1.2
Serious injury accidents (1984 - 2000)



of the "twin pronged" policy of the MPV-III, the first aiming at the renewal and intensified application of the focus areas and the second at a preventative strategy now known as Sustainable Safety.

Figure 1.3
Road accident casualty rates on different road classes in the Netherlands, 1986 and 1995 (SWOV)

Road type	maximum speed	Mixed Traffic	At grade crossing/ median separation	Casualty rate (Casualties/10^6 km) 1986	1995
Residential	30	Yes	Yes	0,20	1,15
Urban collector	50	Yes	Yes	0,75	0,73
Urban arterial	50/70	Yes/No	Yes	1,33	1,27
2-lane rural roads	80	Yes	Yes	0,64	0,51
Undivided 2-way rural roads (ltd. access)	80	No	Yes	0,30	0,28
Expressways	100	No	Yes/No	0,11	0,08
Freeways	100/120	No	No	0,07	0,05

In 1999 preparations were made for the first National Traffic and Transport Plan (the so called Nationale Verkeers en Vervoer Plan - NVVP). The National Traffic and Transport Plan makes provision for eventual spatial reservations. The Town and Country Planning Act stipulates that such reservations are made according to Key Planning Decision (PKB) procedures and criteria and hence the NVVP has been attended PKB status. The PKB procedures entail the following phases:

- Phase 1 - The Policy Intention
  The policy intention announces the outline plans in the broad area of transport over the period covered by the plan (in this case to the end of 2020)

- Phase 2 - Public comment and consultation
  During this phase local and regional authorities, pressure groups, the private sector and citizens can react to the proposed policy intention and, if desired, lodge objections.

- Phase 3 - Cabinet standpoint
  If necessary, the comments received in the second phase are processed and incorporated in the draft policy intention (PKB). This is then submitted to Cabinet for Senate approval.

- Phase 4 - Final National Traffic and Transport Plan
  Once the PKB is processed by the houses of Parliament the definitive text of the National Traffic and Transport Plan are finalised.

The policy intention for the NVVP was tabled at the end of 2000. In mid 2001 it was processed in lower chambers of the States General. It is anticipated that the definitive Plan will be presented toward the end of 2001.

The main themes of the proposed NVVP are :

- accessibility;
- safety; and
- quality of the residential environment.

The primary focus of the NVVP is on :

- more intelligent use of existing infrastructure;
- a more equitable system of passing the cost of transport to the user;
- construction and/or expansion of infrastructure only where essential; and
- application of technology.

1.2 From philosophy to concrete policy

"Sustainable Safety" (Duurzaam Veilig) was formally introduced in the Netherlands in the Third Long Term Road Safety Plan of 1991. The Sustainable Safety concept introduces a new approach to addressing the ever present road safety problem in the country. The essence of the Sustainable Safety programme lies in the prevention of unsafe road traffic conditions. This is a fundamental shift from historic policies and strategies which have been reactive to recurring and new problems, always seeking to find solutions and cures after the event. Integral to the Sustainable Safety approach is that man is the measure of all things (i.e. central in the process of planning, provision and operation - the concept of design for all).

Sustainable Safety became a policy instrument at a time when it became apparent that conventional methods for dealing with the road accident problem would not be adequate to meet stated long term policy goals. During the late 1980's forecasts of road accident trends clearly indicated that the long term road safety targets, set as far back as 1972 and revised in the 1980's, were not going to be met. These targets were :

- a 25% reduction in road traffic casualties by the year 2000 (using the average number of casualties over the period 1984 to 1986 as reference); and
- a 40% reduction in road accident injuries and a 50% reduction in fatalities over the period 1986 to 2010.

Since the 1990's, the Sustainable Safety philosophy has increasingly taken the place of the spearhead policy. It is now an integral part of the NVVP and is the basis on which road safety will be pursued in the years to come.

1.3 Road safety in the NVVP

The NVVP outlines how road safety policy will be developed over the coming years. Of importance is that the road safety targets that were based on those set in the Second Structure Plan for Traffic and Transport (SVV-II), have been retained, albeit in a slightly modified form. The NVVP uses the average of the period 1997 to 1999 as its reference year and sets its long term road accident targets in absolute numbers (compared to percentages in previous policy). The road accident targets for 2010 are :

- less than 750 fatalities (a reduction of 30% compared to 1997-1999)
- less than 14 000 serious injuries (a reduction of 25% compared to 1997 - 1999)

To support the decentralisation drive (devolution of functions to lower levels of government) in the Netherlands, the National road safety targets set in the NVVP will be translated into regional, and eventually municipal, targets. Together with the setting of regional (local) goals comes a devolution of power with regards to the administration and management of regional road safety.

1.4 Regional road safety goals

Demographic and geographic differences between the various regional areas in the Netherlands make it difficult to derive equitable regional road safety targets. At present the Netherlands comprises 12 provinces and 7 Framework Act areas, each with its own unique characteristics. Road accident trends are influenced by many factors including population density, land use, road network, traffic volumes, proportion of through traffic and others. The 2010 target year set by the NVVP is fairly long term and at this stage it is known that certain regions will experience higher growth rates in certain aspects (e.g. population) than the national average over the same period.

To facilitate the derivation of regional targets, a working group representing National government, provinces, municipalities, water management authority and the Framework Act areas (similar to metropolitan areas), was formed. After considering a number of alternatives the working group has, in the interim, opted to base the regional targets directly on the percentage reduction derived from the national target (i.e. each region must reduce fatalities by 30% and serious injuries by 25%). In practice this decision implies that regions with comparatively high levels of road safety face a daunting challenge (coming from an already low base). The working group has recognised the potential influence of increased residential development (and associated population growth) in certain areas and has made marginal adjustments to the targets to compensate for these effects. In each region the percentage reduction was applied to the actual number of fatalities and serious injuries in the region and the target in absolute numbers derived.

At the present time, certain data relating to the underlying road network (e.g. traffic volumes) are not available. Consequently it is not possible to derive road accident reduction targets based on vehicle-kilometres travelled, density etc. As a result the targets adopted by the working group have been used in the interim and been submitted to the regions for approval (May 2001). To assist the regions in assessing the attainability (and affordability), a package of road safety measures has been developed and published. The package of measures will be used as the basis for identifying the most effective (road safety) measures for implementation in the region.

Once all the regions have completed this assessment (including identifying financial, organisational and policy constraints), a national package can be derived. During the spring of 2002, the administrative partners will enter into a formal agreement to realise these goals.

2 Organisation of road safety

The Dutch Government has for many years aimed at the further decentralisation of its policies. Central to this goal is the theme "Decentralise where possible, leave central where necessary" (place the responsibility where it is best carried out). This applies to especially road transport policy, which has a predominantly regional and local character. Problems associated with this are therefore best solved by regional and local transport authorities, preferably in close collaboration with one another and with regionally developed instruments (i.e. parking and land use policy, public transport policy, UTC systems, traffic management and control, etc.). To give weight to such regional policy, not only decision making powers but also financial resources need to be decentralised.

However, transport related problems are not the sole responsibility of the authorities. Transport users to a large extent determine the outcome of their transport choices. In the Netherlands the process of decentralisation is facilitated by the now well known Dutch "Polder" model. This model represents the typically Dutch consultation culture in which all parties continue to talk with each other until consensus is reached or until a proposal/solution acceptable to all participants is found. This process also applies to current road safety policy which was formulated by central government, regional and local authorities, the private sector, NGO's and pressure groups. Resulting from this process is the NVVP which now, more than ever, specifies the roles and tasks of regional and local authorities.

2.1 Stakeholders

Principally the Netherlands has two stakeholder groups, namely the administrative partners and the consultative partners.
The administrative partners are responsible for the road network which comprises :

- the national "freeway" road network providing national and international connections to major economic centres, major towns/cities and conurbation's. This network comprises 3 200 kilometres of high order roads and is the responsibility of the national government.
- the provincial road network providing the interurban connections within the provinces. The Netherlands has 12 provinces who are collectively responsible for managing the 7 200 kilometres of provincial roads.
- the municipal road network comprising connections between residential, commercial and urban areas as well as access to the surrounding provincial and national networks. The Netherlands has 502 municipalities who collectively are responsible for some 113 000 kilometres of urban roads.
- the water control authority roads consisting of roads situated on dykes and roads in proclaimed polder areas. The roads are the responsibility of the Union of Water Management Authorities and comprise a length of 6 400 kilometres.

The four administrative levels responsible for these roads serve terms of office of 4 years after which elections for new administrations take place. Recently a fifth administrative layer was introduced to administer the so

called Framework Act areas which comprise several municipal areas within conurbation's such as Rotterdam, Amsterdam and Utrecht. The concept of the Framework Act areas is in many respects similar to the international concept of Metropolitan Authority. The administrative responsibility for the Framework Act area is shared by representatives from the various municipal councils in that area. The Water Management and Framework Act area authorities are empowered to perform fewer administrative and decision taking tasks when compared to local and provincial authorities.

2.2 Consultative and other partners

This group represents the umbrella bodies of the road users, pressure groups and industry. Prior to 2000 the Netherlands had three road safety organisations representing the private road users. These organisations were:

- Veilig Verkeer Nederland (Road Safety Netherlands, VVN)
- De Voetgangersvereeninging (Pedestrian Association)
- Stichting Kinderen Voorrang (Foundation for the priority of children)

Although independent, these organisations received financial support (subsidy) from the State. At the request of the Minister of Transport, these three organisations were fused during 2000 to form what today is known as 3VO (Vereenigde VerkeersVeiligheid Organisaties or United Road Safety Organisations). The motivation for this merger was primarily to build capacity and improve professionalism within the organisation, making its employees independent experts and leaders in the field of road safety.

In addition to 3VO, there are a number of NGO's involved in road safety. Collectively and independently these bodies have significant influence on the decision making process and they include :

- ANWB (Koninklijke Nederlandse Toeristenbond, representing tourism, road users, cyclists etc. - an organisation similar to the Automobile Association in the UK)
- Fietsersbond (Cycling Association)
- EVO (An NGO representing transport and freight operators)
- Connexxion (representing public transport operators).

2.3 Decentralsiation agreement for road safety

As discussed in Chapter 1 (Figure 1.3), the greatest opportunities for road safety lie in the problems associated with the underlying road network. These roads contribute to 80 per cent of all injury accidents and this is one of the main reasons that the Netherlands has opted for developing a decentralised road safety policy.

During 1994 a decentralisation agreement (known locally as the "convenant"or covenant) was entered into by the national government and the umbrella organisations representing the provinces (IPO - the Interprovincial consultation body) and local authorities (VNG - the Association of Dutch local authorities). The agreement stipulates that an independent consultation platform be formed in each province. These platforms are known as "Regionaal Orgaan Verkeersveiligheid" (ROV or Regional road safety body) and have been designated the following tasks:

- promote the safe and effective distribution of road traffic in the province. To enable this, each ROV must develop a systematic approach to reduce the number of road accidents and this must be captured in an documented action plan.
- the mutual co-ordination of road safety activities in the region and between the bodies and organisations working in the region. To facilitate this the ROV must have an all inclusive representation comprising local, regional and national governments; pressure groups, NGO's and the Police.

The agreement stipulates that the approach adopted for addressing road safety problems is administratively shared by the three government levels. It states that the primary responsibility for policy co-ordination within the provincial boundaries lies with the province. However, the province must ensure that periodic regional consultations are held to facilitate vertical administrative co-ordination. A dedicated, specific fund has been established to cover the cost of the ROV's. Annually the Minister of Transport consults with representatives of the other administrative partners with respect to the performance of current policy.

The decentralisation agreement expires in 2003. It will be replaced by the provisions for a Joint Structure Plan in the Transport Planning Act and by administrative agreements resulting from the further implementation of Sustainable Safety as outlined in the National Traffic and Transport Plan (NVVP).

The process of decentralisation relates not only to devolution of powers, but also to the allocation of adequate financial resources. In parallel to the development of the Road Safety Decentralisation Agreement, a broader process of decentralisation of transport policy was being formulated. This culminated in the signing of the VERDI (VErkeer en vervoer, Regionaal, Decentraal en Integraal - Traffic and transport, regional, decentralised and integral) covenant by the administrative partners (Central Government, IPO and the VNG) in 1996. Although the Framework Act areas were not a signatory they soon were linked to the VERDI process, largely the result of the overlapping problems in the municipal and framework act areas.

The VERDI agreement encompasses the development of a statutory structure plan, the decentralisation of responsibility for public transport and exemption from the requirement to have all projects exceeding a value of €11,4 million (*f*25 million) approved and administered at national government level. Furthermore, there are provisions for technology transfer, capacity building, HR-issues and information management.

National government remains responsible for maintaining the standard of knowledge in transport and for making this knowledge and information available. To facilitate dissemination, the knowledge platform VERDI was established at the AVV Transport Research Centre of the Ministry. Officials from local, provincial and national governments are identified, selected and seconded to the centre on an as-needs basis.

With the promulgation of legislation on decentralised powers, the VERDI agreement can, to a large extent, be considered redundant.

To promote regional processes and ultimately the more efficient use of resources, a proposal has been tabled to increase the regional limit on larger infrastructure projects from €11,4 million to €238 million (25 to 500

million Dutch Guilders). This places a substantial increase in the responsibility and accountability of the regional authority. To facilitate this, the budget of the Combined Specific Purposes Payment Fund (GDU) will be increased to accommodate not only infrastructure projects but also road safety and traffic management projects. All projects exceeding the €238 million limit will still have to be submitted to central government for approval and eventual administration.

The Planning Act stipulates which plans need to be formulated, what they should contain, the degree of detail the contents should cover and who should draft, or be involved with drafting these. The Act provides for a framework for the formulation of not only a National Traffic and Transport Plan (NVVP) but also regional transport plans.

The NVVP sets out the long term policy for the next 20 years. It contains the national government plan, states the implementation tasks and outlines the policy objectives and targets. These targets include goals for accessibility, environment, road safety, quality of the residential environment etc. These targets are the basis for developing regional targets which in turn must be taken up in regional plans. The regional plans must indicate how national plans and goals have been interpreted and which measures are to be adopted in realising these.

According to the Act, local authorities are not required to develop similar plans. However, municipal policy is required by law and this should at least give an indication on how the local authority intends to implement actions in support of national transport policy.

3 Principles of Sustainable Safety

In contrast to the spearpoint policy the sustainable safety strategy is characterised by a proactive and preventive approach. Whereas the spearpoint-policy was a reactive (and curative) approach aimed at addressing problems when they occurred, sustainable safety has "prevention is better than cure" as its motto.

Sustainable safety recognises that 90 percent of road accidents are attributable (to a greater and lesser extent) to human error. Consequently sustainable safety realises that the human is the weakest link in the traffic and transport chain. Furthermore, the human does not readily change or adapt and many attempts at influencing road user behaviour have failed or had merely short term effects. The limitations of the human remain evident. Motivation, attention, emotion, observation, prediction, knowledge and skills are all weaknesses that prevent the human from being the ideal traffic participant.

In a sustainable safe traffic system the human takes a central role. Humans are (largely) unpredictable and influencing their behaviour cannot be sustained over the long term. They are therefore incorporated in sustainable safety as a reference against which other system elements are gauged.

Sustainable Safety is based on a system approach where all elements of the traffic safety and transport system are geared to one another. At the highest level it is the interaction in the relation man, vehicle and infrastructure. At the next level it is the relation between function, form, legislation and usage.

Function relates to the use of the infrastructure as intended by the road authority. Form relates to the physical design and layout properties of the infrastructure. Legislation relates to regulatory requirements for the use of the infrastructure and usage relates the actual use of the infrastructure and behaviour of the road user within the system.

In summary a sustainable safe traffic system comprises:

- a road environment with an infrastructure adapted to the limitations of the road user;
- vehicles equipped with technology to simplify the driving task and provided with features that protect vulnerable and other road users; and
- road users that are well informed and adequately educated.

Sustainable safety distinguishes three categories of road:

- roads with a through function (for the rapid movement of through traffic);
- roads with a distributor function (for the distribution and collection of traffic to and from different districts and residential areas);
- roads with an access function (providing access to homes and shops while ensuring the safety of the street as a meeting place).

Each category of road requires a design compatible with its function, while at the same time ensuring optimum safety. To meet the latter requirement, all road categories should comply with the following three safety principles:

- functionality (preventing unintended use of the infrastructure);
- homogeneity (preventing major variations in the speed, direction, and mass of vehicles at moderate and high driving speeds); and
- predictability (preventing uncertainty among road users).

Preventing unintended use of the infrastructure
It is very important to make a clear distinction between roads with a through function and roads with an access function. Through traffic does not belong on roads with an access function, and local traffic does not belong on roads with a through function. This requirement has implications for the routing and design of roads: roads with an access function should not offer time-saving connections to through traffic (that is: traffic travelling to or from a location outside the immediate area); and roads with a through function should not offer direct access to homes, schools, offices, factories, sports facilities, etc.

Preventing variations in the speed, direction, and mass of vehicles at moderate and high driving speeds
The severity of road accidents is usually determined by differences and variations in the speed, direction, and/or mass of vehicles. In the Netherlands the safest roads are the freeways, where driving speeds are the highest but relatively uniform. There is also little or no variation in direction and vehicle mass. Also relatively safe are the 30 km/h zones and residential areas, despite considerable variation in the directions and mass of vehicles using them. Their safety is attributable to low driving speeds and small speed differences between different road users.

The roads in between require special attention, since they are the most dangerous. These are the roads with a distributor function and on which vehicles travel at fairly high speeds. There is a great deal of intersecting traffic. Safety improvements on these roads requires the separation of motorised and non-motorised traffic (e.g. separate cycle lanes). This reduces variations in speeds and mass of vehicles. At locations where motorised and non-motorised traffic intersect, lower maximum speeds have to be introduced, or traffic has to be separated time-wise (e.g. traffic signals, roundabouts etc.). At intersections roundabouts are preferable. Traffic signals can cause large variations in driving speeds (e.g. when drivers ignore red lights).

Preventing uncertainty among road users
To prevent uncertainty among road users, roads should be constructed and marked to make obvious what sort of behaviour is expected. In other words the road must be "self-explanatory". The number of road categories should therefore be limited, and their design and layout as uniform as possible. Road users will then have a better idea of what sort of driving behaviour is expected of them, and be better able to anticipate the driving behaviour of other road users. With self explaining roads, road users will know at which speed to drive, whether to expect traffic from side roads, and whether cyclists are likely to be on the road.

To give Sustainable Safety the required impetus, a steering committee was formed and tasked with the implementation and further development of the then concept programme. Representatives from central Government,

the Association of Dutch Local Authorities (VNG), the Union of Water Management Authorities (UvW) and the Interprovincial Consultation Body (IPO) were nominated to serve on the committee.

Shortly after the formation of the committee an investigation was commissioned and this concluded that the implementation of measures proposed by Sustainable Safety could not be realised within the short term. This resulted in the development of a detailed phased implementation programme for a future safe and sustainable traffic and transportation system. The strategies outlined in implementation programme were incorporated into a convention (a multi-party agreement known as the "Convenant) between the government and other role players (the "convenant" partners).

3.1 The implementation phases

The first phase of the implementation programme covers the period 1998 through 2002. It entails the implementation of a comprehensive basket of measures that include infrastructure provision and adaptation, education, enforcement, enabling legislation and financing. The primary aim of Phase 1 of the programme is to nationally provide clarity and uniformity regarding the infrastructural measures to be provided on the revised road network. To this end local and provincial authorities are preparing detailed road classification plans. These will form the basis for short to long term infrastructure provision. The first phase will focus predominantly on the lower order urban and rural road network. The implementation of measures anticipated on these roads during Phase 1 is based on the principles of traffic integration. Due to the extent of new infrastructure to be provided, and the costs associated with total re-engineering, Phase 1 aims at infrastructure provision at only those locations which can from a road safety point of view be deemed dangerous or potentially dangerous. In the Netherlands this approach has been termed the "sober" approach (the ideal is the optimal approach where the road or area is completely transformed to the desired end-state).
For the execution of Phase 1 it has been estimated that an investment of approximately *f*400 million (€181,5 million) in new infrastructure is required. To facilitate the implementation, the government will, in the form of a subsidy, fund half of the total investment cost. The balance is to be paid by the other partners (i.e. local and provincial governments).

The second phase of the implementation programme concerns the period 2002 through 2010. Phase 2 entails the implementation of the Sustainable Road Safety principles on the entire Dutch road network. This in effect means the realisation of the road classification plans as submitted in 1999 and in accordance with standards and guidelines for infrastructure provision of all sustainable safety road classes.

3.2 Phase 1 - Start-up programme

The "Start-up programme (convenant) " sets the short term action plans for the implementation of the first phase (start-up) of the Sustainable Safety programme. The 24 actions outlined were sanctioned by the partners and are currently being actively supported and implemented by road authorities. The action plan of the Start-up Programme include:

Planning

1) Sustainable safety will be implemented in two phases. The first phase covers the period 1997 to 2001 and entails the implementation of a coherent basket of infrastructural and educational measures, a

programme of supporting measures and the preparation of a detailed action plan for the implementation of Phase 2. As a contingency and given the extent of the programme, Phase 1 may be extended to the end of the year 2002.However, the detailed action plan for phase 2 must be completed and tabled by the end of 2001.

During 1999 decisions will be made regarding the implementation of a general 30 km/h speed limit in urban areas. In support of this ruling, stakeholders will be required to enter into agreements binding them to providing adequate levels of traffic law enforcement during and after the new limit is introduced.

Due to unforeseen delays, the actual implementation of Phase 2 has been consciously delayed to the end of 2004, this to allow the authorities and partners sufficient time to reformulate the approach to meet the requirements of the NVVP. In the interim, a bridging fund has been established to facilitate the transition between Phase 1 and 2.

Infrastructure

2) Local and provincial authorities and the Union of Water Management Authority (UvW) will prepare concept road categorisation plans which distinguish between roads with a predominant traffic function and roads that have a mixed function and use. The criteria on which this distinction is based is that roads with a mixed function and use are such that they can be adapted to reduce the mobility of motorised traffic and thereby enhance the concept of shared use.
3) The government supports the timeous amendment of the traffic legislation to introduce a general 30 km/h speed limit in urban areas. The legislation must make provision for exemptions to allow local authorities the flexibility to post higher speed limits on selected (predo minantly) traffic routes (50 km/h and 70 km/h roads). The implementation of this measure is dependant on the detailed implementation and road categorisation plans submitted by local authorities in 1999.

Expansion of 30 km/h zones

4a) To compliment the implementation of the general 30 km/h limit in urban areas, the length of roads and the number of 30 km/h zones will be increased . To this end the signatories agree to realise at least an additional 12 000 kilometres of infrastructurally adapted 30 km/h roads in the period 1998 to 2001.
4b) Under the joint responsibility of the signatories (central government, VNG, UvW and IPO) a brochure describing the minimum layout requirements (the so called sober approach) for 30 km/h zones and roads will be prepared and published for use by local authorities.
4c) The design standards (BABW) will be amended to relax the current design and layout requirements for 30 km/h zones. The standards presently apply to the provision of traffic calming devices in an optimal situation. Due to the cost implications of an optimal solution, it was decided to allow 30 km/h zones where only unsafe and potentially unsafe locations are treated with traffic calming devices (the sober approach).

60 km/h zones in rural areas

5a) During the period 1998 to 2001 the length of infrastructurally adapted roads in 60 km/h zones will be increased by at least 3 000 kilometres.

5b) To support the expansion of 60 km/h zones, a brochure with design and layout alternatives will be prepared and published.

Assigning priority on traffic arterials

6) By the end of the year 2000 priority at all intersections on traffic arterials will be controlled by means of road signs and/or other infrastructural means.

Roundabouts

7a) By the year 2000 legislation will be amended to standardise priority at traffic roundabouts. From this time the rule will be that traffic on the circulating carraigeway has right of way. At present there are still some (historical) roundabouts where traffic on the approach road has right of way.

7b) By the end of the year 2000 road authorities will implement the necessary measures (including complete reconstruction if necessary) to reverse the priority at those roundabouts where approaching traffic has right of way.

Moped on the roadway

8a) By the end of 1999 traffic legislation will be amended to make it mandatory for mopeds to drive on the roadway (and not on the cycle path as is currently the case).

8b) By the time the amendment is passed, road authorities will have taken the necessary steps and provided the supporting infrastructure for the measure.

Priority for cyclists from the right

9) By the end of 1999 legislation will be amended to introduce a general rule that all traffic (incl. cyclists, mopeds and vehicles for handicapped persons) approaching from the right has priority.

Financing

10) It is estimated that the introduction of articles 4 through 9 of the convenant will require a total investment of ƒ400 million (€181,5 million). The government has committed itself to funding 50 per cent of the cost and has reserved ƒ200 million (€90,5 million) in its design budget of 1998. This amount will be made available as a temporary subsidy to road authorities for :

- infrastructural adaptation of local and provincial roads. An amount of ƒ120 million (€54,5 million) is available for the expansion of 30 km/h zones. In exceptional cases these funds may be applied for 60 km/h zones. An additional amount of ƒ15 million (€6,8 million) is reserved for the UvW for the implementation of new 60 km/h zones.
- For the implementation of 30 km/h zones a subsidy of ƒ10000,00/km (€4550/km) of new 30km/h road. Per local authority a maximum allocation of 40% of the total cost (all 30 km/h projects) is applied. For 60 km/h roads a subsidy of ƒ5 000,00/km (€2270/km) is available.
- For the implementation of priority control on urban arterials an amount of ƒ60 million (€27,2 million) has been reserved for the required infrastructural and other changes. The amount will be proportionally allocated to road authorities on the basis of the ratio between the length of arterial roads and total length of road network.
- For the standardisation of the priority rule at roundabouts, an amount of ƒ5 million (€2,27 million) is reserved with a maximum limit of 50 per cent of the actual project cost.

- Based on experience gained during implementation and with the application of the allocated funds, the signatories may amend the budgeted financial splits as agreed in the foregoing articles.

Subsidy splits between 30 and 60 km/h zones

11) The subsidy will be applied on the basis of applications submitted by the responsible road authority.
   a) Local and provincial road authorities and the UvW must submit their applications before 1 January 1999.
   b) In the event of an over-subscription on the available funds, maximum limits will be applied to all applications. This limit will be based on the ratio between the length of roadway to be changed and the total length of roadway in the jurisdiction of the responsible road authority.
   c) Subsidies will be granted on condition that by 1999 the road authority can prove that the planned or actual implementation programme corresponds to the original application. Failure to do so may result in the subsidy being partially or even fully withdrawn and re-claimed.
   d) Only projects realised after 1 July 1997 (the date on which the convenant was signed) will be considered for subsidy.
   e) During 1999 the split in the allocations may be amended in order to realise the implementation of the highest possible length in new adapted 30 and 60 km/h roads. At that time the government may, on the basis of funds not yet allocated, increase the unit amounts for 30km/h zones. This will be decided in consultation with the signatories and based on past experience.

Enforcement

12) The signatories agree that effective law enforcement is essential if the road safety targets set by the programme are to be met and if a sustainable, safe traffic and transport system is to be realised.

   Local and provincial authorities will ensure that traffic law enforcement with regards to the Sustainable Safety programme is prioritised in the planning of the police and law enforcement agencies and that it becomes an agenda item for the three way discussion forums that currently exist. As a parallel action, a cabinet memorandum will be drafted on means to guarantee effective traffic law enforcement. This will include strategies for intensified law enforcement. The partners will enter into new agreements ensuring that this is applied and realised.

Education and communication

13) During the implementation of the start-up programme particular attention will be paid to communication with all organisations representing the various road user groups and with road users themselves. The signatories will ensure that large scale publicity and information campaigns are launched to inform road users of changes to the road traffic rules and legislation. These will be supported by educational campaigns at primary and secondary schools.

Supporting measures

14) A traffic and transport knowledge (technology transfer) centre will be established on the basis of the VERDI agreement. To this end an information centre (Infopunt Duurzaam Veilig) dedicated to providing technical and other support to the implementation of the Sustainable Safety Programme will be established. The information centre will facilitate the exchange of knowledge, provide technical support (guidelines,

layouts etc.) and be the medium where road authorities can exchange ideas and experiences during implementation. The cost of running the centre will be borne by the government. Internal communication (i.e. within the structures of road authorities) will be the responsibility of that particular authority or organisation.

15) Before 1 March 1998 the road authorities in consultation with practitioners (consulting engineers, police, road safety specialists etc.) will develop a protocol for the execution of Road Safety Audits. The development costs will be borne by central government. The VNG, UvW, IPO and the Ministry will ensure that local, provincial and national road authorities and practitioners are made aware of the road safety audit procedures and processes. The cost for executing an audit will be borne by the end user.

16) The state, in collaboration with road authorities, will ensure that CROW guidelines are published for the design and layout of Sustainable Safe roads. In consultation with road authorities design criteria will be tested in pilot applications and demonstration projects. By 1 January 1999 definite design guidelines will be published and circulated to end users.

17) By the end of the year 2000, local provincial and national road authorities will have classified their road networks on the basis of the CROW guidelines. Although no definite arrangement was made for the co-ordination of this process, provincial road authorities took it upon themselves to undertake this. To ensure that discrepancies in the road networks across municipal, provincial and other boundaries are minimised, responsible road authorities will co-ordinate and communi cate with neighbouring authorities in this regard.

18) New systems and alternatives for financing traffic safety will be developed and proposals formulated by 1 January 1999.

19) The convenant covers the period 15 December 1997 till 31 December 2001 (by extension 31 December 2002).

20) The signatories of the convenant will participate in a management co-ordination committee for Sustainable Safety. For a period of 4 years an assisting committee (Realisation Committee) will be established to execute the main committee workplan. For this purpose, an annual budget of ƒ630 000,00 is reserved by the signatories. Within this struc ture other working groups/committees may be formed as and when necessary.

21) The progress of the programme is monitored by the co-ordinating committee. Annually progress is reported to the National Committee Traffic and Transport (LOVV). Where necessary, additional agreements will be entered into. For monitoring purposes road authorities will provide global statistics regarding the implementation programme in their region. During the year 2000 an evaluation of the programme thus far will be conducted to determine the relative success of the Start-up programme (Phase 1).

The last three articles of the convenant relate to disputes and other organisational issues.

3.3 Demonstration projects

To demonstrate the concept of sustainable safety to a broader public, a start has been made with implementation in practice. For that purpose four demonstration projects were selected and are currently running. The objective of the demonstration projects is to show how road traffic accidents can be reduced by an approach focused on the tools of sustainable safety

By disseminating information and knowledge gathered through the experiences with the demonstration projects, new knowledge can be brought to the notice of others and capacity built in this way. This new knowledge is important for the realisation of other projects

The four demonstration projects selected were in the areas of West Zeeuws Vlaanderen, Grubbenvorst, Oosterbeek and KOVO. In addition there are two similar, although independent, initiatives running in the areas of Westland and West Friesland (See Appendix 1 for a short description of the demonstration projects).

3.4 Expected benefits

From previous research results(SWOV, 1990; CROW, 2001), the road safety effects expected from the implementation of the Start up programme have been extrapolated and these include :

- *Assigning and controlling priority on primary roads (freeways, expressways and distributors)*

  This is anticipated to reduce the total number of road accidents at intersections by some 10 per cent.

- *Introduction of 30 and 60 km/h traffic restraint zones*
  The phase 1 expansion of 30 and 60 km/h traffic restraint zones is anticipated to yield a reduction of between 10 and 20 per cent of all accidents in the areas where the traffic restraint zones are introduced and the infrastructure adapted.

- *Uniformity in the layout and design of roundabouts*

  The conversion of the old "yield to approaching traffic" rule to the "yield to traffic on the circulating carraigeway" rule and associated changes to the layout and design of the old style roundabouts will have a limited effect on road safety. However, uniformity in design and layout will have a positive effect.

- *Priority cyclist from the right*

  The introduction of this measure will have an indirect effect on road safety.

- *Moped on the roadway*

  On routes where mopeds are displaced from the cycle path to the roadway the anticipated effect is a 50 per cent reduction in injury accidents involving moped riders.

- *Enforcement*

  Intensified speed enforcement can reduce average speeds on national roads by 2,5km/h. This has been translated (CROW, 2001) to a reduction of 12,5% of all serious injury accidents occurring on these roads.

  The wearing of seat belts can reduce occupant fatalities by 40% and serious injuries by 25%. The wearing of crash helmets can reduce moped rider injuries. The current wear rate must be increased.

- *Construction of rural distributor (80km/h) roads*

  The correct reconstruction of this category of road can result in reductions of 50% in head-on collisions on these roads. Furthermore the provision of cyclepaths, treated (hardened) shoulders, parallel roads for agricultural and other slow traffic etc. can reduce categories of accidents on these roads class by as much as 70% (CROW 2001).

3.5 Phase 2 - the path to 2010

During 1999 a detailed action plan was developed for the implementation of the second phase which covers the period 2002 to 2010. In essence the second phase will entail the realisation of the planned new road categorisation plans, design standards and guidelines for the new road network hierarchy determined for Sustainable Safety and the cementing of new funding streams for traffic safety. These elements are briefly outlined in articles 16, 17 and 18 of the convenant.

Intrinsic to the second phase is the further expansion of the 30 and 60 km/h networks. Furthermore, the 30 and 60 km/h zones realised during the first phase will generally not comply to the concept of optimally traffic calmed. Due to financial constraints, most of these zones are realised on the basis of providing infrastructure at only those locations within the area that were designated as unsafe or potentially unsafe (the so called "sober" approach). In practice this may mean that between measures drivers are still able to exceed posted speed limits. A safe sustainable road network aims to make each road class unique and recognisable to the road user and equip it with infrastructure that elicits the correct behaviour. To achieve that over the length of especially the access road network (30 and 60 km/h) implies that measures will need to be taken at short, regular intervals.

During the time frames set by Sustainable Safety there will undoubtedly be developments in transport, information and communications technologies (e.g. automatic vehicle guidance systems, Intelligent speed adaptation and other ITS applications). As these evolve and their possibilities in terms of enhancing road safety become clear, they can be incorporated into the longer term planning of the second phase.

4 The Status Quo

4.1 Phase 1 implementation

The first phase of Sustainable Safety was launched in December of 1997 and is at present being implemented in the Netherlands. This chapter will provide an overview of the steps taken and of the measures implemented during the first two years of the programme.

4.1.1 Project planning and timing

At present all road authorities are committed to meeting the deadlines outlined in the action plan. During the year 2001 a "mega-evaluation" of the programme will determine whether the implementation date of the start up programme will be extended by a year. Recommendations in this regard will be drawn up and submitted for approval to the National Management Committee. Simultaneously, the committee will make decisions regarding the implementation of the proposed 30 km/h speed limit for urban areas.

During 1999 a separate committee was formed within the structure of Sustainable Safety. Their task was to initiate the detailed planning for the second phase of the programme. This has resulted in the preparation of an action plan followed by a series of workshops and interactive sessions with road authorities, ministries, NGO's and other stakeholders to create awareness and to rally support for the introduction and subsequent implementation of the second phase. During 2000 the Phase 2 action plan will be negotiated with the "convenant" signatories and a new agreement will be drafted and entered into by the partners.

Due to the delays mentioned earlier, the preparation of Phase 2 will be finalised toward the end of 2001. In the period 2002 to end of 2004 road authorities will be tasked to develop detailed regional implementation programmes (including measues and costs) aimed at meeting the regional road safety targets. To ensure that the momentum of Phase 1 is not lost, a bridging fund (60 million Euro or 132 million guilders) has been made available to help road authorities with the extended implementation of Phase 1 and further preparation for Phase 2.

4.1.2 Expansion of 30 km/h zones

Prior to the launching of the start up programme in late 1997, 30 km/h zones and woonerfs had been implemented in a large number of urban areas throughout the Netherlands. In total some 8 500 kilometres of the approximately 55 000 kilometres of urban roads had already been designated as woonerf roads or roads in 30 km/h zones. In practically all cases the infrastructure on these roads were designed and provided on the basis of design guidelines and standards set down by the CROW and BABW. For all practical purposes it can be said that these roads have an infrastructure that, in terms of certainly speeding, is self enforcing. The combination of vertical and horizontal design elements are integrated with the surrounding built environment to project a unique and recognisable image of the area and the road.

The start up programme anticipated that 30 km/h zones would be expanded by an additional 12 000 kilometres by the end of 2001.

However, once applications for the reserved subsidies were made it became apparent that the budgeted funds would be inadequate to cover the demand. Furthermore, many local authorities realised that an amount of ƒ20 000,00/km (50% of which is for the account of the road authority) would be totally inadequate for re-engineering certain road types now designated for 30 km/h use. Certain roads had generous geometric standards applicable to higher order roads but these were now required to be downgraded and their layout adapted to conform to standards set for 30km/h zones. To achieve this within the design principles set in the standards would require substantial investment. In the short term it was realised that funds for this could not be raised and therefore the concept of a "sober" implementation approach was introduced.

The "sober" approach essentially allows for the phased introduction and realisation of roads in newly designated 30 km/h zones. The approach concentrates on the provision of traffic calming measures at unsafe locations (i.e. those with an accident history) and potentially unsafe locations (i.e. in the vicinity of schools, shopping and recreational centres, old age homes, etc.) within the designated 30 km/h zone. In this way the area can be gradually transformed to the desired end-state. In the short term, the posted 30 km/h speed limit is partially supported by traffic calming devices whilst the transformation of the area is made clearly evident to the user. Over time, the intensity of measures can be increased and the area transformed over time to its desired end-state.

During 1999 an opinion poll among local authorities determined that the majority of local authorities were prepared to implement 30 km/h zones during the period 1999 and 2000. However, local authorities had applied for subsidies for the realisation of nearly 30 000 kilometres of new 30 km/h roads or 2,5 times the budget and target set for these roads. This has resulted in a reallocation of the budget on the basis of the ratio between the road length applied for by each authority to the total length of roads to be designated 30 km/h (i.e. 30 000kms). In effect this means that certain road authorities will receive substantially less subsidy than originally anticipated. However, each road authority may apply their proportion of funds based on their own prioritisation for the implementation of 30 km/h zones. In other words they do not need to implement the measures on all the roads initially applied for but may be selective to realise as great a length as is allowed by the subsidy and their own contribution.

To this end local authorities must prepare detailed plans for the new 30 km/h zones, clearly indicating those which are to be constructed using the allocated funds. These plans were submitted to the Regional Directorates of the Ministry of Transport at the beginning of 2000. An analysis of these plans will give a true reflection on the actual length of urban roads that will be re-constructed as traffic calmed 30 km/h roads and also on the actual number of new 30 km/h zones to be realised.

During 2000, the Central Bureau for Statistics conducted an inventory of local and provincial roads. This provides an indication of the total length of reconstructed 30km/h roads and of roads planned for reconstruction as 30km/h roads. By the end of 2001 a total length of some 18000 kilometres of 30km/h roads had been realised, albeit primarily in the sober layout.

To support the "sober" implementation approach, an implementation and design guideline was published by the Sustainable Safety information centre. This brochure gives details regarding the approach, considerations, layout alternatives and examples of measures.

Various amendments to the traffic legislation and regulations were published during 1999. These support certain of the actions outlined in the start-up programme and included new road signs and the new measure "Moped on the roadway". Associated with these amendments were changes to current design standards.

4.1.3 Distinguishing between traffic zones or corridors and traffic restraint zones

One of the actions of the start up programme called for road authorities to draft concept road network plans which make clear distinction between those roads (or areas) that in future will have a predominant traffic function and those roads which will have a predominantly mixed traffic function (traffic restraint zones). This process was initiated during 1998 and has met with mixed success. Many road authorities applied this principle to the future rather than the current situation. Also certain road authorities deemed this process to be the same as the longer term road categorisation plan (which on the basis of the Sustainable Safety principles aims to re-classify the existing network to an "ideal" future network). The difference between the two appears subtle but is fundamental. The first step is really to make the distinction between roads/areas where mobility is and must be a first priority and those areas/roads where it is a low priority. From this an intermediate and connecting road network can evolve. The categorisation plans facilitate the transition from the existing situation to the eventual ideal situation. The end state requires long term planning to ensure that the road network evolves to one where there is a clear distinction between traffic corridors where the emphasis is on mobility and roads/areas where traffic is restrained, usage is mixed and the emphasis is on access.

4.1.4 General 30 km/h speed limit in urban areas

During July 1999 the National Management Committee (Bestuurlijke Regiegroep) comprising the highest ranking officials from each of the convenant signatories decided to postpone the decision to introduce a general speed limit of 30 km/h in urban areas to the year 2000. This decision is supported by the fact that detailed law enforcement plans supporting the introduction need to be developed and sanctioned by parliament to ensure the support of the relevant stakeholders. Due to a number of constraints, the primary one being the requirements for signing (restrictions/de-restriction) along arterial roads, a decision was reached during 2000 not to introduce a blanket 30 km/h speed limit for urban areas.

4.1.5 60 km/h zones in rural areas

The introduction of this measure affects mainly the UvW under whose jurisdiction these roads fall and for which a separate subsidy of 15 million has been reserved. The Union is presently well advanced in the planning, design and implementation process for 60 km/h roads. The Union is optimistic that it will realise the intended expansion of 3000 kilometres of 60 km/h road within the time frame of the start-up programme.

Although the majority of future 60 km/h roads are the responsibility of the Union, there are a number that fall under the jurisdiction of local and provincial authorities. Approximately half of all provincial and local authorities have submitted for subsidies for the implementation of 60 km/h roads. As with 30 km/h roads, the total length of road applied for far exceeds the goals of the action plan and therefore the available budget. The allocation of subsidies for the implementation of 60 km/h roads is being applied in the same manner as with 30 km/h roads.

In support of the introduction of 60 km/h roads, a brochure for the layout, design and implementation of these roads was published during 1999 by the Sustainable Safety information centre. The implementation of 60 km/h zones is proceeding according to schedule and it is anticipated that in excess of 3500 kilometres of these roads will have been implemented by the end of 2001.

4.1.6 Priority on arterials

By the end of 1999, roughly 19 per cent of the local authorities in the Netherlands have assigned priority at all intersections along urban arterials. This means that these authorities have introduced road signs and markings on all intersecting roads and that traffic on these arterials now have right of way. In the remaining local authority areas, the old priority rule (yield to motorised traffic approaching from the right) still applied and this situation would have to be reversed by the end of 2000, and at the very latest by mid 2001 (the time which the "yield to cyclists from the right" rule would be introduced). By mid 2001 the vast majority of local authorities had defined the urban distributor road network and implemented priority control at intersections along these roads. Yield control (signing and marking) was predominantly favoured as the control strategy at previously uncontrolled intersections.

4.1.7 Priority control at roundabouts

In the Netherlands there are two issues that concern priority at roundabouts and old traffic gyratory systems. The first is that currently two priority rules for motorised traffic exist in the country, one where traffic on the circulating carraigeway has right of way and the other where traffic on the approach has right of way. To ensure uniformity it was decided to convert the 70 roundabouts operating under the old priority rule (entering traffic has priority) to the "new" rule. At the same time the geometry of some of the "old" style roundabouts, designed with flared and tangential approaches would be changed to conform to the new CROW standards. Proposals were drafted to achieve the required uniformity as was a proposal submitted for subsidising these activities. It is anticipated that this will be realised during 2000. It is also anticipated that legislation will be adapted so that all roundabouts comply to the "new" rule.

The second, and more complicated issue at roundabouts concerns priority for cyclists on separate cyclepaths. Currently there is no mandatory requirement in this regard. CROW guidelines have been published and these recommend that cyclists on separate cyclepaths at roundabouts in urban areas have right of way (i.e. traffic entering/exiting the roundabout must yield to cyclists) and in rural areas they do not (i.e. they must yield to traffic on the approaches). Since this is only a guideline local authorities throughout the country have different opinions regarding this and consequently have adopted what they feel is best. The result is a total lack in uniformity and the associated confusion for the road user as to which rule applies where.

The Netherlands has some 1800 roundabouts (1999) of which some 1130 have separate cycle paths (747 in urban areas and 383 in rural areas). At 523 of the urban roundabouts cyclists do not have the right of way (whereas according to the guidelines they should have) and at 88 rural roundabouts cyclists do have the right of way (whereas they should not). This lack of uniformity is currently a topic of discussion amongst local, provincial and national road authorities. This item has not been resolved

and particularly the northern provinces have elected not to give cyclists priority at roundabouts.

4.1.8 Moped on the roadway

In the Netherlands mopeds are limited to a maximum speed of 40km/h, riders are compelled to wear a crash helmet and may ride on designated roads and/or cyclepaths. Resulting from a significant increase in the incidence of moped/cyclist accidents it was decided during 1998 to introduce changes to the legislation and regulations banning mopeds from certain cycle paths and allowing them to use the roadway. During 1999 these changes were passed in legislation and following a cabinet decision, the new rule introduced on15 December 1999.

Of concern however, is that some 34 per cent of local authorities will not have introduced the required infrastructural changes by the time the new ruling goes into effect. A further problem is that in certain cases (e.g. on 80 km/h roads) road authorities do not want mopeds on the roadway. Because the new ruling allows this road authorities are now compelled to erect signing for these exceptions (both on roads and cyclepaths) showing moped riders that they must in these cases use the cyclepath and not the roadway.

Unfortunately not all local authorities have introduced the required infrastructural changes.

4.1.9 Priority cyclists from the right

During the year 2000 legislation was amended to change the general rule that motorised traffic approaching from the right has priority (unless indicated otherwise) to all traffic (excluding pedestrians) approaching from the right has priority. This amendment will then also provide for cyclists, mopeds, vehicles for invalids and all other slow moving traffic.

To meet the implementation date (previously set for 1 December 2000) road authorities had to ensure that that priority at all intersections on urban arterials was controlled (regulated). Due to various constraints the implementation date was delayed and the regulation eventually introduced in mid 2001. To determine the effect of the measure, a monitoring programme has been established and will be reported toward the end of 2003.

4.1.10 Financing

The budget for the National subsidy for 30 and 60 km/h roads has been allocated in the Ruling Sustainable Safety. The criteria applying to allocation of these reserved funds have also been taken up in the ruling.

Towards the end of 1998, the state reserved *f*60 million in subsidy for the provision of measures for cyclists and mopeds. All but two road authorities applied for the subsidies and a total of *f*56 million was paid out for the provision of measures.

A study was initiated to determine an equitable means for applying the budget reserved for the uniformity of priority at roundabouts. From this study costs for the conversions were calculated and it was apparent that the budget was insufficient to cover a 50 per cent subsidy for the conversion of the 65 roundabouts not complying to the requirements. Additional funds would have to be secured. A phased implementation approach was recommended in which the majority of the non-conventional roundabouts

requiring relatively minor adaptation would be converted in the year 2000. The remaining complex and expensive roundabouts would be converted over the following two years. Based on a decision of the co-ordinating committee, the subsidy allocation is based on a 50 per cent subsidy with a maximum of half a million per project.

Virtually all road authorities have submitted applications for subsidy for 30 and 60 km/h projects. The total amount applied for is in the region of ƒ400 million whilst only ƒ120 million is available for local and provincial authorities and a further ƒ15 million for the UvW. Based on the over subscription a subsidy rule was applied on the basis of the ratio of road length to be constructed in each region to the total length (in the Netherlands) of urban or rural road. For most road authorities this implied a substantially lower amount in subsidy although they were permitted to apply these funds on the basis of their own prioritisation for 30 and 60 km/h projects. To this end it was decided that by 1 January 2000 road authorities would submit detailed plans of definite projects to be implemented to the Regional Directorates. On the basis of these subsidies were finally allocated.

4.1.11 Enforcement

In all regions traffic law enforcement has been added to the list of policing priorities of the police. Following agreements reached at National level, traffic law enforcement plans have been drawn up at both local and regional level. The nine regional plans were compiled by the regional police corps in consultation with the Bureau for Traffic Law Enforcement (Public Ministry, BVOM). These projects will receive additional funds to ensure a high level of enforcement on speeding, red light violations, drinking and driving and the wearing of seat belts and crash helmets. The regional police have also invested in extra resources, both manpower deployment and new equipment.

Three way discussion forums have been established to facilitate discussion regarding law enforcement between local authorities, the police and the Public Ministry. Road authorities are of the opinion that the results attained with respect to law enforcement at the local level can be improved. Consequently significant efforts are being made to improve organisational structures and the communication between the partners.

Towards the end of 1997, the cabinet decided to investigate the introduction of a devolved (to local level) system of law enforcement. This action is not supported by the VNG, IPO and UvW and currently discussions and investigations (needs for enforcement, desired and optimum levels of enforcement.) into alternatives are being conducted as input on making decisions and reaching some form of consensus with all role players.

4.1.12 Education and training

An extensive publicity campaign for the introduction of "Moped on the roadway" was prepared and launched in November 1999. The campaign targets moped riders and motorists and is being communicated across all mediums of media. At regional level authorities responsible for road safety are responsible for adding local relevance to the campaign. All police stations and municipal offices have received information packages containing brochures, copies of TV and radio spots etc. For use within their area of jurisdiction. Finally CD-Rom's with learning materials, adverts and games

have been released to secondary level schools for use among students. To ensure that road authorities are kept abreast of the developments of the Sustainable Safety programme, workshops were held in virtually all the regions. The workshops presented a wide range of topics on the programme and were well attended by most sectors involved in Sustainable Safety.

During 1998 the development of a co-ordinated approach for permanent traffic education was launched. Towards the end of 1999 a series of interactive workshops were held with the aim to formulate a joint vision and goal for the year 2010. The results of the workshops will be used as basis for strategy development and this was finalised in February 2000.

4.1.13 Supporting measures

During 1998 a protocol for road safety audit was developed. The protocol is based on English and Australian practices but the procedures and checklists have been adapted to reflect the local situation. Following the development of the protocol a series of training workshops were held to train road safety specialists and practitioners in the audit procedures. Toward the latter half of 1998 and throughout 1999 the protocol (guideline) was tested in a number of pilot road safety audits. Based on the experience gained during the pilot phase shortcomings in the process and procedure (checklists, reporting, administration etc) were identified and amendments made.The road safety audit protocol was then published as a final guideline document (crow 2001). It is anticipated that road safety audit in the Netherlands will be applied on a voluntary basis and that applications and execution for road safety audits will be centrally co-ordinated and administered by a yet to be formed independent organisation or body.

The road safety audit has met with mixed reactions in the Netherlands. As was the case internationally, designers are of the opinion that the audit is unnecessary since design standards and guidelines are in themselves inherently safe. Road authorities also feel that the audit introduces additional costs and place constraints on the critical path of project plans. Due to an overall lack of quantitative data and research it has not been possible to convince road authorities of the benefit of the audit, especially with respect to accident reduction. However, from the pilot projects it is evidenced that once exposed to the process, road authorities do perceive some benefits and certainly see the audit as a value addition in the infrastructure planning, design and provision process. This positive perception will be exploited for the purpose of future marketing of the road safety audit.

The majority of local, provincial and national road authorities have prepared conceptual road network plans on the basis of the new sustainable safe principles and based on the new road hierarchy (road classes). These provide a new functional framework for the existing road network and serve as the basis for identifying, designing, costing and prioritising the implementation of 30 km/h zones, intersection control strategies on arterials and other measures required for the first phase.

4.1.14 Summary

The first phase of implementation of Sustainable safety is entering its fourth year and during this period significant progress has been achieved. Local, provincial and national road authorities are in general extremely supportive of the programme and are extending themselves to meet the deadlines set for the short term implementation plan. 30 and 60 km/h zones are being implemented throughout the country and measures such

as regulating priority on traffic arterials and mopeds on the roadway have been implemented within tight time frames. Communication and education campaigns have been developed to support implementation. Law enforcement is high on the agendas of the police departments and every effort has been put into place to ensure a high and intensified level of policing during the first phase of Sustainable Safety.

4.2 Phase 2 implementation

During the period 1998 to the end of 2002, the road authorities have been preparing the next phase together as a working group. First, the areas for special attention were charted. To this end, comprehensive literature studies were conducted and all the major knowledge institutes were consulted. On the basis of the information collected, favourable points of action to improve road safety were formulated. The costs and effects of the various measures were then determined.

The measures related to the following themes:

- education and information;
- infrastructure;
- enforcement;
- vehicles and vehicle technologies;
- spatial planning; and
- private sector.

The working group gradually came to the conclusion that a policy targeted at the implementation of measures, as was the case in the first phase, was not the correct and most efficient approach for the next phase. The impact of the various measures on reducing road accidents will not be same everywhere. Moreover, the implementation of a large number of measures involves wasting a lot of valuable time. That time is simply not available. After all, by 2010 road accidents must have been reduced substantially, if the targets are to be attained. An additional aspect is that if large-scale improvements in infrastructure are pushed through, while major maintenance work has not yet been carried out, the result will be large disinvestments in infrastructure. It is better to plan the work properly. Matters like this cannot be co-ordinated at the national level. A regional approach is therefore deemed more desirable.

Another important finding of the planning group was that the road safety policy had hitherto been approached in too sectoral a manner. It did not always mesh with adjacent policy domains, such as accessibility, spatial planning and the environment. Because road safety had its own consultation committee, it was difficult to achieve integration of road safety in, for example, spatial planning. If road safety is included from the outset in the design of new residential areas, for example, expensive investments can be avoided in the future.
Road safety must therefore not be approached in a sectoral way, but rather included as a facet in other policy domains.

A third aspect relates to the involvement of the private sector in achieving better road safety. Up to now, transporters/shippers of freight have been insufficiently aware of their possibilities and responsibilities. The development of a safety culture within this sector offers excellent opportunities to tackle road safety at the source. Here again there is a WIN-WIN opportunity. Apart from the immaterial side of the question, financial gains may be expected because drivers will less often be unable to work for a shorter or longer time, vehicles will incur less damage, and also less time will be lost

waiting in queues. A not inconsiderable proportion of the congestion in the Netherlands is caused by road accidents.

The following characteristics distinguish Phase 2 of Sustainable Safety from the first phase:

- not sectoral, but integral
- not national, but regional
- not only authorities, but also the private sector and individuals
- not measure-driven, but dependent on the regional situation.

4.2.1 Additional agreements

To ensure that the regional process gets a good start, the combined authorities needed a set of agreements to supplement the NVVP. These agreements, mostly relating to the creation of the required conditions, concern efforts of all the authorities for the road safety policy as a whole. These include:

- division of responsibilities;
- facilitation of developments in the area of knowledge and expertise, development of instrumentarium (e.g. a handbook of measures) and the deployment of financial resources;
- agreements about influencing behaviour (e.g. education, communication, enforcement, legislation and regulation) and the possible continuation of the work of the Regional Road Safety Agencies (ROVs);
- the development and application of new safe vehicle technology;
- the (adaptation of) infrastructure and essential characteristics (layout) to which the different kinds of roads must comply;
- the integration of road safety policy within other policies on mobility, and co-ordination with spatial planning policy;
- knowledge development;
- monitoring and evaluation (indicators, measurement times, content and frequency of reports).

To flesh out these additional agreements regional meetings for administrators from the national government, provinces, Framework Act areas, municipalities and water control authorities were held in mid 2001. On the basis of the outcomes, the agreements will be finalised, after which they will be administratively adopted at the national level in spring 2002.

4.2.2 Regional direction by administrations of provinces and Framework Act areas and regional packages of measures

The provinces and Framework Act areas will co-ordinate the development of integrated packages of measures to realise the regional targets. These packages will be determined on the basis of an analysis of road accidents in the region, using risk assessment methods, road accident data and monitoring instruments which have now been developed for establishing road hazards in certain regions. The best potential solutions can be specified using methods which are now available for determining the causes of accidents. These will include not only infrastructural measures, but also measures to influence behaviour, such as intensified of the enforcement of traffic regulations, education and/or public awareness.
At the moment, a first version of a catalogue of measures is being developed. The catalogue gives an insight into the effects of especially infrastructural measures, and the costs associated with these. Over the next few years this catalogue will be further improved andamended on the basis of evaluations of implemented road safety measures.
At the moment there is still a lack of knowledge concerning in particular

the effects on road safety of behaviour influencing measures, such as education, training and public awareness.

On the basis of the inventory carried out by the province or Framework Act area, the most cost-effective measures can be charted, and an implementation programme established. This programme will have to contain not only a package of measures to achieve the desired reduction compared with 1998, but also a package of measures to compensate for the increase in road accidents as a result of growing mobility.

4.2.3 Finance

Bringing the targets within reach in fact entails that the worst accident blackspots or dangerous areas in the region must be taken in the short term. This also implies that extra financial resources are needed to really deal with cost effective measures.. The national government has promised to finance around 50% of the costs. At the moment an application for financing has been submitted to a special fund whose purpose is investment in measures which can have a positive influence on the Dutch economy. As mentioned earlier, the costs to society of road accidents are tremendously high. Previous calculations (SER 1999) have shown that investing in better road safety gives an extremely high return, namely 7%. Other investments, including improvement of accessibility, cannot compare with this.

The claim which has been submitted to this fund is for 5 billion guilders (2.4 billion Euros). Together with matching funds from other road authorities is should be possible to achieve the share which the authorities must realise in the total road safety targets. This was shown by calculations produced by the Institute for Scientific Research Road Safety (SWOV) for the NVVP (SWOV, 2000). The decision will be made in 2002 as to whether this sum will in fact be made available for the period 2002 to 2010 inclusive.

The extra resources for road safety will be added to the aforementioned fund for the Combined Special-Purposes Payment (GDU), which falls under the responsibility of the provinces and Framework Act areas. The provinces and Framework Act areas can then determine in consultation with the other authorities in the region how these resources can best be deployed. In addition, realisation of the road safety targets also has consequences for citizens and businesses. Measures such as the newly qualified driver's licence, registration numbers of mopeds and improving the safety culture are also necessary in order to achieve the targets. It is assumed that the parties concerned will finance these measures themselves. For the private sector, an approach will be chosen which makes it more attractive to operate safely, by means of a quality mark and better accessibility to urban areas which have this quality mark.

4.2.4 Road safety measures

Precisely which measures are needed depends on the regional circumstances. What is important is that the regional authorities should put together an optimum mix of measures. The possible measures include, among others:

- conversion to 30 km/h or 60 km/h area (speed restriction, safe intersections with arterial roads, adaptation of traffic circulation so that through traffic is concentrated on arterial roads);
- redesigning the layout of arterial roads (separating different types of traffic according to direction, speed and/or mode of transport, conver

ting intersections into e.g. roundabouts, introducing parking measures and providing uniform road markings);
- communication in combination with enforcement of traffic regulations (e.g. targeted on the reduction of alcohol, drugs and medications that influence behaviour, promotion of the wearing of seat belts and helmets, speed checks and bicycle lights);
- activities targeted on schools, school students and parents;
- out-of-school education and training (e.g. moped course, refresher courses in road safety knowledge, training courses for parents);
- projects, such as raising awareness, safety culture and encouraging the use of safety devices in specific target groups (e.g. businesses, associations and different kinds of road users).

4.2.5 Task of the national government

The national government makes its contribution firstly in the improvement of road safety in the regions. After all, freeways are an inseparable part of the regional network. And if the working method is an integrated approach, then all the authorities have to take part. Secondly, the national government naturally has its own responsibilities. These are, in particular, measures which the Dutch government must introduce everywhere at the same time, and which serve as limiting conditions for the regional policy. Consequently, the government will also have to conduct many of these activities in co-operation with regional and local authorities, and in certain cases with the private sector and pressure groups. The activities which are planned at the national level are:

- development of a package of measures to improve the safety of vulnerable road users (pedestrians, cyclists, moped and motor-bicycle riders, motorcycle riders). This involves tightening vehicle requirements, registration numbers, requirements of driving capability and driving ability, etc.;
- giving a quality incentive in the transport sector and commercial traffic, resulting in guarantees for efforts in the area of road safety;
- development of regulations to combat drugs and medications that influence driving behaviour, and monitoring for these;
- measures targeted on newly qualified drivers (provisional driving licence, alcohol limit of 20mg/100ml);
- tightening of requirements for driving capability and driving ability at the European level;
- development of a mobility test for spatial planning processes; internalisation of costs of road accidents; and
- conducting research in association with the European Union into the (vehicle) technologies aimed at promoting safer driving behaviour (intelligent speed governors, data recorders and suchlike).

All these activities are included in the government's policy calendar (section C of the National Traffic and Transport Plan - *NVVP*). This policy calendar will be updated every two years on the basis of the results of monitoring and progress in carrying out the current government calendar.

As further elaboration of the transport policy, the government has naturally also formulated a programme with an agenda, actions and research.

The agenda has the following *lines of approach* :

- In the coming years the government will make agreements with municipalities and provinces about the approach and further elaboration of a sustainable safety transport system. To this end, the government

together with the other authorities is developing methods to translate the national road safety objectives into regional objectives.
- Together with the decentralised authorities, the private sector and societal organisations, the government is developing a package of measures to improve the road safety of vulnerable road users, such as pedestrians, cyclists and moped/moped riders. This involves tightening requirements for vehicles, registration numbers, requirements of driving fitness and driving skill, measures for the lay-out of and place on the road, and the place of the various groups of road users on the road.
- In co-operation with the Motorcycle Riders' platform, the sector and other organisations, measures are being implemented to improve the road safety of motorcycle riders. This focuses on improving visibility and risk perception, encouraging the wearing of appropriate clothing, and improving vehicle control.
- The government is holding consultations on road safety with, among others, employers' and employees' organisations, insurance companies and other relevant businesses and organisations, to investigate the possibilities of internalising the societal costs of road accidents. This entails that the person who causes the accident is liable for the costs. Options could be to increase premiums in the event of culpable driving behaviour; to encourage the purchase of safety devices; and to influence driving behaviour by checking driving skills.
- The government wishes to introduce, in conjunction with the private sector, insurance companies, the other authorities and other parties concerned, a quality incentive in the transport sector and commercial traffic leading to guarantees for efforts in the area of safety. Special attention will be given here to vans.
- The government is aiming for further tightening of requirements for driving skills and driving fitness at the European and the national level. The government is developing regulations for the use of drugs and medications which influence driving behaviour, and the testing of drivers for their use.
- By means of experiments, the government is giving an impulse to the development of Advanced Driver Assistance (ADA) systems. ADA is an umbrella term for, among other things, various forms of intelligent speed adaptation and lane departure warning systems. Large-scale tests will be carried out as from 2003.
- The government is setting up a calendar for the development of Automatic Vehicle Guidance (AVG) for the coming years. This is being done in co-operation with the private sector, in particular with the objective of improving road safety and road utilisation. The intention is to fit in with international developments and to realise the necessary legal frameworks.

The government has further resolved to prepare and execute the following *actions*.

- The government will determine the most hazardous sections and black spots in the national trunk road network and improve them.
- The government will start a trial with a speed governor in light trucks and vans. This will be done in co-operation with the private sector. After the trial, and taking account of the results, the government will commence efforts for amendment of the law in the European context.
- A cabinet standpoint is being prepared on administrative enforcement of traffic regulations. This entails that municipalities and provinces will themselves be able to decide on their approach to the enforcement of road safety. They may use the revenue from the administrative penalties

themselves, for their own purposes.
- The government aims to extend the five pilot studies with intensive police supervision of regional enforcement of traffic regulations to all 25 police regions in The Netherlands.
- The government will intensify the enforcement of speed limits on the motorway network, through extra deployment of the national police force.
- The government aims to introduce a beginners' driving licence for newly qualified drivers.
- Depending on the results of further research, a blood alcohol limit of 0.2 mg/ml for either newly qualified drivers or all drivers could be introduced in 2002.
- Following trials with Intelligent Speed Adaption (ISA) in Tilburg, the Dutch Government is pursuing options for wider implementation within the context of development in the European Union.
- The government is developing a strategy for the introduction of electronic vehicle identification and electronic registration numbers. In the first instance, this will relate to combating registration number fraud. Later, it will be possible to add, for instance, enforcement of the traditional vehicle requirements.
- The government will give an impulse to the development and application of the on-board computer and the driving behaviour data recorder (black box). The accent lies on the commercial market, especially freight transport, with the objectives of realising logistic advantages and contributing to safer driving behaviour. A pilot study is being started.
- The government is developing measures which improve the protection of vehicle occupants, both in individual and collective passenger transport and in freight transport. These involve, among other things, improving the seat and headrest constructions of cars to help prevent whiplash; collision compatibility; and requirements for the roof construction of buses.

Within the scope of the present policy, the government will start the following *research studies.*

- Research into the possibilities of safer road behaviour have high priority: what means and activities can be used to teach new road behaviour, restrict undesirable road behaviour and encourage desirable road behaviour. The background of this is the endeavour to further harmonise measures focusing on the road infrastructure, road behaviour and the vehicle. The desired strengthening of the policy on behaviour makes it necessary to conduct thorough research into the possibilities for innovation of the instrumentarium.
- The government will start a study on the relation between road infrastructure, road behaviour, road accidents and consequent injuries, so that a measures-oriented policy can be pursued. A point of attention is restriction of the number of serious injuries.
- Better embedding of road safety in policy areas outside the direct road safety policy can be very effective. The relation with spatial planning and urban development will be further investigated. One of the possibilities is to introduce a road safety audit for spatial plans.
- An approach focusing on the vulnerable road users is extremely important for road safety. Further research will be conducted concerning numerous effective measures for this category.
- The government will take the initiative to research the influence of alcohol, medications, drugs and unhealthy lifestyle on driving behaviour in the freight transport sector, possibly followed by a package of

measures to be formulated in conjunction with the sector for a business-oriented approach (safety culture).

4.2.6 Instrumentarium

Like the measures listed in 4.2.5, the instrumentarium will also be developed in co-operation with other highways authorities. For instance, at present the various authorities are deliberating on the desired structure for joint knowledge development and distribution in the area of transport. An important element here is the policy line which is to be developed for the various knowledge platforms.

Much use is also made in the Netherlands of an institute established specially for this purpose, the Information and Technology Centre for Transport and Infrastructure (CROW). This institute has been commissioned by the government and other authorities to develop, among other things, guidelines for the design of infrastructure and methods of analysis for accident blackspots and dangerous areas, etc. The institute has the task of developing guidelines with the necessary support, and if necessary subjecting them to administrative tests.

Over the last three years, all the guidelines for roads outside the built-up area have also been scrutinised. This has involved not only updating them, but also adapting them to the Sustainable Safety road hierarchy classification. Thus, draft guidelines have now been prepared for 'stream' roads, distributor roads and access roads outside the built-up area.
Major discussion points relating to these guidelines are covered at national workshops, and as far as possible a generally acceptable solution is developed.

It appears that these guidelines will be given the status of a toolbox. Toward the end of 2001, a working group will start work on the minimum norms and layout requirements which will be set for infrastructure. These norms and requirements will, however, have to be administratively adopted by all the authorities.

In addition to all kinds of guidelines and other resources, an information point has been set up to assist highways authorities with their questions concerning the layout of infrastructure. This information point has both a telephone helpdesk and a website with, among others, sections for frequently asked questions, background information and other sources.

5 Implementation Measures

5.1 Road categorisation

The underlying principle applied in determining a road network hierarchy is that roads in a traffic network have one of two functions, namely a traffic function directed at the displacement of movements (mobility) or residential function directed at providing access within the activities (playing, parking etc.) of that environment. Roads with a mobility function (Traffic corridors) focus on providing the efficient, orderly and safe movement of traffic and goods. On roads in activity areas (residential, woonerfs, shopping and recreational areas, industrial/commercial and agricultural areas) traffic gets a secondary role to activities such as walking, cycling etc. The road space is thus shared and traffic only uses it to access property.

Traffic corridors are those roads that facilitate traffic flow and within the road network two types can be distinguished namely the freeways (between urban centres) and the district distributors (between the freeways and activity areas).

Based on this philosophy three primary road categories emerge; freeways, distributors and access roads. Taking into account land use, a further distinction emerges namely in rural areas freeways (100 and 120 km/h), district distributors (80 km/h) and access roads (60 km/h) and in urban areas district distributors (50 or 70 km/h) and access roads (30 km/h). This philosophy underlies the approach that road authorities have to adopt in the re-classification of their existing road networks and taking into account the functions and needs in the medium to long term.

To assist road authorities with the re-classification process a methodology was developed by the CROW and the Sustainable Safety Information Centre. The methodology entails a sequential process of actions and decisions that lead to a concept road network hierarchy (Figures 5.1. and 5.2).

Preliminary classification

Based on the CROW 116 procedure or from an existing road network structure plan determine the roads that clearly have a predominant mobility or mixed function. Once this is completed there will be a multitude of roads that cannot be assigned one of these two functions. For these roads the entire classification process (described below and on Figures 5.1 and 5.2) must be followed for each road.

Is an increase of the activity function of the area desirable?

The road authority must consider the current and future land use along the road under consideration. A decision must be made whether it is desirable to increase the traffic function of the road or to change the road such that it supports activities within the area (e.g. takes the character and function of a residential road where space is shared between all users). Good indicators supporting this decision are complaints from residents regarding the traffic situation, road accidents, the segregation effect of the current road etc.

Figure 5.1
The functional classification of urban roads

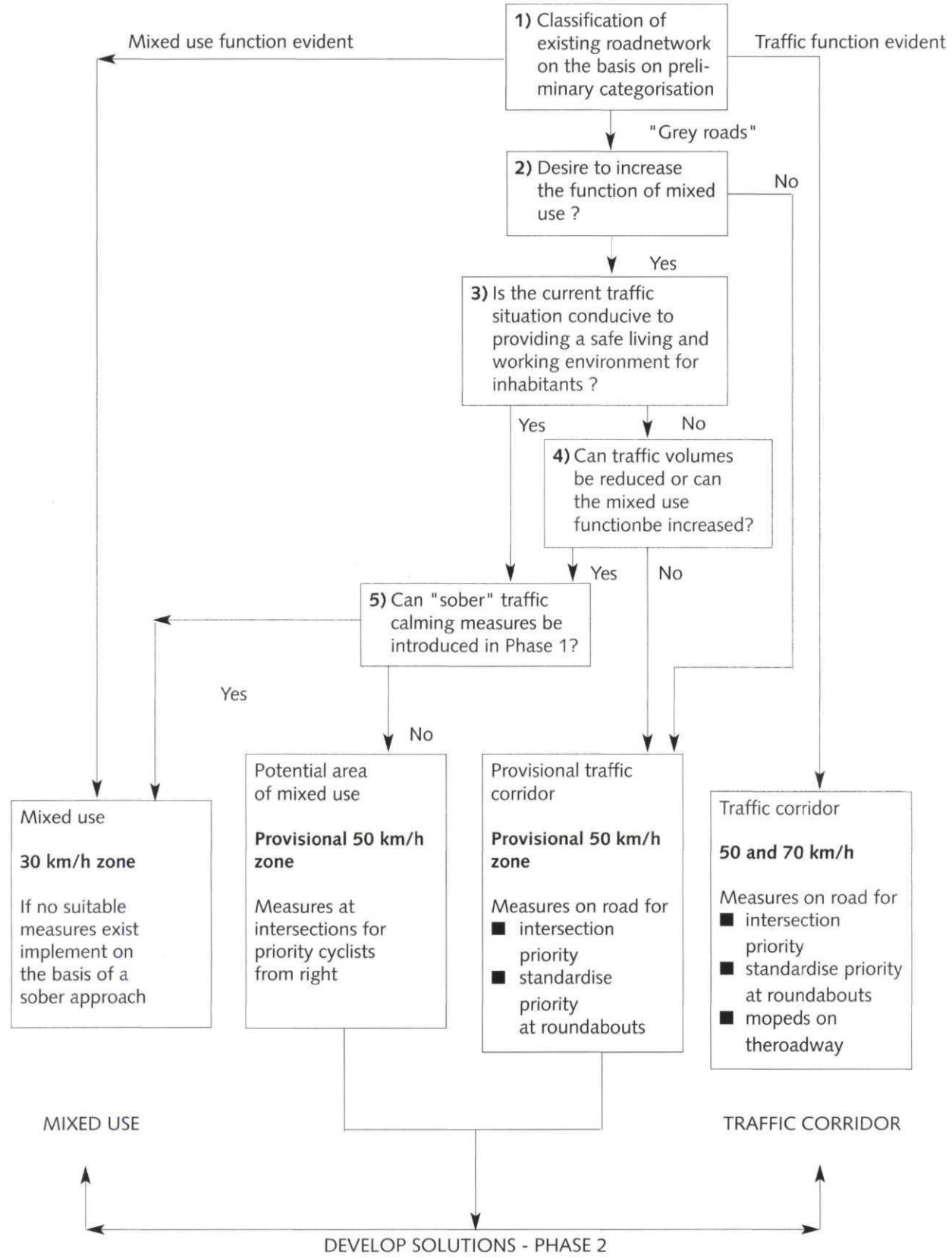
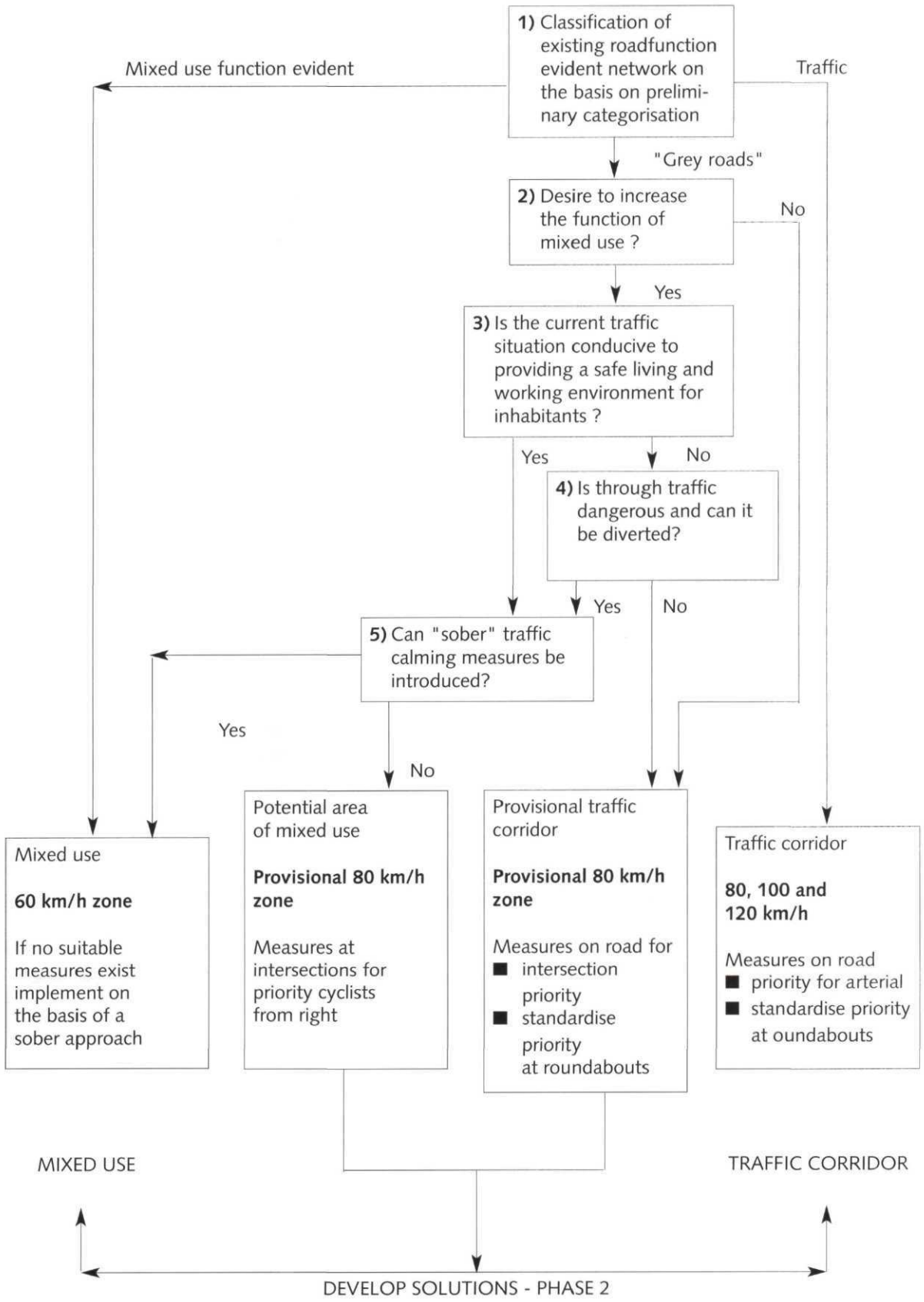


Figure 5.2
The functional classification of rural roads



Current traffic demand

Existing (and projected) traffic volumes must be considered if the function of the road is to be changed to accommodate mixed use. To an extent the function of the road is described by traffic demand. For this purpose urban roads with an activity function are defined as roads with an Average Daily Traffic (ADT) below 6000 vehicles and rural activity roads as those with an ADT below 2000 vehicles.

Can the activity function be increased?

Although a change in road function may be desirable (e.g. increasing the residential function) it may not always be possible. If current volumes are high and need to be decreased to suit demands for roads with mixed use then the capacity of the surrounding network must be evaluated to determine whether the component of traffic displaced (i.e. non-local through traffic) by the changed function can be accommodated. Also the current and future land use along the road must be evaluated to ascertain whether this supports the roads of mixed use. In cases where the traffic demand is high and surrounding land use is not supportive, the road will automatically be assigned a traffic function. In other cases demands will be too high and cannot be accommodated on the surrounding network but the land use and environment are typical for a road of mixed use. In such cases a long term plan will be developed to allow the change to take place. In the interim the road will be assigned a mixed use function and special care taken to ensure that drivers adhere to the changed function and rules that apply to this. If a long term solution is not evident then the road will be assigned an interim traffic function and over time be changed to a true traffic corridor.

Can traffic calming measures be restricted to problem locations (i.e. the sober approach)

For those roads which are assigned an interim mixed use function traffic behaviour has to be adapted to suit the changed function. Here it must be determined whether prevailing speeds can be reduced to acceptable limits through the introduction of traffic calming at only unsafe and potentially unsafe locations. These measures must be implemented before 2002 and are dependant on :

- the nature and type of conflicts;
- available funding and resources;
- prioritisation;
- condition of the existing road; and
- the (community) participation process.

Should it not be possible to implement the measures before 2002, then the road may remain a 50 km/h road although it is assigned the function of mixed use. However, at intersections measures must be introduced to allow the introduction of "priority for cyclists from the right". During the second phase of Sustainable Safety the remaining measures will be introduced and the function of the road changed.

Testing

Based on the above process the road network under consideration should be categorised on the basis of traffic corridors, interim traffic corridors,

roads (areas) of mixed use and interim roads (areas) of mixed use. The consistency of the classification should be tested on the basis of the CROW 116 guidelines. Equally important is that the proposed functional road classification be compared with the proposals for surrounding road networks (i.e. to ensure that roads crossing municipal boundaries are consistently classified in a systems context). Where roads change category across boundaries these must be clearly indicated by 'gateway" treatments.

5.2 Consequences of road classification

Once the categorisation process is completed four road types will emerge for both the urban and rural road networks. For each road type there are certain consequences associated to the implementation of the Start-up programme and these are discussed below.

In the urban environment the road network can be functionally classified according to :

1) *Roads in areas with mixed use*
These are the roads in areas where traffic calming measures are already present (i.e. existing 30 km/h zones, woonerfs and pedestrian zones) as well as the roads where traffic calming measures will be implemented (either based on a sober approach or based on existing guidelines for 30km/h zones etc.) in the period 1998 - 2001 and a general area wide speed limit of 30 km/h introduced.

2) *Roads in potential areas of mixed use*
The maximum speed limit on roads in these areas temporarily remains 50 km/h. After 2001 traffic calming measures are implemented and a general maximum speed limit of 30 km/h is introduced. During the first Phase however, measures for the introduction of "priority cyclists from the right" will be taken at specific problem locations. In conjunction with this attention must be paid to infrastructure and other provisions for the introduction of "moped on the roadway".

3) *Provisional traffic corridors*
Before the end of the year 2000 and based on final road network classification plans, all traffic corridors will be identified and planned for implementation. In the period before 2002, roads that are currently functioning as lower order roads but are planned as arterials (traffic corridors) will be assigned a provisional traffic corridor status and a maximum speed limit of 50 km/h will apply. Simultaneously measures for "priority cyclists from the right", "moped on the roadway" and priority at roundabouts will be implemented on a route basis during Phase 1 of the programme.

4) *Traffic corridors (distributors)*
Those roads currently operating as traffic corridors must be adapted during the first phase to accommodate the introduction of "priority cyclist from the right", moped on the roadway, priority at roundabouts and other intersections must be uniformly assigned along the length of the road or route. A speed limit of 50 or 70 km/h will apply.

For roads in rural areas the road network will comprise :

1) *Areas of mixed use*
During the period 1998 - 2001 a "sober" approach will be adopted to implement traffic calming measures on an area basis where a general

speed limit of 60 km/h will apply. Due to the larger speed differentials between road users in rural areas, specific attention will be paid to implementing measures for the introduction of "moped on the roadway" and "priority cyclists from the right". For limited parts of the rural network, typically rural residential areas, recreational areas, bungalow parks etc., a speed limit of 30km/h may be introduced.

2) *Potential areas of mixed use*
Roads in these areas can be infrastructurally adapted to 60 km/h after 2001. During the first phase however, speed limits will remain at 80km/h. With regards to the introduction of "priority for cyclists from the right" measures will be implemented at conflict and potential conflict points along the road or route. On roads where separate cyclist paths are provided it is recommended that mopeds are not allowed on the roadway.

3) *Provisional traffic corridors*
The same as in urban areas, these are those roads which will become traffic corridors after 2001. However, during the first phase measures will be implemented to assign priority at intersections and standardise the priority rule at roundabouts. It is recommended that mopeds be allowed to use cycle paths where these are provided. A speed limit of 80 km/h applies on these roads.

4) *Traffic corridors*
These are the roads that presently function as district distributors and are typically multi-lane roads with divided carraigeways. Priority at intersections along these roads or routes must be controlled and assigned. Priority at roundabouts must be assigned on the basis of the standard rule (circulating traffic has priority). It is recommended that mopeds are restricted from using the roadway/s.

5) *Freeways*
These are roads that constitute the primary road network between towns and cities. They have a predominant traffic function providing mobility for high volumes of through traffic. Intersections are grade separated and the roads have generous geometry and high capacity. Posted speeds are typically 100 and 120 km/h.

5.2.1 Size of zones

Traffic safety and quality of life are the two aspects that benefit the greatest from a zoned approach to traffic calming (and speed management) and hence it is desirable to implement speed reduced zones over as large a area as possible (i.e. with as few roads segregating different areas as possible). However, mobility cannot be totally disregarded and therefore careful attention must be given to aspects such as origin-destination patterns, journey times and Levels of Service, public transport, access for service and emergency vehicles etc.

During the first phase a provisional road network hierarchy will be defined. Due to the provisional nature and dependence on the ultimate implementation of measures on these roads, the exact size of speed calmed zones cannot be defined at this point. This will become evident during phase 2.

5.3 Consequences of Sustainable Safety in the urban environment

5.3.1 Traffic restraint and speed calmed areas (areas of mixed use)

As mentioned earlier these are those areas currently designated as a 30 km/h zone, erf (woonerf) and pedestrian areas. Also included are those areas identified for implementation as 30 km/h zone during the period 1998 - 2001. Only the new areas to be implemented qualify for the state subsidy set aside for the Start-up programme of Sustainable Safety.

Traffic restrained areas (areas of mixed use) are characterised by:

- all drivers use the same road or carraigeway
- there are no longitudinal roadmarkings (i.e. centre and edgelines)
- all intersections are uncontrolled (i.e. no assigned priority and the yield to the right rule applies)

Traffic restrained areas can be introduced, amongst others, where people live, work, go to school, shop, recreate and other sensitive areas such as at old age homes, hospitals etc.

Important aspects to remember in 30 km/h zones

The following goals and conditions apply when implementing 30 km/h zones :

1. Locations that are problematic in terms of traffic safety and/or quality of life must be addressed first.
2. The measure "priority for cyclist from the right" must be safely implementable throughout the area.
3. In principle mopeds are restricted from using cyclepaths.

The design and layout of the area make it possible to introduce a general speed limit of 30 km/h throughout the area, except on designated traffic corridors where a 50 km/h limit applies.

5.3.2 Description and implications of the proposed changes

Road authorities must concern themselves with the legislative changes proposed for the measures "priority cyclists from the right" and "moped on the roadway" as well as changes proposed in the design standards and norms (road signs and markings). These changes are necessary to support the implementation of the start-up programme but also imply that road authorities must implement the measures according to the new requirements.

Priority cyclists from the right

The introduction of this amended rule of the road does not have major implications in 30 km/h zones. Since the speed differential between the different road users is already reduced, cyclists can safely be given equal status to motor vehicles in 30 km/h zones.

Moped on the roadway

In the urban area, especially in traffic restrained areas, mopeds will as far as possible be banned from cyclepaths, cycle lanes on the roadway and dedicated cycle routes and be expected to share the roadway with other motorised traffic. In certain situations this may not be possible and excep-

tions may be allowed. Examples of this include situations where the cycle-path offers a shorter alternative to mopeds and situations where due to other constraints the moped rider is forced for short distances to use the roadway, then the cyclepath and then the roadway again. In this last situation it is preferable to ensure continuity and therefore restrict the mopeds to the cyclepath. With both these exceptions, road authorities will be required to replace the dedicated cycle path sign with a shared cycle/moped sign.

Design and layout requirements

The Start-up programme makes mention of a so called "sober" approach in implementing traffic calming measures in traffic restrained zones. The term sober does not reflect a design compromise of the actual measure implemented but that measures are first introduced at problem (unsafe) or potential problem (conflict) locations. Measures adopted must comply to the design layouts set in the standards and guidelines. Measures must at least be introduced at all locations crossing the area boundary as well as at locations that are known problem locations.

On this basis speed reducing and other calming measures are adopted only where the layout and character of the road are such that high speeds are possible (even provoked) and where accidents have occurred or the potential for them to occur is high (e.g. in the vicinity of schools etc.). To the road user these roads appear to be higher order roads with generous geometry, separate facilities for cyclists etc. and carrying relatively high traffic volumes. On the other hand residents along these roads often perceive these as unsafe and generally support the introduction of traffic calming measures. When implementing measures it is necessary to take into account the local situation and, based on a route or area, select and design appropriate measures.

A current requirement in the standards is that 30 km/h roads may not have a through traffic function. For the purposes of the Start-up programme this requirement is waived on condition special attention is paid to the (new) layout of the road and its environment through the application of speed reducing and highly visible (and attracting attention) measures. This applies to primarily intersections on:

- roads/route with relatively high motorised traffic volumes;
- roads/routes for cyclists and/or pedestrians, and especially school routes; and
- public transport routes (ensuring that measures accommodate this)

Priority ruling

Intersections in 30 km/h zones are in principle uncontrolled and priority is not specifically assigned by means of signing and marking. The general rule of the road that traffic (cyclists included) approaching from the right has right of way. By increasing the area of 30 km/h zones this ruling introduces a number of unique problems, one of which is where dedicated bus lanes and cycle paths intersect. In these cases buses must be allowed priority and thus it is allowed to assign priority through the introduction of signing and marking. The same applies to primary cycle paths where limited motorised traffic is allowed.

An alternative to assigning priority by means of signs and markings is to construct exit constructions. In principle this entails elevating a small

portion of the side road to the same height as the pavement with a ramp on either side. Legally this measure means that all road users approaching from a road with an exit construction must yield to all other traffic. The effect is the same as with signing and marking except that the placement of priority signing and marking in 30 km/h zones requires an exemption (for each application) from conditions regulating these areas. Exit constructions are also used to indicate intersections with woonerven and private property with roads used extensively by public transport. Other than that it is not recommended that priority be specifically assigned in 30 km/h zones.

Pedestrian crossings

Current requirements for 30 km/h zones exclude the provision of pedestrian crossings. Due to the extent of expansion of these areas it is anticipated that situations will occur where these may be necessary in future (e.g. at schools and shopping centres). Consequently the road signs and markings standards will be amended to allow pedestrian crossings to be provided in 30 km/h zones.

5.3.3 Duties of the road authority

A framework methodology has been developed to assist road authorities in preparing an implementation plan for the re-engineering of areas identified for traffic restraint (30 km/h zones).

1) Inventory of problem locations and causes

This entails the identification of problem locations on the basis of objective and subjective assessment. The first locations can be readily identified from an analysis of road accidents, traffic volumes and traffic speeds to identify (amongst others) accident locations, high traffic volume locations and areas where speeding is prevalent. The subjective assessment is somewhat more complicated and readers entails an inventory of complaints received by residents, schools, action groups etc., a review of potential conflict areas, pedestrian and cyclist desire lines etc.

In principle an inventory of problem locations requires that specific attention be given to:

- locations where a relatively high number of accidents have occurred in the past three years;
- complaints from residents and other parties;
- the traffic situation in general and specifically problems for pedes trians crossing roads in the vicinity of schools, old age homes, shopping centres, recreational areas, play parks and other areas generating pedestrian traffic;
- pedestrian and cyclist desire lines and points of conflict with high speed traffic;
- roads used by through (non-local) traffic;
- roads that differ significantly with respect to traffic volumes, speeds and appearance from other roads in the area; and
- the intersections and locations on the boundary of the area.

2) Development of solutions

Based on the inventory of the problem locations solutions can be developed and measures identified for eventual implementation. A procedure for selecting appropriate measures at intersections, between intersections, at network level and at boundaries (gateways) is provided

in various supporting guidelines (ASVV, 1996; Sustainable Safety Information Centre, 1998,1999). The guidelines provide design and l layout details for a broad range of traffic calming devices. Important in the process of developing solutions and identifying appropriate measures is that interested and affected parties are consulted in this process.

3) Implementation plan

Based on the costing of the selected measures a detailed implementation plan can be developed according to the available budget. In many cases the cost of the package of measures will exceed the available budget and the road authority will have to prioritise and phase the implementation.

The Start-up programme estimated that the average cost for re-engineering roads in traffic restraint areas would be ƒ25 000,00 per kilometre road length. The state's contribution (subsidy) toward this is 40 per cent of the cost with a maximum of ƒ10 000,00 per kilometre. This average cost takes into account that an extensive part of the existing urban road network has already been adapted and that only minor investment is necessary in these. On the other hand areas realised in the 1950's and 60's require major infrastructural adaptation and it is anticipated that with the subsidy these can be introduced.

4) Evaluation

It is important that the (traffic) effects of implemented measures and schemes are monitored and evaluated. This allows for the identification of remaining problems and the implementation of additional (supporting) infrastructure or small modifications to existing layouts. In the event of a "sober" approach to traffic calming, monitoring assists in identifying operational problems that can in future be taken into account during the planning phase.

5) Communication

As mentioned earlier, the involvement of Interested and Affected Parties (I&AP's, residents, shop owners, public transport operators etc.) during the planning phase of traffic calming schemes is vitally important to the eventual successful implementation. Public participation in the planning stage facilitates the incorporation of public needs and opinions whilst simultaneously creating awareness of the proposed scheme.

In the Netherlands there are a number of approaches to public participation during the planning process. These include PODO, Casco and the ANWB (exceptionally Safe) methods.

5.4 Potential traffic restraint areas

Financially it is unrealistic to realise the total (traffic calmed) 30 and 60 km/h road network in the short term. For this reason the Start-up programme has set as goal 12 000 km of 30 km/h roads by 2002.
A proportion of these roads will be adapted on a phased approach, in the short term implementing measures at problem and potential problem locations (the sober approach) and in the long term based on the traffic calming guidelines for 30 km/h zones. However, it is anticipated that even with this approach there will be a proportion of 30 km/h roads where a

sober approach will be insufficient to change the character of the road. These problems include :

- the extent of the problems is severe;
- the road authority does not have the necessary expertise;
- the road authority does not have sufficient (human and plant) resource capacity; and
- there are inadequate financial resources.

From Figure 5.1 these roads are classified as provisional 50 km/h roads in the identified traffic restraint area. The road authority must however take into account the introduction of mopeds on the roadway, priority for cyclists from the right and assigning priority at intersections along traffic corridors. Subsidies for these measures have been reserved by central government. With the exception of placing signing and marking restricting mopeds to the roadway, steps can be taken to implement the supporting measures.

5.4.1 Tasks of the road authority

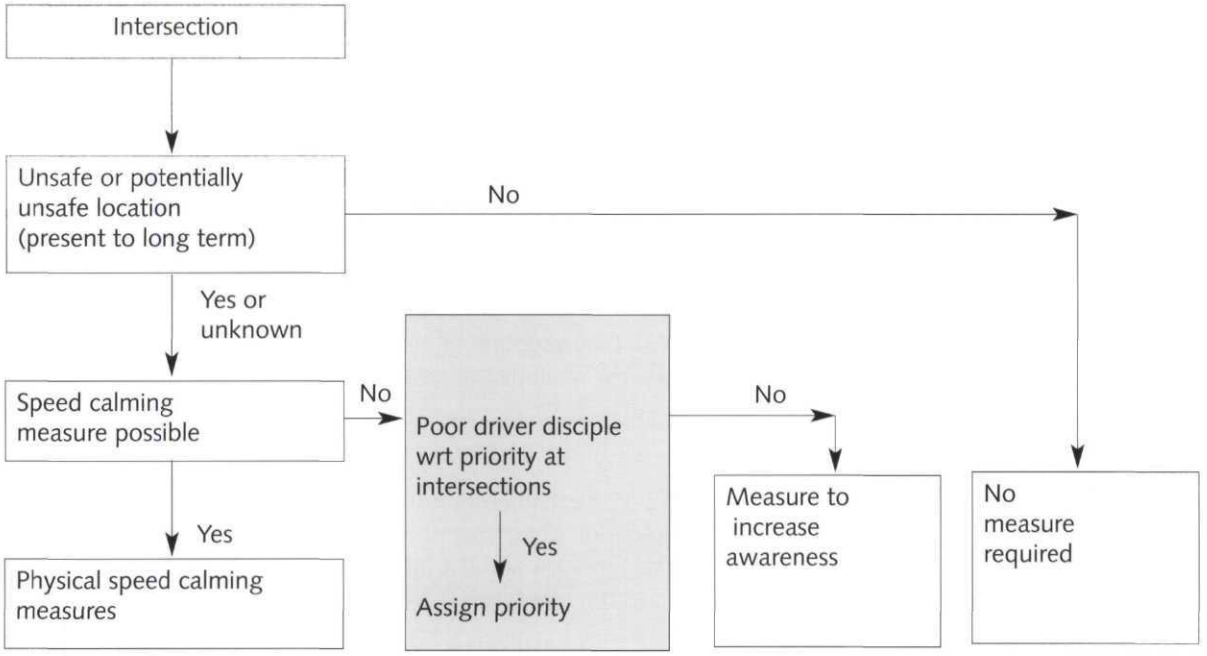
The primary task of the road authority with respect to provisional 50 km/h roads is the preparation of an inventory of problem (unsafe) and potential problem (conflict) locations and the identification of measures to support the introduction of the three new rules of the road.

Priority cyclist from the right

The most significant change with respect to traffic restraint areas is the introduction of priority for cyclists from the right. For the provisional 50 km/h roads in these areas extra attention has to be paid to the measures identified to support its introduction, especially since speeds on this category road are higher (50 instead of 30 km/h).

An evaluation of all intersections and conflict locations on these roads must be conducted to identify those where road safety might be negatively impacted by the introduction of the new rule. The evaluation must pay specific attention to prevailing traffic behaviour with respect to priority, speed distributions and profiles, sight distances and visibility. At potentially unsafe locations, 30 km/h traffic calming measures must be selected (Figure 5.3) and implemented. Examples of applicable measures are plateaux's, raised intersections, temporary placement of warning signs (J8), road markings to heighten awareness and temporarily assigning priority. The last mentioned is the least favoured measure.

Figure 5.3
Selection of measures at intersections



Moped on the roadway

In the urban environment, and especially in 30 km/h and potential 30 km/h zones, it is recommended that mopeds are banned from cycle paths and assigned to the roadway. There are however certain exceptions where this is not possible (Figure 5.4).

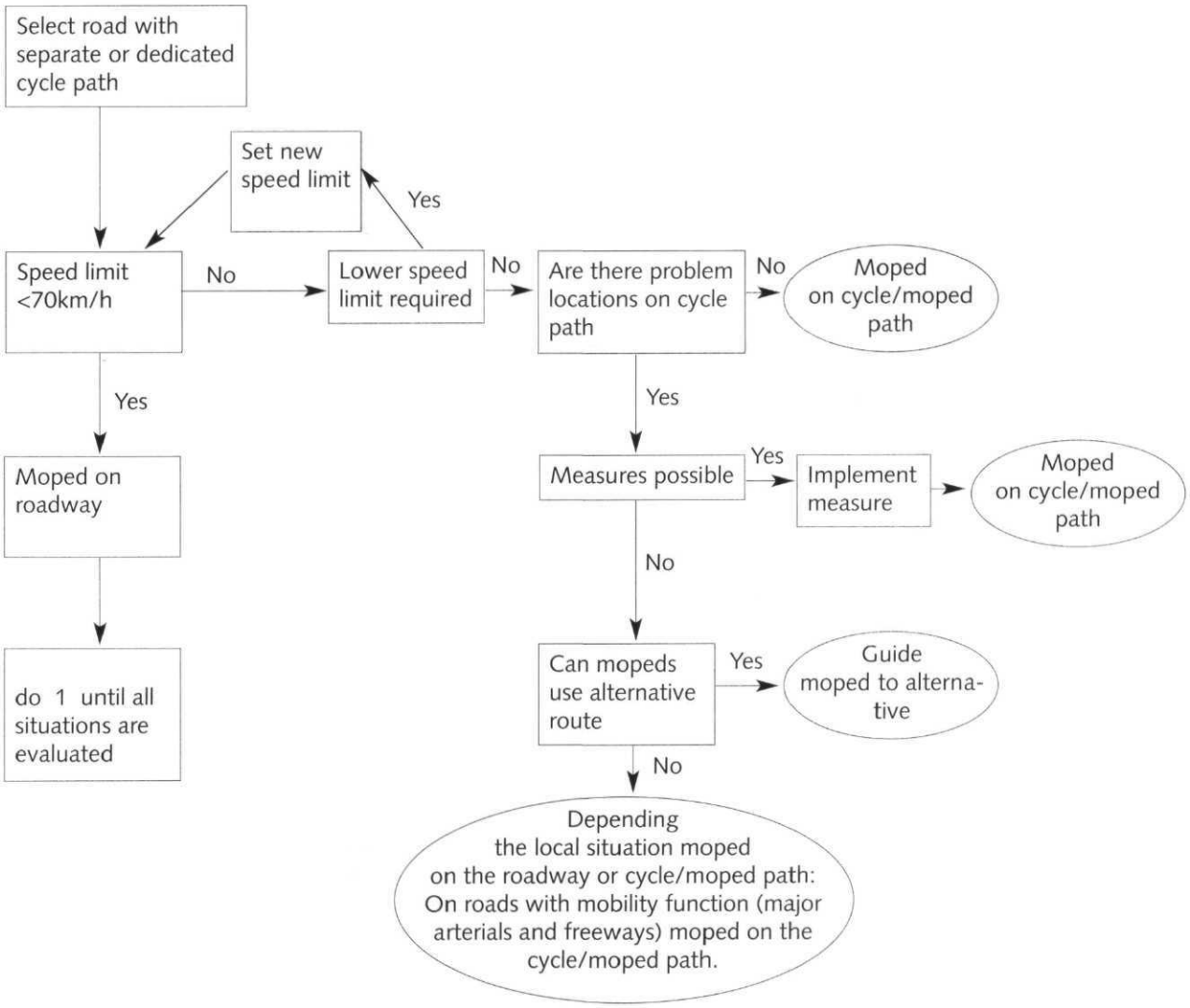
One of the exceptions applies where the moped is diverted from the cycle/moped path to a short length of roadway and then back to the cycle path. In these cases it is preferable to provide continuity by means of (other) infrastructure or traffic management measure. A second exception applies where the cycle path offers the logical shortest route and diversion to the roadway would lead to significant increases in the moped journey time.

Where the moped remains on the cycle path the new sign "Compulsory cycle/moped path" must be erected. Road authorities must pay specific attention to the transition zones where the cycle/moped path switches to the roadway. These must be located such that all road users can anticipate them, use them safely and clearly comprehend the situation.

Transition zones - traffic restraint road to traffic corridor

At transition zones where provisional traffic restraint roads become or join traffic corridors speed limits are kept at 50 km/h. Important however is that priority is assigned to the traffic corridor by erecting road signs B3 to B6.

Figure 5.4
Decision matrix for moped on the roadway



5.4.2 Communication

The primary change to the traffic operation in provisional traffic restraint areas is introduced through changes in legislation which are supported by the limited application of (supporting) traffic calming measures. For the new supporting infrastructure it is recommended that I&AP's participate in the planning and implementation process, especially for the introduction of priority for cyclists from the right.

Legislative changes will be communicated at national level through all forms of mass media. Municipal and other road authorities are encouraged to support the national action with local communication campaigns. It is also recommended that road authorities in consultation police, department of education schools and others, prepare specific communication and educational campaigns for certain target groups which will be affected by the new traffic legislation. These include primary and secondary school children and the elderly.

5.5 Traffic corridors and provisional corridors

During the transition from the existing to the future re-classified road network, there will be roads that under current operation have a predominant traffic function (provisional traffic corridors). These may in time be downgraded to pure access roads or remain functioning as arterials. During the transition phase speed limits of 50 (or sometimes 70) km/h apply.

Road authorities must pay attention to infrastructure for mopeds on the roadway (see also Chapter 5.3 and 5.4), assigning priority at all intersections to the traffic corridor and ensuring that roundabouts all have the "new" priority rule (i.e. circulating traffic has priority) in operation. Also recommended is that cyclists on separate cycle paths at roundabouts are given priority over motorised traffic in the urban areas. The reverse is recommended for cyclists at roundabouts in rural areas.

At signalised intersections road authorities must also erect traffic signs assigning priority. This is deemed necessary for instances when the signals are not operating (e.g. power failures, maintenance etc.).

At priority controlled intersections road authorities may introduce speed calming measures to support the traffic control measures.

5.6 Consequences for roads in rural areas

5.6.1 Traffic restraint areas (60 km/h roads)

The long term goal is to realise infrastructurally adapted 60 km/h zones in all (potential) traffic restraint areas. During the first phase three short term goals apply, namely to reinforce the mixed use (shared) function of the area , traffic volumes are low or are reduced by means of selective traffic calming and speeds are kept at acceptable levels.

During the first phase, road authorities, in this case primarily the UvW (Union of Waterways), must pay specific attention to problem locations (in terms of road safety and quality of life), the safe introduction of "priority cyclists from the right" and where necessary accommodating mopeds on the roadway.

In principle the same conditions for implementation apply as to roads in urban areas (refer to sections 5.1 to 5.5). However, certain situations in traffic restrained rural areas require specific attention. One of these is the treatment of property access roads to farms which may or may not be surfaced. These intersections must be reconstructed as exit constructions with a vertical difference between the 60 km/h road and the property access road. In principle intersections on 60 km/h roads are uncontrolled and the rule "yield to all traffic (incl. cyclists and mopeds) approaching from the right" applies. In certain situations the road authority may assign priority at intersections (e.g. poor sight distances or potentially unsafe conditions). Also locations where large pedestrian movements occur may be restricted to a 30 km/h speed limit and measures to support this introduced.

Roads designated as potential 60 km/h roads will (in the short term) operate as 80 km/h roads. Because of the higher speed differential between road users, road authorities must pay specific attention to intersections with cycle/moped paths to ensure the safety of the more vulnerable road user. On these provisional 80 km/h roads it is recommended that mopeds use the cycle paths.

As far as distributor and potential distributor roads in rural areas are concerned the road authority must follow the same principles as applied for this category of road in urban areas. However, mopeds are restricted from using the roadway where separate cycle infrastructure exists. Priority must be assigned at intersections. At roundabouts with separate cycle/moped facilities priority is assigned to motorists and measures must be taken to ensure that all roundabouts operate on the "priority to circulating traffic" rule.

5.6.2 Regulations applying to 60 km/h roads

In general speed limits are posted as a logical result of the image projected by the road and its environment. For 60 km/h roads however, new conditions have been introduced in regulations and standards and these are :

1) The road primarily provides access to (private and public) property.
2) To prevent high volumes and proportions of through (non-local) traffic, roads and their environment are adapted (calmed) accordingly.
3) In the light of speed reduction and/or raising the awareness extra attention is paid to (potential) unsafe locations. Examples of these are locations with high volumes of crossing pedestrians, intersections with high volume cycle routes and priority controlled intersections.
4) Roads with transition zones from one speed limit to another are clearly constructed and marked to indicate the higher or lower limit.
5) If the transition to a higher speed limit occurs within 20 metres of an intersection, that intersection will be priority controlled or an exit construction will be introduced.

6 Selection and Implementation of Measures

This chapter provides an overview of the process followed to date in the Start-up programme and gives examples of the measures implemented. The overview is presented as a series of case studies as illustration of the process. A brief summary of the results of case studies is also presented.

6.1 Road categorisation plans

A sustainable safe traffic and transport system has three road categories, roads with a pure mobility function (freeways and expressways), distributor roads linking areas to the mobility roads (inter-district arterials and district collectors) and access roads providing access to property. To ensure traffic safety on these roads they must comply to three safety principles, namely:

- a road may only have one function;
- conflicts resulting from directional differences (opposing and crossing traffic streams) and large variations in mass, combined with large speed differentials must be avoided and where they cannot be avoided the impact of differences minimised; and
- the prevention of unsure road user behaviour through the provision of uniform traffic control and management measures that distinguish differences between road classes.

From this 12 functional requirements of a sustainable safe road network emerge, namely:

- The traffic restraint areas (areas of mixed use) must be continuous and as large as possible.
- The smallest proportion of the trip must occur on the (relatively) unsafe part of the road network.
- Minimise trip lengths.
- Combine the shortest and safest routes.
- Avoid that travellers must search for destinations.
- Make the different road categories unique and recognisable to the road user.
- Limit the number of engineering solutions and keep these uniform.
- Avoid conflicts with opposing traffic.
- Avoid conflicts with crossing traffic.
- Separate different classes of traffic.
- Reduce speeds on approaches to potential conflict points or locations.
- Avoid obstacles along the roadway.

By applying these principles, the primary characteristics for each road category were developed (Table 6.1). Based on these characteristics, design criteria were developed (CROW, 1996) for each road category (Tables 6.2 and 6.3).

Table 6.1

Characteristics per road category

Road type	*Urban areas*	*Rural areas*
Access roads	■ 30 km/h speed limit ■ No longitudinal road markings ■ No lane marking or separation ■ Uncontrolled intersections (priority from right rule) ■ Mixed traffic ■ Selective speed calming between and at intersections ■ Mopeds on the roadway	■ 60 km/h speed limit ■ No directional separation longitudinally ■ No lane separation ■ primarily uncontrolled intersections (priority from right) ■ Selective speed calming between and at intersections ■ Moped on the roadway
Potential access roads	■ 50 km/h speed limit ■ As many characteristics of the access roads	■ 80 km/h speed limit ■ As many characteristics of the 60 km/h roads ■ Moped and cyclist on cycle path
Provisional traffic corridors (distributors)	■ 50 km/h speed limit ■ Priority controlled ■ Moped on the roadway ■ Provisions for cyclists (priority from the right)	■ 80 km/h speed limit ■ Priority controlled ■ Broken edge marking ■ Continuous centre line marking ■ Moped and cyclist on cycle path
Traffic corridors (distributors)	■ 50 or 70 km/h speed limit ■ priority controlled ■ cyclists on cycle path ■ on 70 km/h roads moped on the cycle path ■ Divided carraigeway	■ 80 or 100 km/h speed limit ■ Priority controlled ■ Divided carraigeway ■ Broken edge marking on 80 km/h roads ■ Continuous edge marking on 100 km/h roads ■ Cyclist and moped on cycle path

Table 6.2

Operational requirements for roads outside built-up areas (CROW 1996)

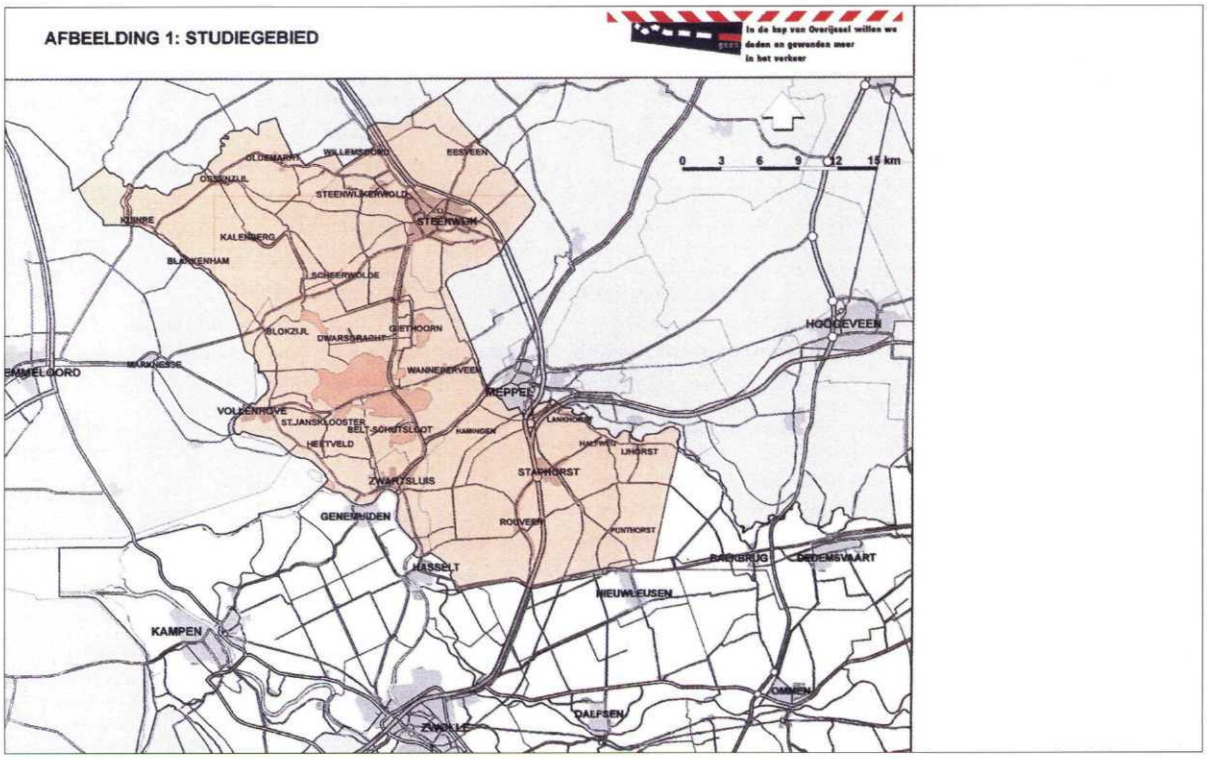
Operational criteria/design elements	*Through roads*	*distributor roads*	*access roads*
maximum speed	120/100 km/h	80 km/h	60
directional signs	situation dependant on category		
longitudinal road markings	full	partial	none
Number of lanes	2x1 or more	2x1 or more	1
Surfacing	impervious (asphalt or concrete)	impervious (asphalt or concrete)	pervious (pavingstone, brick)
connection with residential areas (property access)	no	Limited or none	yes
carriageway separation	Physical median	difficult to traverse	none
intersections	grade separated	roundabouts/traffic control and priority control	intersections with speed control measures
parking	no	no	on carriageway
provisions for breakdowns	emergency lane	hard shoulder or turnouts	none
obstacle distance	large	medium	small
bicyclists	separated	separated	situation dependent
mopeds	separated	separated	on the carriageway
slow-moving motorised traffic	separated	separated	on the carriageway
speed reducing measures	no	suitable measures	yes
public lighting	dependant on situation and category		

Table 6.3
Operational requirements for roads inside built-up areas (CROW 1996)

Operational criteria/design elements	*distributor roads*	*access roads*
maximum speed	50 or 70 km/h	30 km/h
directional signs	dependant on situation and category	
longitudinal road markings	partial	none
Number of lanes	2x1 or more	1
Surfacing	impervious (asphalt or concrete)	pervious (pavingstone, brick)
connection with residential areas	limited	yes
carriageway separation	difficult to traverse	none
intersections	roundabouts or speed control measures and priority control	uncontrolled with speed control measures
parking	only in parking facilities	on carriageway
provisions for breakdowns	parking lane	none
obstacle distance	medium	small
bicyclists	separated	on the carriageway
mopeds	separated from 70 km/h on carriageway from 50 km/h	on carriageway
slow-moving motorised traffic	on the carriageway	on carriageway
speed measures	yes	yes
public lighting	dependant on situation and category	

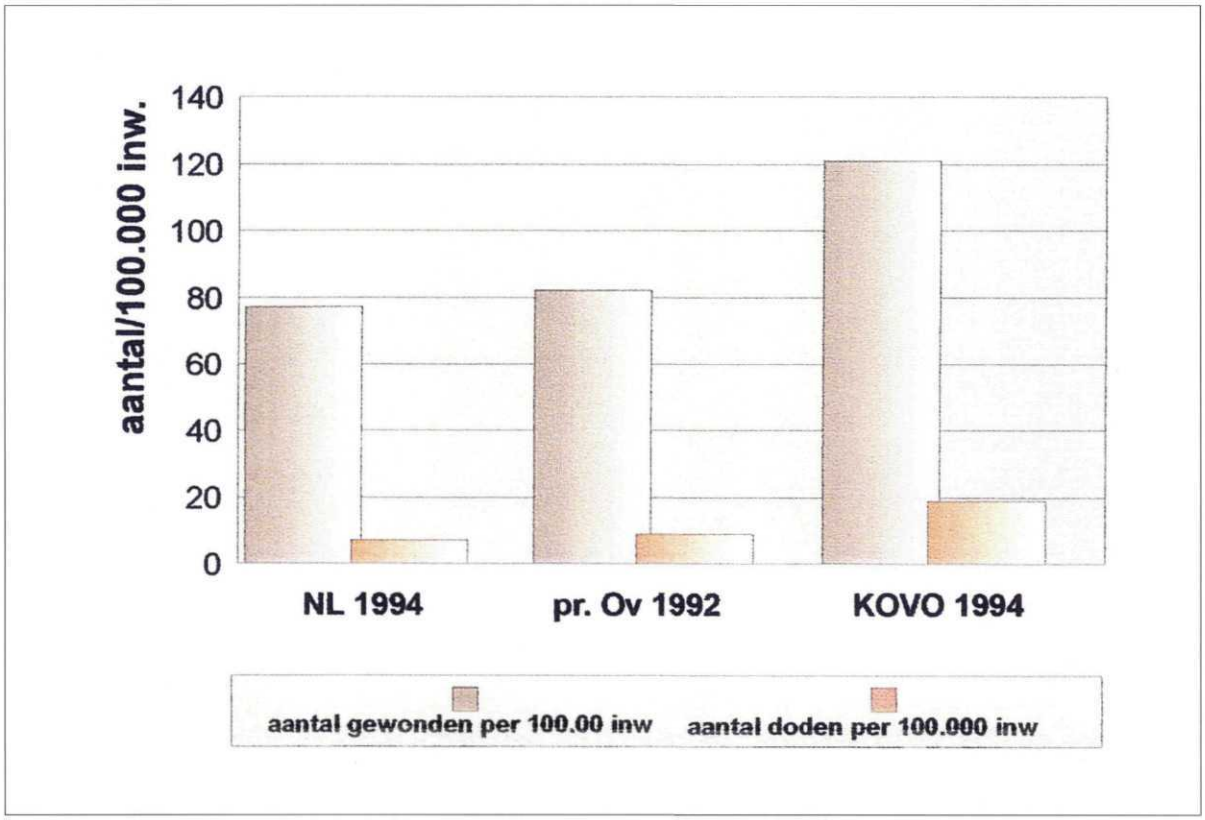
To illustrate realising a re-classification of an existing road network on the basis of the sustainable safety goals and principles the region "Kop van Overijssel" (KOVO) is used as example. The region (Figure 6.1) has a road accident fatality rate (based on 100 000 population) almost five times the national rate (Fig. 6.2). Consequently a working group was set up in the region to specifically develop a categorisation plan as one of the first steps to addressing the road safety problem in the long term.

Figure 6.1
The KOVO study area



The approach adopted by the working group was based on extensive participation and awareness creation with all relevant stakeholders in the region. In addition particular attention was paid to the relation between traffic and other policy. An integral traffic management vision was formulated to serve road traffic safety and the other policy areas of nature, recreation, environment, land use, quality of life and others.

Figure 6.2
Fatal road accident rates, national and KOVO



The working group chose awareness building, communication and participation as the foundation to the development of the plan. A series of information sharing sessions were organised with residents of the region to create awareness of the concepts of Sustainable Safety, road categorisation, long term vision etc. Following this, workshops were held in each local authority area and involving persons selected from the information sharing sessions. The workshops each comprised three components, a briefing of the principles underlying categorisation, categorisation of the regional road network (rural) and finally categorisation of the local authority road network with an indication of the traffic calming measures which could possibly be implemented. The results of these are shown on Figure 6.3. Based on the initial plans generated by the workshops a work conference was organised with private sector and other organisations, specifically to measure areas of conflict.

The plans developed through the participation process were evaluated from a traffic engineering perspective (applying traffic assignment models based on various short to long term traffic forecasts, land use scenarios etc.) and compared with a number of long term road network development strategies and plans (fig. 6.4 - 6.7). From this a "provisional" integral vision of a future road network was developed (fig. 6.8) and shared with stakeholders

and participants from previous meetings. Also a provisional road classification of urban roads was developed (fig. 6.9) and potential 60 km/h zones defined (fig. 6.10). Figures 6.11 and 6.12 provide examples of measures identified for the different road classes in rural and urban areas.

The example from the KOVO region illustrates that through an inclusive process and taking into account policy, future growth, land use and related issues an existing road network can be functionally re-classified and operationalised.

Figure 6.3
Initial road network classification
- Kop van Overijssel (KOVO)

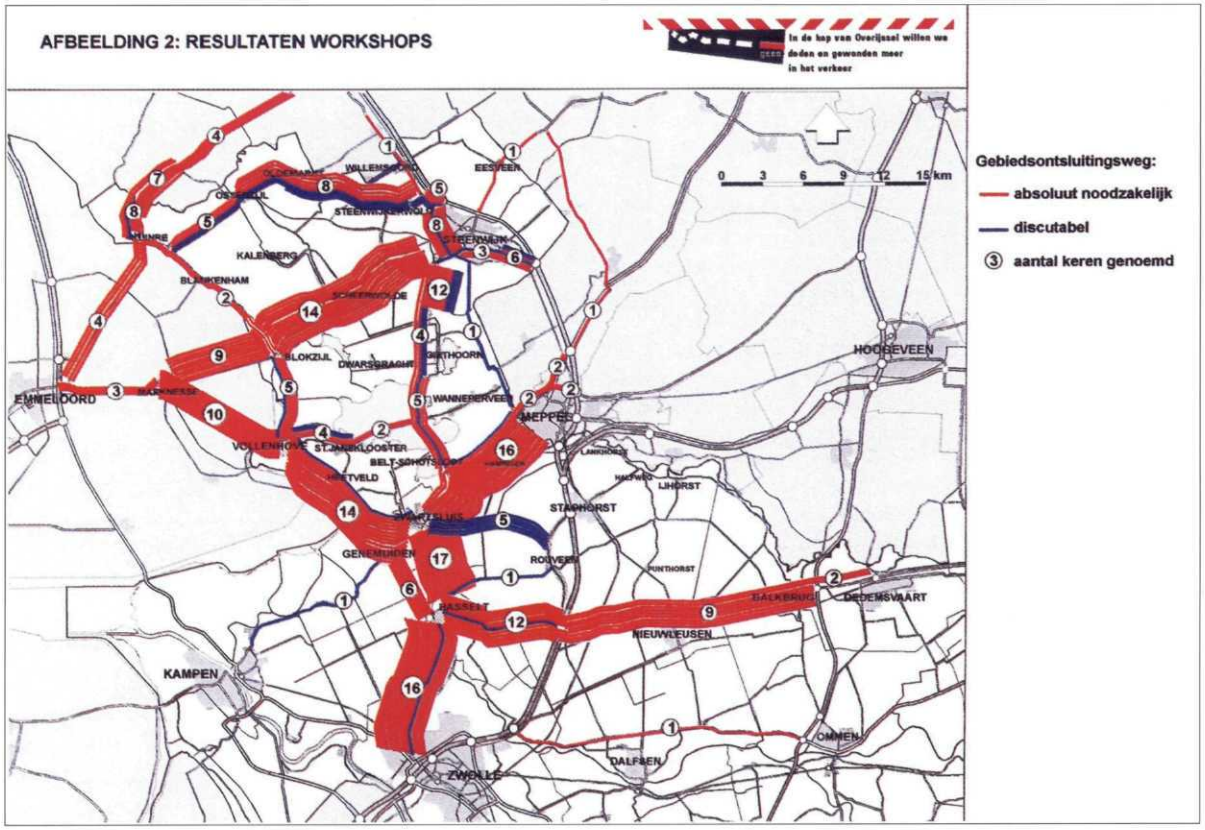


Figure 6.4
Road network vision - Accessibility, safety and mobility

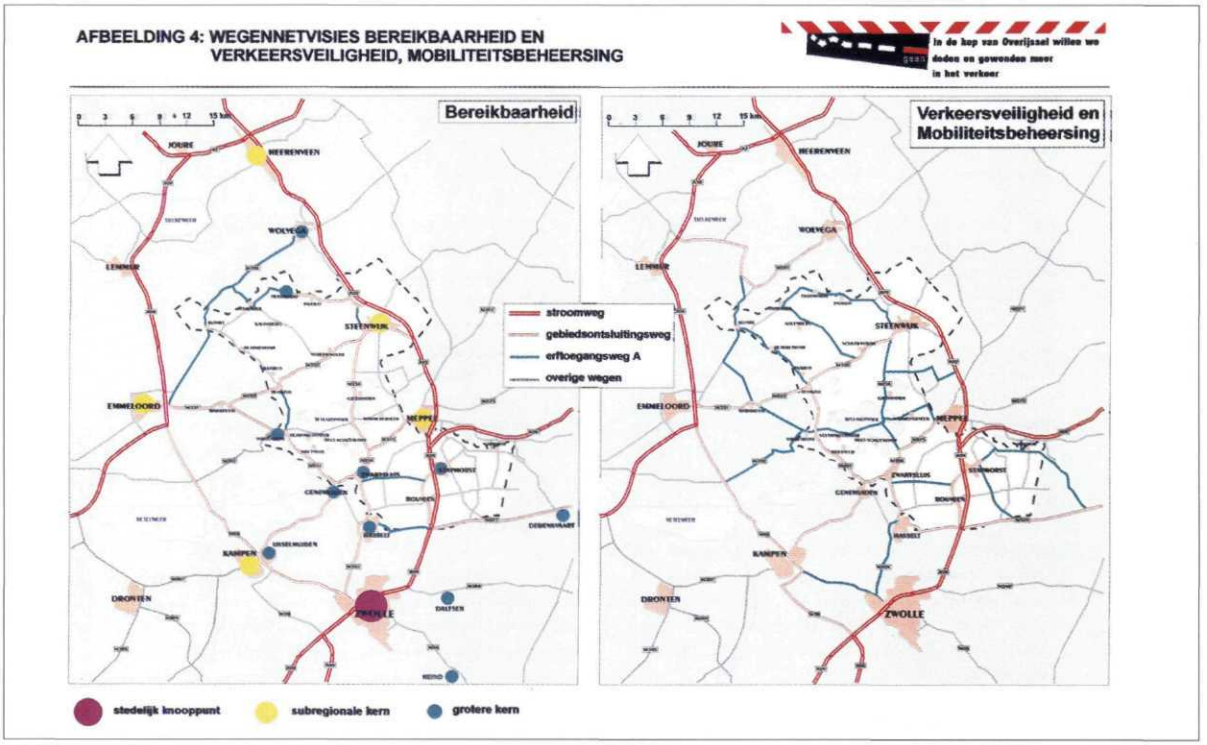


Figure 6.5
Road network vision - Quality of life and environment

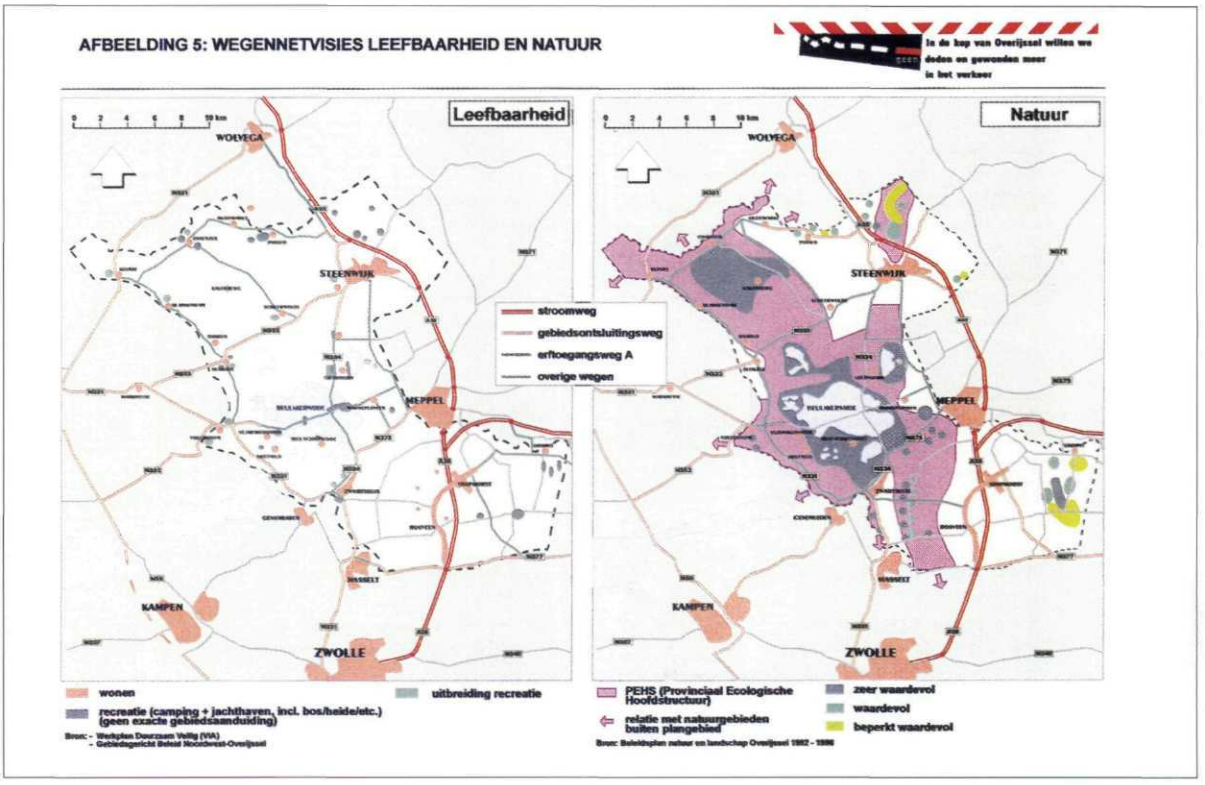


Figure 6.6
Road network vision - mobility growth

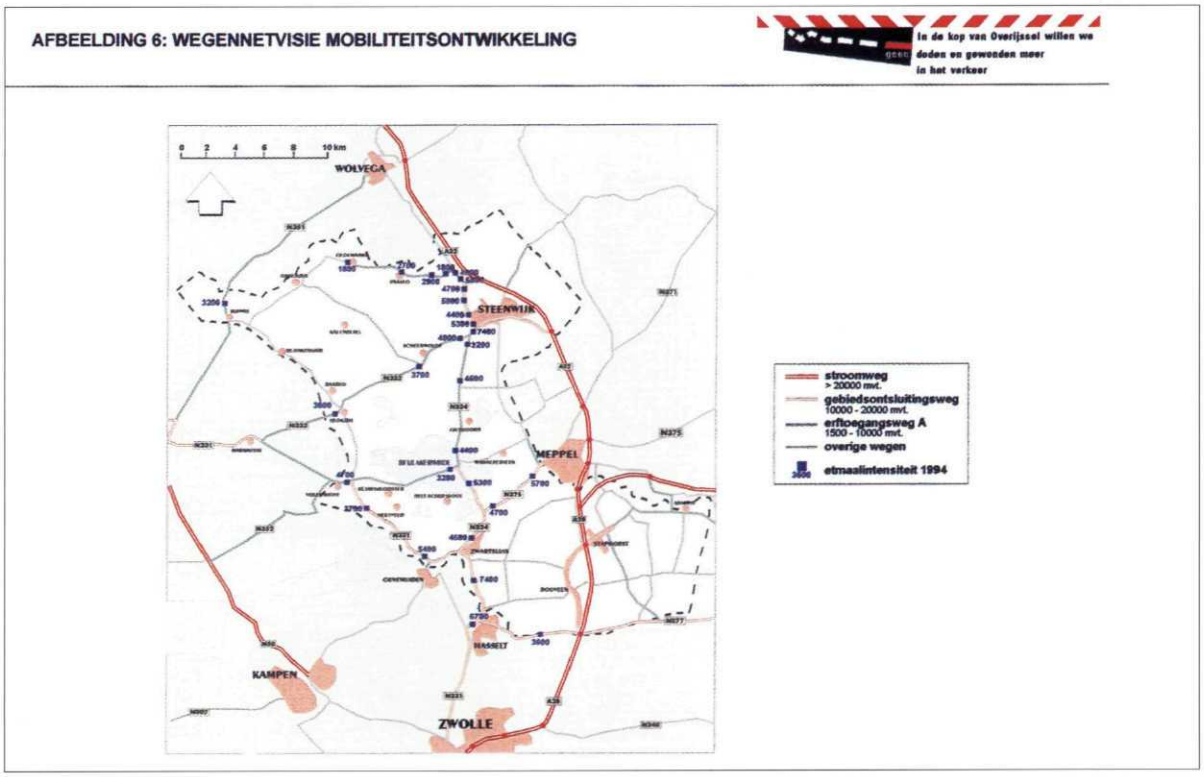


Figure 6.7
Traffic assignment - Re-classified network in 2010

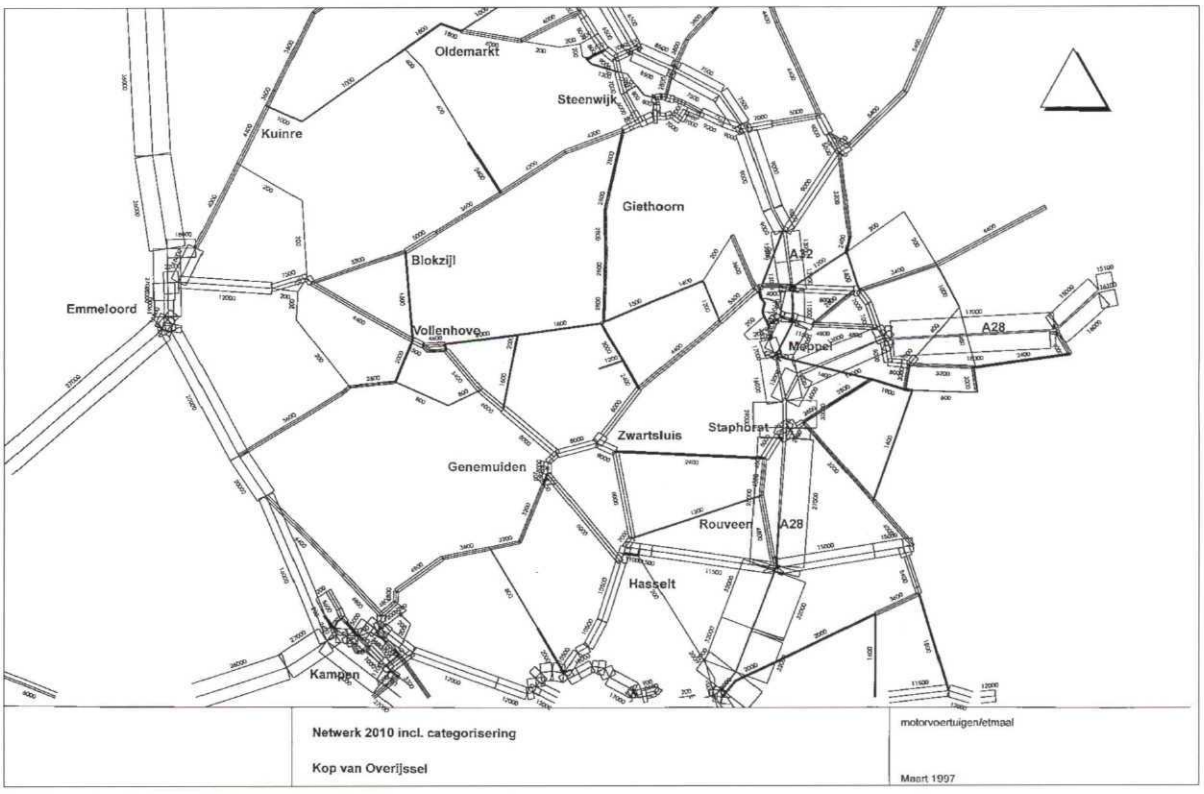


Figure 6.8

Desired KOVO road network

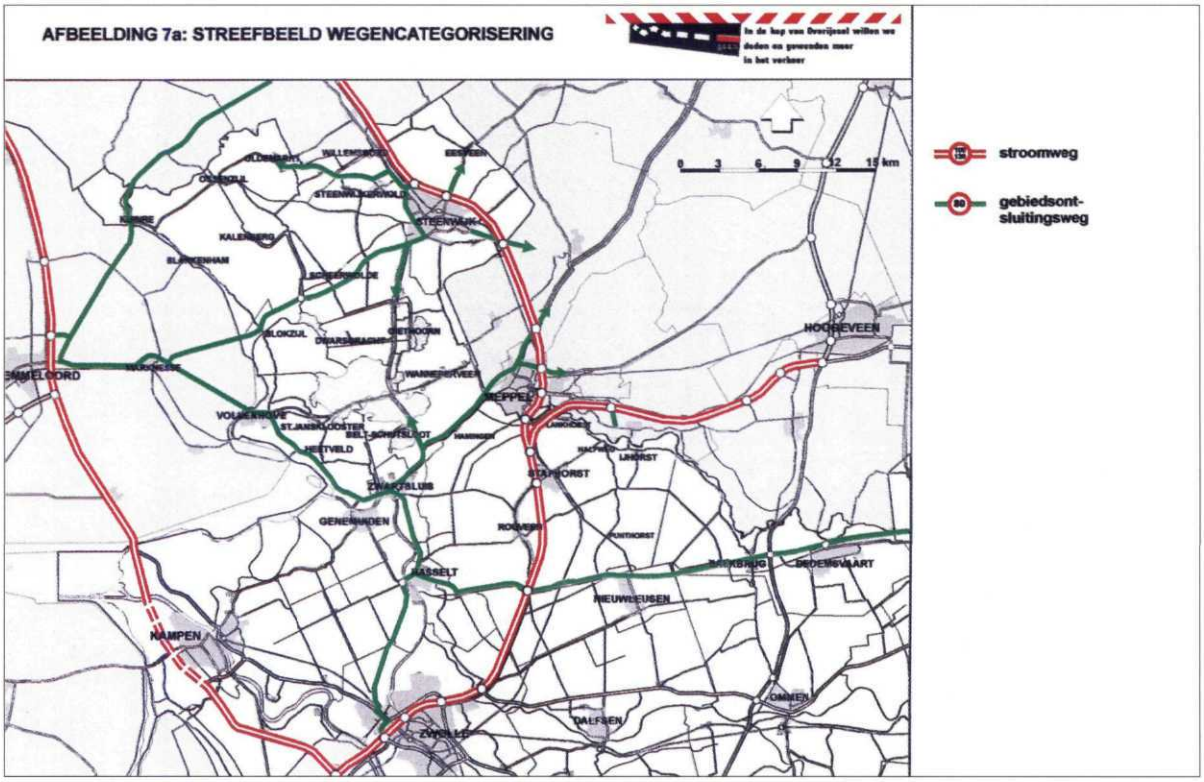


Figure 6.9

Desired KOVO road network, Urban areas

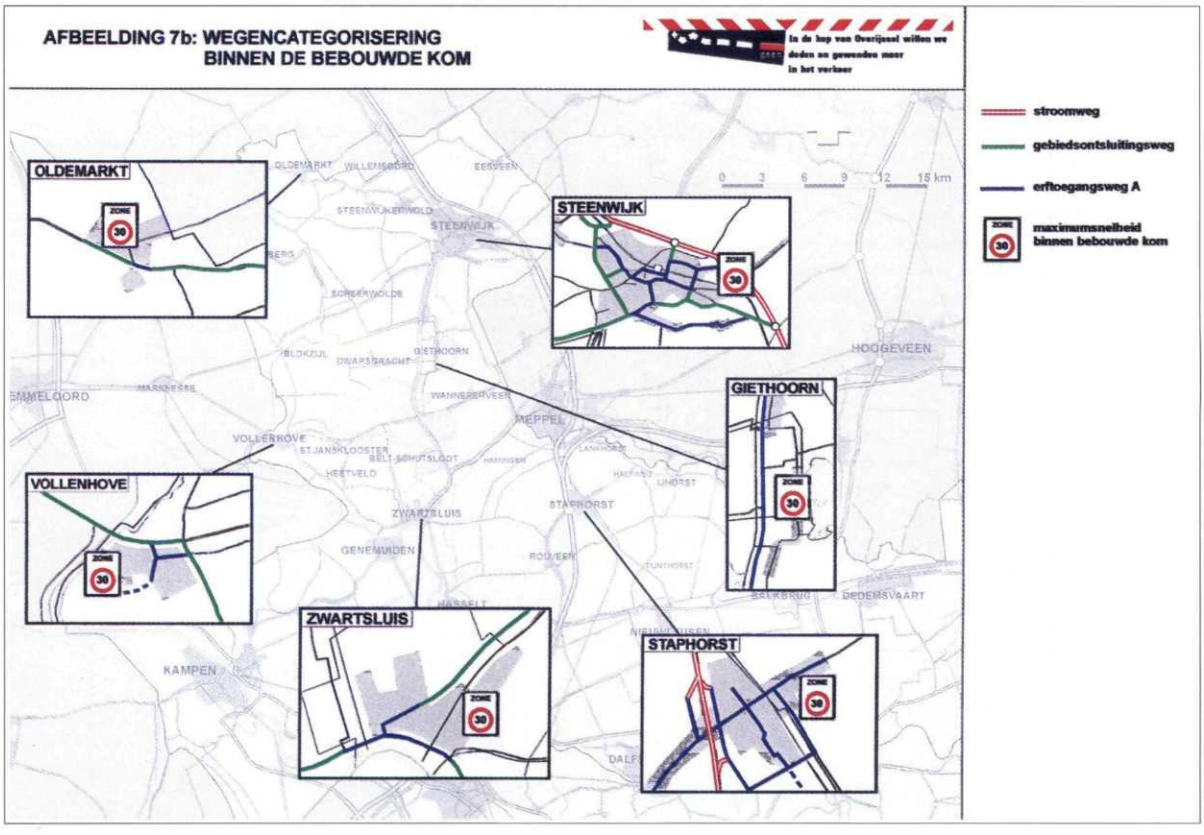


Figure 6.10
Desired 60 km/h zones in KOVO

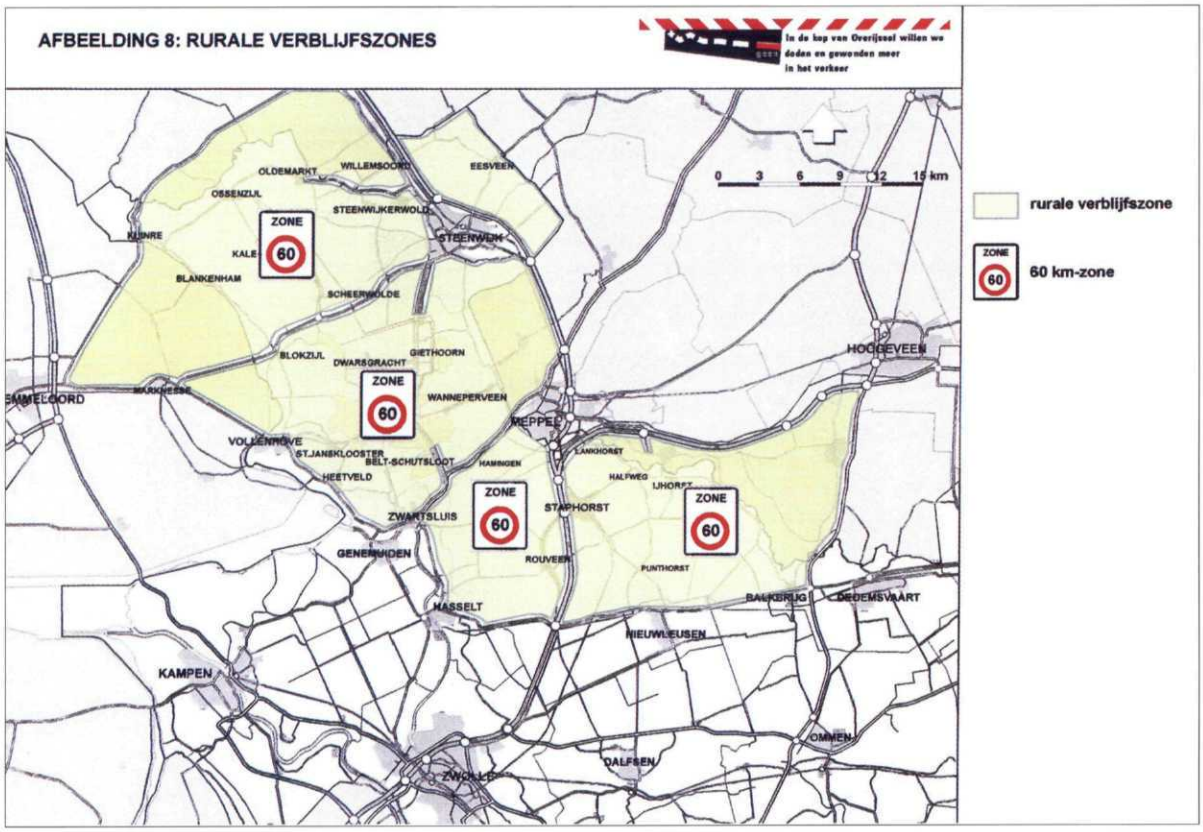


Figure 6.11
Examples of measures in rural areas (KOVO)

Figure 6.12 : Examples of measures in urban areas, KOVO

6.2 Measures for 30 km/h roads

This section provides an overview of the process for introducing traffic calming infrastructure on access roads in newly zoned 30 km/h areas, both on the basis of the "sober" (i.e. problem locations) and optimal (according to the 30 km/h guidelines) approach.

Functionally access roads accommodate the displacement of all traffic movements at different speeds and/or direction. These roads collect and distribute traffic, accommodate all turning movements, allow stopping and parking of vehicles and facilitate pedestrian and cycle movement.

The access road is intended purely providing access to private and public property in urban (including erven, woonerfs) and rural traffic restraint zones. Because these roads are open to all traffic and permit all movements speeds are low. All access roads are designated as 30 km/h roads.

However, the Start-up programme has anticipated that the re-classified road networks cannot be implemented in one short phase and will need to evolve over a longer period of time. Hence provisional road classes are allowed in the short term and their final classification will become clearer as the road network infrastructure is adapted. Provisional access roads are allowed a 50 km/h limit but measures applicable to 30 km/h roads must be introduced at unsafe and potentially unsafe locations.

Access (30km/h) roads are characterised by having a single carriageway with one or two lanes and allowing two directional flow. These roads have

no longitudinal road markings nor are traffic lanes indicated. Pedestrian and cycle crossing movements may occur over the entire length and the road is shared by all traffic (vehicles, cycles, pedestrians, mopeds etc). In certain situations transverse road marking may be introduced for pedestrian crossings or to increase the visibility of an intersection. Intersections with other access roads have equal priority and are uncontrolled. Intersections with higher order 50 km/h distributor roads are priority controlled. Parking is allowed over the length of the road but the road authority must ensure that the safety of children is guaranteed. No specific provision for public transport (turning bays etc.) is made other than normal stopping points. To distinguish these roads from others it is recommended they are surfaced with open surfacing (brick or other paving). If asphalt is used then this should have a different texture and colour. Due to the low speeds on these roads, the clear roadside area (obstacle distance) is of lesser importance and lateral distances of between 25 centimetres (vehicle side to kerb) and 1 metre (vehicle side to vertical wall) are recommended.

6.2.1 Design speeds and other considerations

Depending on the budget available to the road authority, he may implement traffic calming measures on the basis of the guidelines for 30 km/h zones (optimal spacing of measures) or implement on the basis of guidelines for a "sober" approach". The latter implies that measures are implemented :

- at high accident locations
- at locations that are subjectively unsafe (complaints)
- at locations generating pedestrian and other vulnerable road user traffic (e.g. schools, old age homes, shopping and recreational areas etc.)
- at locations near and with pedestrian or cycle routes (intersecting or alongside)
- on roads which differ in terms of appearance, volume or speed to other roads in the area
- at locations on the boundary of the area.

It is important that measures implemented conform to recommended design practice and that uniformity in design and layout is strived for. Table 6.4 gives the recommended design speeds for speed calming measures on access (30 km/h) roads in urban traffic restraint zones.

Table 6.4
Design speed for speed calming measures in 30km/h zones

Location of the measure	Design speed (km/h)
Gateways (boundary of area)	30
On road links	30
At intersections	15 - 30
At conflict points	15 -30

Traffic volumes are not a major determinant for defining an access road. Typically these roads can accommodate 5 000 - 6000 vehicles per day although higher volumes are allowed if these do not materially affect the quality of life or the participation of other road users.

Although recommended that the size of 30 km/h zones should be as large and as continuous (not regularly separated by 50 km/h distributors) as possible, there is no definitive limit set in this regard. Journey times of between 3 and 5 minutes at speeds of 30 km/h are accepted by motorists

before a higher order (and higher speed) road is expected. This relates to a traffic restraint zone of roughly 3 to 5 kilometres in diameter. However, this is an indicator only and the size of the zone is dependant on the local situation.

6.2.2 Measures that impact traffic at the network level

The re-classification of the existing road network may have significant impact on current origin destination patterns within the region. The up or downgrading of a particular road class implies that through traffic has to be re-assigned to the intended traffic corridor. For this purpose traffic calming measures aimed at diverting through traffic from newly defined traffic restraint zones are adopted. However, before these are implemented the road authority must ensure that sufficient capacity and required traffic management and control exists on the designated higher order road network.

Two approaches for diverting through traffic exist, namely making the road less attractive by regularly applying traffic calming measures and thereby significantly increasing journey times, and physically limiting access into the area and/or physically breaking up long continuous through routes in the area (Figure 6.13).

All of the above approaches have a negative impact on emergency, public transport and service vehicles. It is important to consider this and be flexible in designing appropriate measures that accommodate these needs. An effective network measure in the Netherlands is the placement of restriction signs which has been known to divert up to 70 per cent of through traffic. However, it is often necessary to implement supporting infrastructure in the form of physical closures (figs. 6.14 - 6.16).

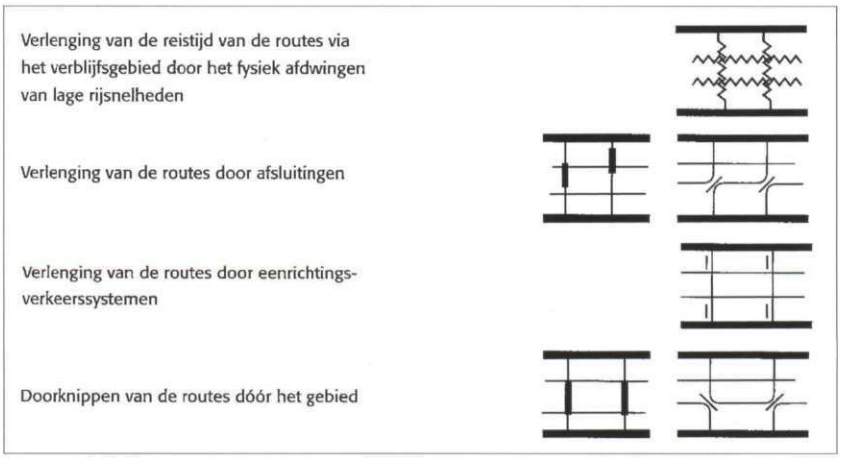


Figure 6.13
Strategies for traffic restraint

Figure 6.14
Diagonal closure

Figure 6.15
Physical closure

Figure 6.16
Partial closure

6.2.3 Gateways (Boundary treatments)

A number of gateway alternatives are possible, including speed transition zones within the urban environment and transition zones between rural and urban boundaries. The speed transition zones that occur in the urban environment are :

- 70 km/h arterial to 30 km/h access road
- 50 km/h arterial and provisional 50 km/h arterial (or access road) to 30 km/h access road

On the boundary of urban and rural areas the following speed transition zones are possible:

- 80 km/h rural distributor (and potential 80 km/h rural distributor) to 30 km/h urban access road
- 60 km/h rural access road to 30 km/h urban access road.

The layout of the gateway is dependant on the nature and environment of the traffic restraint area and existing layout of the road. If the transition is between a distributor and an access road then a minimum requirement is a double transverse line over the width of the road and supported by 30 km/h zone road sign on either side (fig. 6.17). Where the nature of the traffic restraint area is self evident and the road width is less than 5 metres then a 30 km/h zone is placed only on the right hand side of the roadway (fig 6.18). Where the nature of the area is not self evident, additional measures (figs. 6.19 and 6.20) must be implemented (ASVV, 1996).

Figure 6.17
Gateway treatment Transition 50 km/h arterial to 30 km/h access road

Figure 6.18
Gateway treatment on narrow roads

Figure 6.19
Supportive gateway treatment

Figure 6.20
Supportive gateway treatment

Transitions between rural roads and 30 km/h roads in 30km/h zones, the treatments are similar (fig. 6.21 and 6.22)

Exit construction may also be applied as a gateway treatment at intersections in the urban environment. In this case intersections may also be priority controlled and the approach entering the traffic restraint zone equipped with 30 km/h zone road signs (figs. 6.23 and 6.24).

Figure 6.21
Gateway treatment - transition 80km/h rural distributor to 30km/h urban access

Figure 6.22
Gateway treatment - transition 60km/h rural access to 30km/h urban access

Figure 6.23 : Exit construction

Figure 6.24 : Exit construction plus restraint signing

6.2.4 Measures at intersections

Intersections within traffic restraint areas (30 km/h zones) are in principle uncontrolled with the general rule "Yield to traffic from the right" applying. However, intersections with higher order distributors on the zone boundary are priority controlled as are intersections with certain cycle routes and dedicated bus lanes/roads.

For the purposes of a sober approach, intersections are the most appropriate location to implement traffic calming given the high conflict potential and need to reduce speeds and to increase driver awareness. A procedure to assist in the selection of intersection measures was discussed in Section 6.1.

For roads given a provisional status it is recommended that priority be assigned under the following circumstances :

- the intersection is unsafe or potentially unsafe, may become unsafe after the introduction of "priority cyclists from the right" or after changes in the existing hierarchy are introduced
- physical speed calming measures cannot be introduced due to constraints (geometric/technical or financial)
- current operation is informal and unstructured under the yield to the right rule.

The most common measures applied at intersections in 30km/h zones are raised intersections (fig. 6.25), "punaise" (Spheres - fig. 6.26), median closures (fig. 6.27), extended sidewalks (fig. 6.28), reduced kerb radii (fig. 6.29) and objects in the intersection (figs. 6.30 and 6.31). In addition treatments are applied to improve the safety of intersections with solitary (isolated) cycle paths and major cycle routes (figs. 6.32 - 6.34).

Figure 6.25
Raised 30 km/h intersection

Figure 6.26
4 m spheres (punaise)

Figure 6.27
Median narrowing

Figure 6.28
Extended sidewalk at T-intersection

Figure 6.29
Reduced intersection radii

Figure 6.30
Circular object in intersection

Figure 6.31
Rectangular object in intersection

Figure 6.32
Intersection with isolated and solitary cycle path

Figure 6.33
Intersection with isolated cycle/moped path

Figure 6.34
Intersection with major cycle route

6.2.5 Traffic calming measures between intersections in 30 km/h zones

Roads within 30 km/h zones are roads of mixed use and especially motorists must be made aware of the presence of other (vulnerable) road users and that unexpected movements occur and should be anticipated. Essentially there is one unmarked roadway (other than transverse markings for pedestrian crossings or similar) which accommodates two directional traffic.

In newly designated 30 km/h traffic restraint areas where a "sober" implementation approach is adopted, intersection measures may in many instances need to be supported by speed calming devices on road links. The layout of older areas is such that the spacing between intersections is relatively large and therefore easy for motorists to exceed speed limits. Also unsafe or potentially unsafe locations may exist along the link. At these locations additional traffic calming measures will be required to reinforce the 30 km/h character of the road and the area. On potential 30 km/h

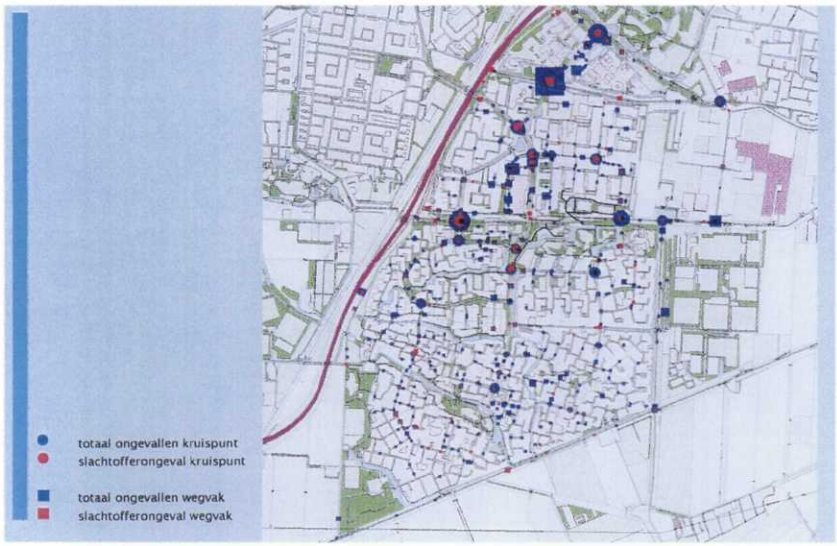
roads speed limits of 50 km/h will apply in the interim although 30 km/h traffic calming measures will be introduced at unsafe and potentially unsafe locations. In these cases advance road signs and markings will need to be placed warning of the specific measure.

Based on an analyses of unsafe and potentially unsafe locations (Fig. 6.35), measures can be identified depending on the problems specific to each. Based on a careful selection as to which combination of treatments will have the highest overall effect in the area they can be phased for implementation.

Measures most commonly applied between intersections in 30 km/h zones include sinusoidal speed humps (fig. 6.36), speed cushions (figs. 6.37 and 6.38), trapezoidal speed humps and plateau (figs. 6.39 - 6.41), rubber "stick-on" speed cushions (figs. 6.42 - 6.43), chokers (fig. 6.44 - 6.46), central medians (fig. 6.47) and chicanes (figs. 6.48 - 6.50)

Figure 6.35
Analysis of objective and subjective road safety

Ongevallen



Subjectieve onveiligheid

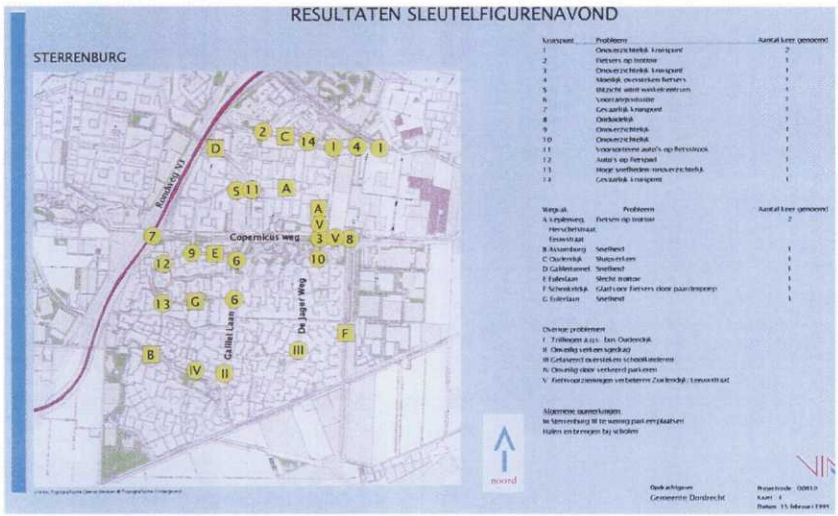


Figure 6.36
30km/h sinusoidal speed hump

Figure 6.37
30 km/h speed cushion

Figure 6.38
30 km/h speed cushion

Figure 6.39
Trapezoidal speed hump

Figure 6.40
Raised pedestrian crossing

Figure 6.41
30 km/h plateau

Figure 6.42
Bus friendly speed cushion

Figure 6.43
Detail Bus friendly speed cushion

Figure 6.44
One sided choker

Figure 6.45
Two sided choker

Figure 6.46
Extended choker with one way treatment

Figure 6.47
Median and lane narrowing

Figure 6.48
50 km/h Chicane 1

Figure 6.49
30 km/h chicane 2

Figure 6.50
30 km/h chicane 3

6.3 Considerations in 60 km/h zones

60 km/h roads have a number of characteristics that clearly distinguish them from 80 and 100 km/h roads in rural areas. These include the absence of directional separation (physical median or painted barrier lines), lane markings and grade separated intersections. Many of the 60 km/h roads are located along dykes and through farmlands. Horizontal alignment (bendiness) is variable with combinations of long straight stretches and gentle to sharp horizontal curvature. To limit single vehicle accidents (run-off accidents) the 60 km/h roads must be designed and constructed to limits speeds to 60 km/h and provide adequate lateral guidance (e.g. broken retroreflective edge line markings etc.) especially during periods of poor visibility.

As a general rule on road links between intersections of 60 km/h rural access roads, speed reducing measures with a design speed of 60 km/h are applied at problem or potential problem locations. However, measures with a lower design speed may be applied at conflict locations that are self-evident to road users. In these instances a 30 km/h design speed is applied to measures in 60 km/h traffic restraint areas and 40 km/h for measures on roads in potential traffic restraint areas. In the latter case posted speed limits are 80 km/h so advance warning of the applied measure is a pre-requisite

6.3.1 Road marking and delineation

The type of road marking applied on 60 km/h roads is dependant on paved width and the presence of cyclists. However, an essential characteristic of the 60 km/h access road is the absence of centre line marking and/or directional separation (barrier lines, medians etc.). In principle these roads comprise an undivided single lane of minimum 2,5 metre paved width for two way motorised traffic with 1,25 metre hardened shoulders or 1,25 metre paved cycle lanes. On (potentially) dangerous curves, broken edge lines may be introduced. On roads with a paved width in excess of 5,5 metres, cycle lanes on either side must be introduced. Cycle lanes or hardened shoulders are marked or provided with a different surfacing or surface colour to distinguish them from the vehicle lane.

A large proportion of accidents are single vehicle accidents on rural roads, many of these occurring on bends and curves. Poor delineation and high speeds, compounded by misleading environmental cues (e.g. rows of trees not always following the course of the road) and sometimes poor visibility result in vehicles running off the road. The K-factor is used to express the ratio of the curve design speed and 85th percentile approach speed and indicates the necessity to place delineator signs, chevrons and/or road markings. Where the K-factor is higher than 0,8 curve delineation markers and broken retroreflective edge markings are required. For lower values different delineation treatments may be applied (Refer to the Guidelines for road signs and markings).

6.3.2 Cross-sectional elements

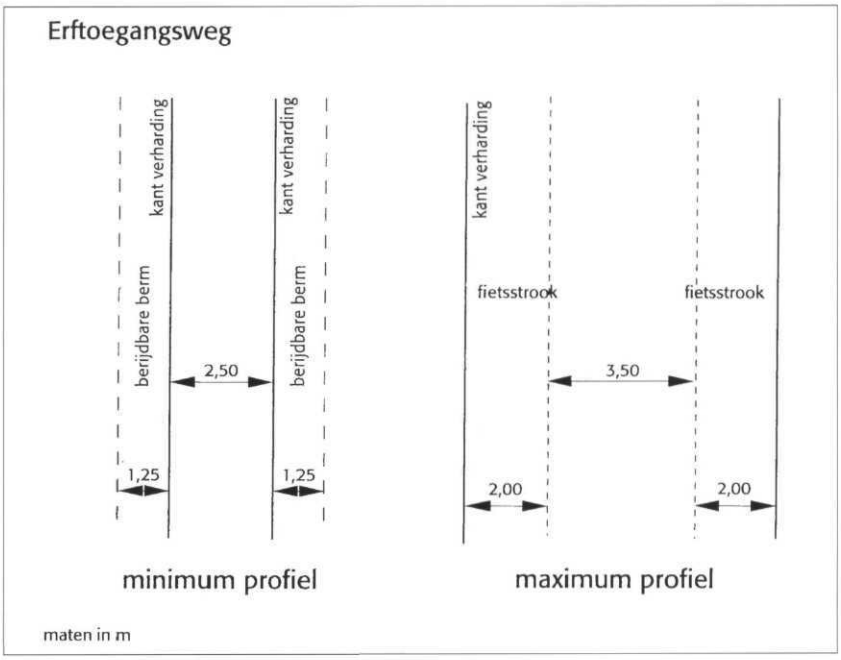
Rural access roads in 60 km/h zones are characterised by a single, paved carriageway without marked lanes. The minimum width is 5 m with a paved vehicle lane width of 2,5 metres and two narrow cycle "strips" or hardened shoulders of 1,25 metres (Table 6.3) and/or passing bays. If separate cycle lanes are provided then the maximum paved width of roadway is 4,5 metres. If cycle lanes are adjacent to the roadway then the shared vehicle lane may not be less than 3,0 m and not more than 3,5 metres (Figure 6.51).

Table 6.5
Dimensioning of cycle and vehicle lanes on 60 km/h access roads

Effective width (m)	Hardened shoulders (m)	Paved vehicle lane (m)	Paved cycle lane (m)
5,00	1,25	2,50	n a
5,00	0,75	3,50	n a
5,00	0,25	4,50	n a
5,50	None	3,00	1,25
6,00	None	3,00	1,50
6,50	None	3,50	1,50
7,00	None	3,50	1,75
7,50	None	3,50	2,00

Note : In the first three cases no road markings are present although the shoulder or cycle strip is of a different material or colour. The remaining cases have broken edge lines demarcating the cycle lanes adjacent to the roadway.

Figure 6.51
Minimum and maximum lane widths on 60 km/h rural roads



6.3.3 Intersections

From the principles of sustainable safety the intersection combinations between access and other road categories shown on Table 6.6.

Table 6.6
Intersection combinations in rural areas

Intersection category Access road with	Intersection type	Comments
Free/expressway	NOT PERMITTED	NOT PERMITTED
Distributor road (traffic corridor)	At grade, controlled	Speed calming + control
Access road	At grade, uncontrolled	Speed calming
Dedicated separate cycle path	At grade, control dependant	Speed calming + control
Dedicated public transport lane/route	Grade separated or signal rail crossing	Separated or protected crossing

Intersections between 80 km/h traffic corridors (distributors) and 60 km/h access roads are at-grade. Speeds between conflicting movements need to be reduced and priority must be controlled. The preferred control measure

is a roundabout designed according to current CROW guidelines (CROW 126,1998). As an alternative a priority control intersection (yield control on the minor road) combined with plateaux's on all approaches can be provided. Due to the higher major road approach speeds, plateaux's should be located approximately 50 to 100 metres from the intersection and designed for a 40 km/h design speed. Advance warning on these approaches is necessary.

Intersections between 60 km/h access roads are assigned equal status with respect to priority. Hence they are uncontrolled with the general rule "yield to traffic from the right" applying. To reduce speeds at the conflict points a raised intersection, a mini-roundabout or other speed calming measure for intersections should be implemented. In exceptional circumstances (e.g. one road appears to have a higher order or function and/or traffic movements are totally informal), priority may be assigned in the short term, and where necessary supported by other infrastructural measures.

Intersections between 60 km/h access roads and dedicated cycle paths are uncontrolled and provided with a raised intersection. The rule "traffic from the right (in this case including cyclists) has priority" applies. Intersections with important and high volume cycle routes are priority controlled with the cycle traffic having priority.

Intersections between 60 km/h access roads and public transport routes (rail, tram or dedicated bus lanes) are grade separated or guarded signalised intersections with booms.

6.3.4 Directional road signing

Traffic using 60 km/h access roads is essentially local traffic and consequently it is not recommended that destinations (inside or outside the area) are signposted. For visiting traffic roadside display maps of the area and street names are deemed sufficient.

Cycle routes on the other hand should be provided with directional signing through the traffic restraint area.

6.3.5 Road surfacing

For the purposes of distinguishing between road types/classes it is recommended that access roads are surfaced with brick paving, using different colours distinguishing the cycle and motorised traffic lane. However, asphalt or concrete may be applied from a maintenance and cost perspective. A combination of brick for the motorised traffic lane and coloured asphalt for the cycle lane is also possible. Where cycle lanes are not necessary, the shoulder should be hardened using a grass-penetrable concrete block.

6.3.6 Mid-block crossings

At locations where significant pedestrian movements occur (e.g. rural schools or bus stops) it is recommended that raised pedestrian crossing are introduced and supported by advance signing. A prerequisite for providing these crossings is that other pedestrian infrastructure (walkway, bus stop, shelters etc.) already exists. Where the crossing can be integrated with an intersection without introducing significant increases in walking distances, this is recommended.

6.3.7 Parking

Stopping and parking on 60 km/h access roads is permitted in the absence of signs indicating a cycle path (cycle symbol) but also depends on the local situation (i.e. adequate road width, hardened shoulders etc.).

6.3.8 Public transport and breakdown facilities

On rural access roads no turnouts for buses are provided. Stopping for the loading or off-loading of passengers occurs on the roadway and at scheduled stopping points. Similarly no provision is made for vehicles that break-down - these make use of the hardened shoulder or, where provided, passing bays.

6.3.9 Clearance zones and remaining issues

Rural access roads are provided with a clear road side area of 4 metres, measured from the edge of the paved surface (i.e. not from the edge of the hardened shoulder).

Since rural access roads are roads with a mixed traffic function, agricultural and other slow moving traffic is allowed.

6.3.10 Consideration in design

Traffic calming measures on 60 km/h access roads in rural traffic restraint areas are implemented on the basis of a 30 km/h design speed. An important consideration in the design and layout of the measure is the traffic mix on these roads; pedestrians, cyclists and mopeds, agricultural traffic, commercial and heavy goods vehicle traffic and public transport vehicles. The selection of the appropriate design of a 30 km/h device must be based on the most appropriate design vehicle specific to that situation. For lateral clearances the design vehicle would generally be the bus although special provisions must be made for large agricultural vehicles (e.g. combine harvesters). For vertical deflections, measures are generally aimed at the car but buses and heavy vehicles should not be materially affected. In this respect it is important that public transport operators are consulted in the selection and design process.

The same principles and considerations as those in 30 km/h zones apply to new 60 km/h zones (see chapter 5 and Figure 5.1)

6.3.11 Gateway treatments for 60 km/h zones

Road users must be made aware that they are entering a zone with a general speed limit of 60km/h and intended for primarily local traffic. The transition can occur between the following road types :

1) 80 km/h rural distributor to 60 km/h rural access road;
2) 70 km/h urban distributor to 60 km/h rural access road;
3) 50 km/h urban distributor to 60 km/h rural access road
4) 30 km/h urban access road to 60 km/h rural access road

Where the transition occurs from an 80 km/h distributors and the paved width (on roads wider than 5 m) remains unchanged, a 60 km/h zone sign on both sides of the road and supported by a double white transverse line is introduced (Fig. 6.52). For roads where the width on the rural access road reduces to below 5 metres, the 60 km/h zone sign is placed on the right shoulder only but still supported by the double white transverse line and 200 mm wide white longitudinal edge lines of 20 metre length (fig. 6.53)

Transition between urban and rural speed zones (case 4) are treated with physical measures and road signs (for example speed cushions - figure 6.54).

To emphasise a transition from a 50 or 70 km/h urban arterial, a double transverse line and the speed zone signs are applied.

In all cases a large "60" road marking is painted in the centre of the paved lane and within 50 metres of the actual threshold.

Figure 6.52
Threshold treatment - 80 km/h rural distributor to wide (>5m) 60 km/h rural access road

Figure 6.53
Threshold treatment-80 km/h rural distributor to narrow (<5m) 60 km/h rural access road

Figure 6.54
Threshold treatment - speed cushion on 30 km/h urban access road to 60 km/h rural access

6.3.12 Measures at intersections in 60 km/h zones

In principle intersecting 60 km/h roads have equal priority and are uncontrolled. However, in certain situations speed reducing measures or measures aimed at heightening awareness are recommended, specifically at intersections on the boundary of the zone, and at intersections that are dangerous or potentially dangerous. The most common measures applied are roundabouts (fig. 6.55) and raised intersections (fig. 6.56). Where resources to introduce physical measures do not exist in the short term, the intersection may be temporarily priority controlled.

Figure 6.55
Roundabout in 60 km/h zone

Figure 6.56
Raised intersection in 60 km/h zone

6.3.13 Measures between intersections on 60 km/h roads

Distinction is made between measures in a longitudinal direction (normally continuous over the length of road section) and local (or transverse) treatments. Longitudinal treatments serve to :

- visually reduce effective lane width;
- emphasise dangerous curves;
- accommodate cycle traffic; and
- protect soft road shoulders and verges.

Longitudinal treatments are not applied to 60 km/h roads with an effective paved width of less than 4 metres. In certain situations, for example road users must be made aware of a dangerous curve or the shoulder/verge adjacent to the paved surface needs to be protected or hardened to allow passing (fig. 6.57), exceptions may be made.

For roads with a paved width of 4 to 5 metres, a broken edge line marking (3-1 ratio) may be used to visually reduce the effective width (figs. 6.58 and 6.59).

On roads with a paved width of 5 to 6,5 metres, a broken edge line marking (1-3 ratio) is used to reduce the effective width and to provide two edge strips which may be used by cyclists and/or motorists to allow passing (fig 6.60).

Roads with an effective paved width in excess of 6,5 metres are marked to provide two 1,5 metre wide cycle lanes on either side of the shared traffic lane (fig. 6.61). It is recommended that the surfacing of the cycle lanes are provided with a different colour (i.e. red). The compulsory cycle path signs are also erected to indicate the legal status.

Local treatments are applied at dangerous or potentially dangerous locations along a 60 km/h road section. Generally these are speed reducing measures applied over the full width of the road. Care must be taken that the design of these takes into account the constraints of certain categories of local traffic, especially agricultural traffic. Typical measures include plateaux's (fig. 6.62), chokers combined with speed humps (fig. 6.63) and choker/speed hump combinations with separate cycle lanes (fig. 6.64).

Figure 6.57
Treatment of soft shoulder on narrow 60 km/h rural road

Figure 6.58
Edge line marking on 5 m wide rural access road

Figure 6.59
Edge line marking on 6 m rural access road

Figure 6.60
Narrow passing or cycle strips on 60 km/h rural road

Figure 6.61
Cycle paths on wide 60 km/h rural road (example on urban boundary)

Figure 6.62
Plateaux on 60 km/h rural access road

Figure 6.63
Choker and speed cushion on 60 km/h rural access road

Figure 6.64
Choker and speed hump with cycle path on 60 km/h rural road

6.4 Moped on the roadway

During 1998 79 moped riders were killed and a further 9 635 were injured in road accidents in the Netherlands. Considering that less than one percent of the total annual travel is undertaken by this mode it is a major source for concern that approximately 7 per cent of all fatalities occur in this vehicle category.

Research into accidents involving mopeds and cyclists revealed that mopeds would be safer using the roadway instead of the cycle path. A pilot project to evaluate the potential effect of this move was conducted by the SWOV in the period 1991 to 1994. The results of the three year experiment revealed that in all cases the number of accidents involving mopeds decreased significantly and when compared to the control locations, decreased by some 50 per cent. In none of the cases did the number of moped accidents increase. In addition it was found that moped riders on the roadway behaved as motorists occupying the centre portion of the lane and maintaining speeds comparable to that of other traffic. Based on the

positive results of the experiments a decision was made to implement legislation banning mopeds from cycle paths in urban areas. Due to the higher posted speeds on roads in rural areas and thus greater speed differentials between mopeds and other traffic, mopeds will continue using the cycle path. Assigning mopeds to the roadway in urban areas resulted in the development of new mandatory road signing indicating restricted cycle path, shared cycle/moped path and information signs (Figures 6.65 - 6.66).

Figure 6.65
Regulatory signs for moped on the roadway

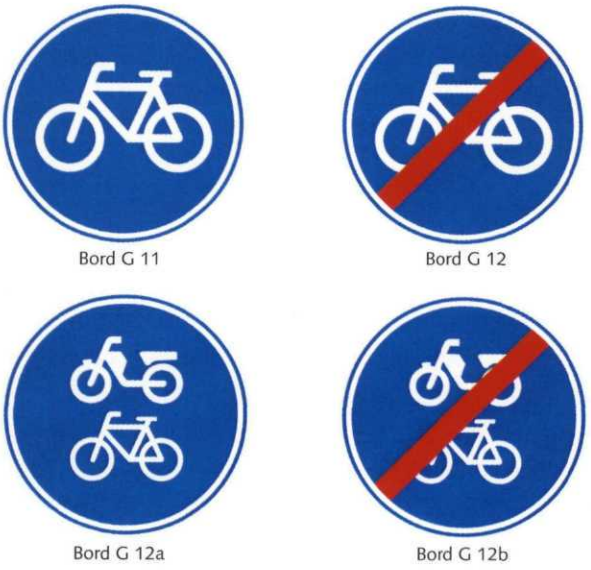
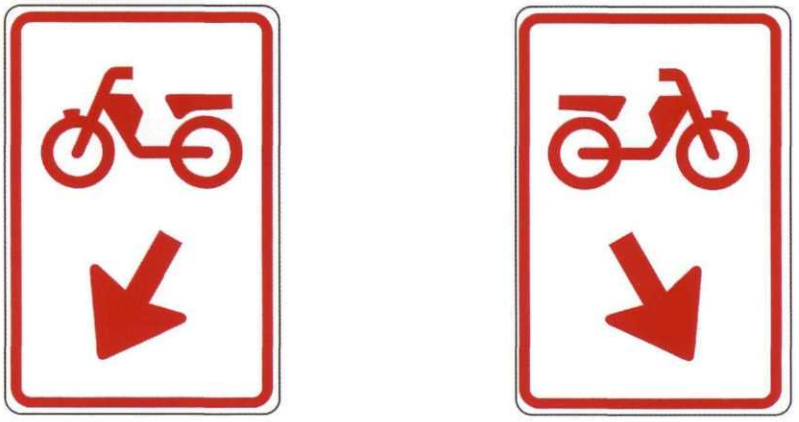


Figure 6.66
Information signs for moped on the roadway



6.4.1 Application of the concept

The measure "moped on the roadway" entails that on urban roads provided with dedicated, separate cycle paths, mopeds share the roadway with other motorised traffic. On urban roads with speed limits of 70 km/h and higher, mopeds remain using the cycle/moped path. In these cases the new road sign indicating the combined cycle/moped path is displayed.

In rural areas mopeds remain using cycle paths where these are present. However, mopeds may use 60 km/h rural access roads where these have

been infrastructurally adapted according to the Sustainable Safety principles.

An underlying principle for mopeds on the roadway is providing continuity along the route and at all costs avoiding situations where mopeds alternate over short distances between a roadway and a cycle path. However, in certain situations it may be unavoidable to divert mopeds from the roadway back to the cycle path and vice versa. Generally all roads with speed limits of 50 km/h and lower are used by mopeds. Exceptions to this are determined locally but may include situations where:

- actual speeds of motorised traffic on the roadway are high
- the existing cycle path is significantly shorter that the roadway alternative
- the difficulty of providing a safe transition zone from cycle path to roadway
- poor continuity (majority of the route is travelled on the cycle path)

6.4.2 Mopeds on the urban road network

In principle mopeds in the urban area share the road network with other motorised traffic. An exception is higher speed traffic corridors with posted speed limits of 70 km/h or higher or situations where continuity or safety cannot be guaranteed. The selection of the appropriate treatment for moped on the roadway is illustrated in Figure 6.67. This process must be followed for each route or road in the network where the measure is to be adopted/adapted.

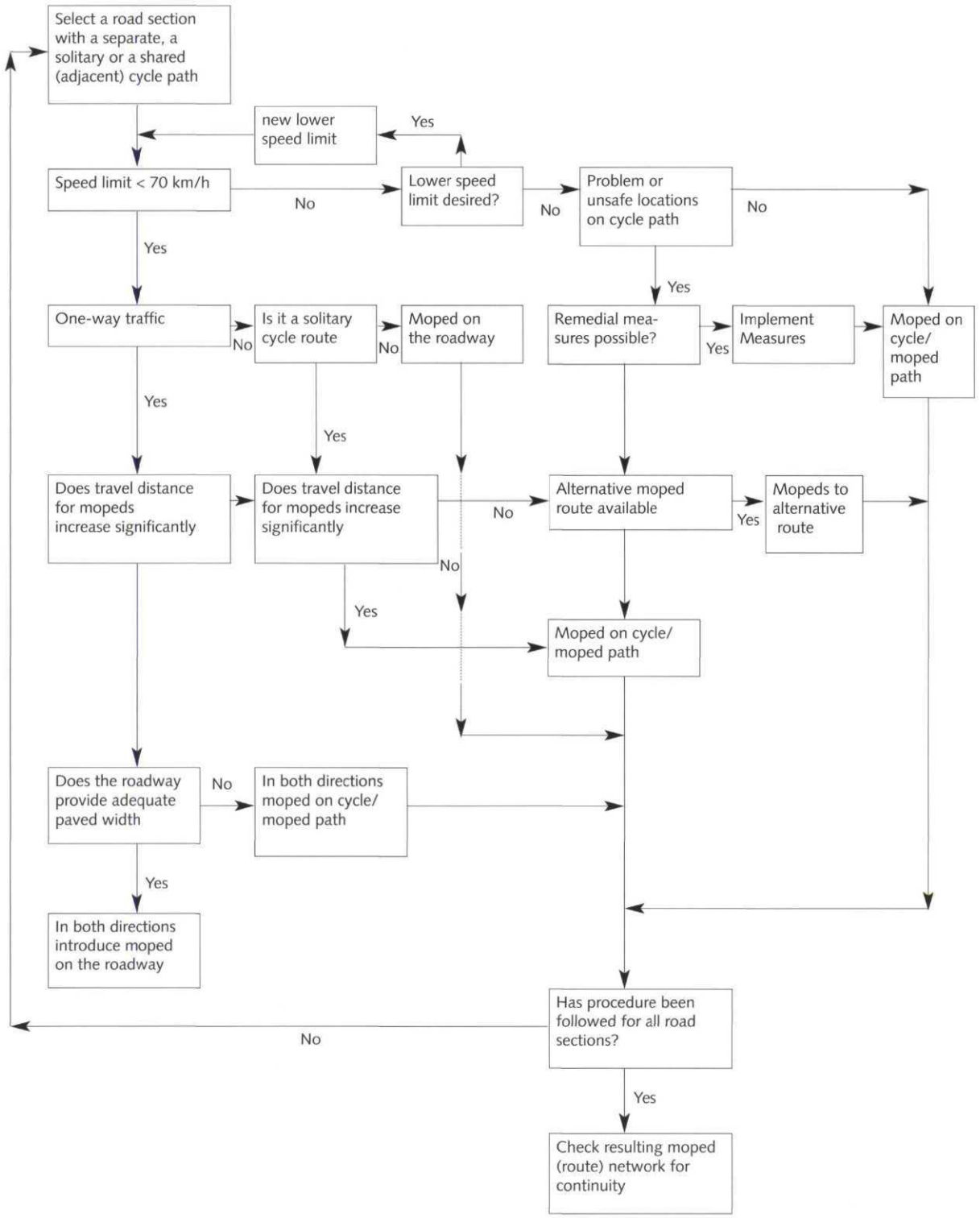
The decision not to allow mopeds on 70 km/h roads is based on purely the hypothesis that the larger speed differentials between mopeds and other vehicles may have a negative effect on road safety. However, where roads have been provisionally classified as 50 km/h roads and where short sections still operate at posted speeds of 70 km/h, mopeds will be allowed to use the roadway. Similarly certain roads have posted speeds of 50 km/h but operate at higher speeds and in these situations mopeds must be kept from the roadway until such time that the infrastructure has been adapted according to sustainable safety principles.

It is also important that the conscious decision to restrict mopeds to using the existing cycle path infrastructure must be supported by an analysis of possible safety consequences, specifically:

- potential for accidents between mopeds on the cycle path and turning traffic on the roadway
- potential for accidents due to priority control measures or priority ruling
- potential for accidents between pedestrians and mopeds
- overtaking accidents among moped riders and with cyclists

Figure 6.67

Selecting the appropriate treatment for moped on the roadway



Many accidents on cycle paths occur due to the high speed of mopeds and measures to reduce these where mopeds are to remain on the cycle path include:

- exit constructions of lower order side roads (fig. 6.68);

- application of speed humps for right turning movements from higher order roads (fig. 6.69);
- application of specially designed speed humps for mopeds (fig. 6.70); and
- adjustment to the width of the cycle/moped path (fig. 6.71)

On roads where mopeds are assigned to the roadway the priority must be controlled (i.e. assigned by means of road signs and markings - fig. 6.72). The same applies to cycle paths and cycle/moped paths. Care must also be taken that roads and cycle paths are well maintained and that the surfacing is not rutted or smooth. Road markings must also be inspected to ensure that these have adequate skid resistance.

Figure 6.68
Exit construction

Figure 6.69
"Right turning" speed hump

Figure 6.70
Moped speed hump

Figure 6.71
Cycle path narrowing

Figure 6.72
Signing and marking for moped on the roadway

7 Conclusion

The Sustainable Safety programme has been launched in the Netherlands and it is anticipated that its full implementation will help realise the targets set for road safety in the first decade of the new millennium. During the period 1997 to 2002 the first phase of the programme is being implemented and major investments in adapting existing infrastructure is being made. The realisation of an adapted road hierarchy based on functionality, homogeneity and predictability will contribute to the concept of the forgiving and self explaining road environment where a harmony between the road, the driver and the vehicle exists.

Although the vision of an end state exists, the initiation of the first implementation phase has also brought to light a number of major obstacles that need to be overcome. The lack of a uniform approach, poor planning, insufficient funding, lack of resources, poor communication and resistance to certain concepts are just a few of these. However, the first phase of the implementation programme aims to identify these issues and to use these as input for developing the strategy for implementing phase 2. It is clear that the decision making process must be transparent and inclusive. Communication and training play a vital role in this whereas enforcement is a vital support element during the transitional phase.

Irrespective of the obstacles, which to an extent were anticipated, the implementation of the first phase of sustainable safety is on schedule and is nearing completion. The financing and other requirements have been finalised and the majority of local and provincial road authorities have embarked on the design and construction phase.

The planning for the second phase is well advanced and the detailed plans will be tabled for final approval in 2002.
To bridge the gap between Phase 1 and 2, an interim period has been introduced and is being funded by Central Government. Early monitoring results indicate positive effects for road safety. In any event it is anticipated that the implementation of the second phase will help the Netherlands reach the road safety targets as set out in the National Traffic and Transportation Plan.

8 References

Ministerie van Verkeer en Waterstaat. Meerjarenplan Verkeersveiligheid I (1987).

Infopunt Duurzaam Veilig Verkeer (1997). Handleiding Startprogramma Duurzaam Veilig : Deel 1 - Achtergronden. CROW, Ede

Ministerie van Verkeer en Waterstaat (1997). Aan de start - startprogramma Duurzaam Veilig Verkeer 1997 - 2000. The Hague, Netherland.

Ministerie van Verkeer en Waterstaat. Meerjarenplan Verkeersveiligheid II (1989).

Ministerie van Verkeer en Waterstaat. Meerjarenplan Verkeersveiligheid III (1991).

SWOV (1986). Road accidents casualties on different classes of roads (sourced from Kraaij, J H - Road safety at the AVV, 1997)

CROW (1988, 1996). ASVV aanbevelingen voor verkeersvoorzieningen binnen de bebouwde kom, Crow Publikatie 110, Ede, the Netherlands.

Unie van Waterschappen (1998). Sobere maatregelen in een zone-60: een impuls voor veilige Waterschapwegen. UvW, The Hague, the Netherlands.

CROW (1998). Eenheid in rotondes. Crow publication 126, ede, the Netherlands.

Infopunt Duurzaam Veilig Verkeer (1997). Handleiding Startprogramma Duurzaam Veilig, Deel 2 en 3. Crow, Ede, the Netherlands.

CROW (1997). Handboek categorisering wegen op Duurzaam Veilige basis: Deel 1 - Functionele en operationele eisen. Crow, Ede, the Netherlands.

CROW (1993). Uitritten. Crow publikatie 68, Ede, the Netherlands.

CROW (1997). Inrijden verboden - aanbevelingen voor selectieve toegangsverlening. CROW publikatie 113, CROW, Ede, the Netherlands

Infopunt Duurzaam Veilig Verkeer (1999). Bromfiets op de rijbaan - Handleiding voor de invoering, CROW, Ede, the Netherlands

Buro voor Verkeerskundige Advisering (1997). Raamplan categorisering KOVO - een integrale wegennetvisie voor de Kop van Overijssel. Report number KOV-135, Ga-Raalte, the Netherlands

DTV Consultants (1999). Practicum Duurzaam Veilig - toegepast in de praktijk, DTV Consultants, Breda, the Netherlands.

Schermers, G (1999). Sustainable Safety - A preventative road safety strategy for the future - 1st edition, Transport Research Centre (AVV) Ministry of Transport, Public Works and Water Management, Rotterdam, The Netherlands.

Ministerie van Verkeer en Waterstaat (2001). Samen voor Veiligheid, Duurzaam Veilig, de tweede fase, Den Haag, the Netherlands

Ministry of Transport, Public Works and Water Management (2001). National Traffic and Transport Plan for the Netherlands 2001 - 2020 - From A to Better, Summary of proposed policy, Ministry of Transport, The Hague, the Netherlands (January 2001)

Infopunt Duurzaam Veilig Verkeer (2001). Maatregel-wijzer Verkeersveiligheid 'er is meer dan je denkt', CROW, Ede, the Netherlands (May 2001)

Infopunt Duurzaam Veilig Verkeer (2000). Sobere inrichting van 30- en 60 km/h gebieden - Een illustratieve aanpak met praktijkvoorbeelden, CROW, Ede (January 2000)

Infopunt Duurzaam Veilig Verkeer (2000). Voorrang Fietser van rechts en voorrang op verkeersaders - Handleiding voor de invoering, CROW, Ede, The Netherlands (September 2000)

Infopunt Duurzaam Veilig Verkeer (2000). Duurzaam Veilige inrichting van wegen binnen de bebouwde kom - een gedachtevorming, CROW, Ede, The Netherlands (November 2000)

SWOV (1990). Naar een duurzaam veilig wegverkeer - Nationale verkeers-veiligheidsverkenning voor de jaren 1990/2010, Stichting Wetenschappelijk Onderzoek Verkeersveiligheid SWOV, Leidschendam, The Netherlands.

Heijkamp, A. H. And Kraaij, J. H. (2001). Road safety in the Netherlands : we all work together, Transport Research Centre (AVV, Ministry of Transport, Public Works and Water Management, Rotterdam, The Netherlands.

Appendix 1 Short descriptions of demonstration-projects

West-Zeeuwsch-Vlaanderen

This relatively small area has the highest number of accident fatalities in the Netherlands, mainly due to an inadequate major road network and the poor design and layout of roads presently functioning in this capacity. Consequently the focus in this area is on the upgrading and provision of an appropriate road network infrastructure, particularly in the rural areas. A well defined road hierarchy linking cities/towns with the capacity to accommodate (large) volumes of through traffic is not evident. Consequently a new road network hierarchy has been developed on the basis of the new Sustainable Safety road categories (freeways, distributors and access roads) and this is currently being implemented. Seeing that the focus is on the rural road network the area has been divided into 9 sub-projects, seven of these focusing on infrastructure, one on enforcement and one on road user behaviour. An open plan procedure has been adopted to involve all role-players in the decision making process. The seven infrastructure sub-projects focus on the implementation of infrastructural measures (incl. traffic calming on 60km/h rural access roads) and these are being identified and selected with affected parties. The enforcement project focuses on speed, alcohol, crash helmets, seatbelts and vehicle standards. The road user behaviour element concentrates on communication, education and awareness. It is anticipated that once implemented the number of injury accidents in the area will be reduced by 55 - 60%.

Oosterbeek

This demonstration project focuses on the re-engineering of the urban road network of the town Oosterbeek, with major focus on a predominant major road in the town, carrying both large volumes of through and local traffic. The demonstration project has as aim the reduction of through traffic, improving public transport, improving road safety and operation on the major road, creating awareness and rallying support amounts residents and users for measures taken throughout the town, effect on road user behaviour, de-veloping a road network categorisation plan for the area. Once again there is a great amount of emphasis on infrastructure provision (incl. traffic calming) and upgrading, supported by public participation in planning and design and also by education/communication and training

Grubbenvorst

Grubbenvorst has a major through road running through it and this has brought about numerous problems. Consequently it was decided to develop a longer term strategy to re-classify and re-engineer the existing network to be safe and sustainable, to adopt a safe mobility policy (incl. reduction of non-local traffic), integrated and safer land-use planning and safe road user behaviour. The focus of this demonstration is on promoting cycling and to a lesser extent public transport. To encourage this traffic calming measures are being used to discourage through traffic, reduce speed and modify behaviour .
This is actively supported by communication, training and promotion. Based on the provision of an integrated traffic and transportation plan a

new road network designed on the basis of predominant modal splits is being implemented. this includes the provision of new infrastructure for through traffic (a ring road).

Kop van Overijssel

The KOVO project entails the development and implementation of measures designed around a new classification of the urban and rural road network hierarchy. The new classification was developed with extensive participation of all interested and affected parties. A series of workshops were held throughout the region to formulate a concept plan based on the Sustainable Safety classes and principles. This was then amended and adapted on the basis of other policies affecting traffic and transportation (environment, quality of life, mobility etc.). Based on long term traffic forecasts, a traffic assignment model was applied to evaluate the effects on the new network. From this a final hierarchy was developed and infrastructural measures selected to re-engineer the roads in accordance with the new function and class.

Westland

Problems underlying the road safety problem in this area include an old road network not designed and with an inappropriate layout for modern day traffic, poor functional differentiation of road types, limited separation of different modes, poorly distinguished rural/urban boundaries and large speed differentials between road users. An integrated approach involving engineering (infrastructure), education, promotion, communication and enforcement was adopted at the outset. Based on the identification of 100 road safety improvement projects in the area, an integrated implementation plan was developed, starting with the re-classification of the existing network, supported by traffic calming infrastructure, re-designed layouts enforcement programs on speed alcohol, seatbelts and crash helmets, education at schools and awareness amongst users and provision for cyclists and heavy goods vehicles. The plan is currently being implemented and aims to reduce accident casualties by 25% by 2000 (compared to 1986).

West Friesland

This area comprises some 400 km of roads in predominantly a rural environment. It is one of the few areas in the Netherlands where the number of injury accidents has increased (by 14%). In this area particularly 50 km/h without cycle paths and 80 km/h roads have high accident rates. Consequently an integrated road safety plan (for all national, provincial and local authority roads) has been developed on the basis of the Sustainable Safety principles.
The plan integrates two approaches, firstly the reactive approach aimed at addressing all hazardous locations and secondly the pro-active approach to re-engineer the existing network to be safe, self-explaining and forgiving. The emphasis in the region is on the provision of facilities and infrastructure, tourism and recreation with active support on creating awareness. Enforcement and education are not featured in the approach. To date a large number of roundabouts and traffic calming measures have been constructed. A 60km/h zone has also been realised. Since 1996 slight injury accidents in the region have been reduced by 19% and serious injuries by 35%.