Traffic Calming in The Netherlands

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1. Introduction

In this paper an outline is provided covering the developments with regard to the structural design of roads and road safety. This also encompasses the legal aspects and the social organizations involved. As might be expected, legislation lags a few years behind developments in the social situation.
In addition a brief outline is sketched of the extent to which these developments have been included in manuals and other aids used by traffic engineering designers.

2. Prior to the nineteen-sixties; the start

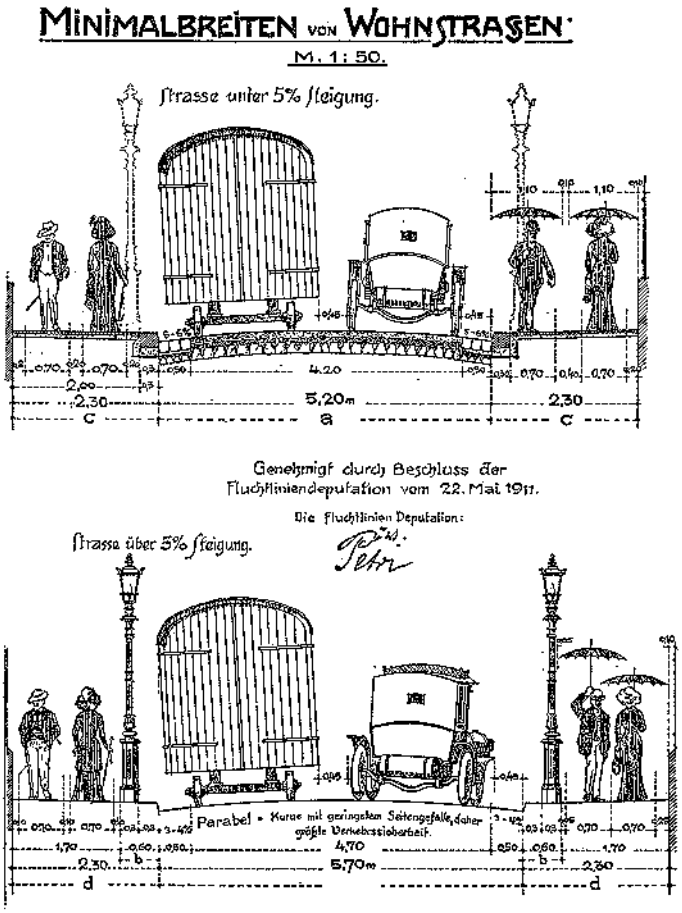

Figure 1. The first design guidelines for the structural design of a public highway, 1911, Wiesbaden Germany

In the distant past the width of a road was determined by the type of carts and carriages then in use, which were mainly horse drawn, or it was determined by military columns marching in line across the country. In built-up areas this was usually determined by the ability of two horses or two pedestrians to safely pass one another, particularly when within ancient city-walls and canals. Due to the geographical structure of the flat polder landscape prevalent throughout the larger part of the Netherlands, once the bicycle was invented it quickly

became the preferred mode of transport. This popular means of transportation was also able to make simple use of the semi-paved roads then covering the country.
At the end of the last century the Royal Dutch Touring Club (ANWB) was founded as the main organization protecting the interests of cyclists. A few years later this organization became concerned with the direction signing of roads, which remains today as one of their most well known and important activities.
Following the invention and widespread introduction of the internal combustion engine and developments in automobile production, roads in The Netherlands were made suitable for this new type of vehicle. Roads in built-up areas dating from the period in question have a cross-section which covers a width of four to five metres of more or less flat pavement, usually consisting of brick paving and having a strip at each side of the carriageway intended for pedestrians, parking or other activities. The fact that the combination of horse and cart, cycle and automobile was not always the safest imaginable is evident from the founding of the Dutch Road Safety Organization (VVN) dating from 1932. From that time up to the present day this organization has been concerned with providing information and education involved with issues affecting road safety. They provide educational resource material for schools, publicity material for action groups campaigning at national as well as regional level, and also develop public information films for television often commissioned by the Dutch government.
At about the time mentioned the first Dutch Road Traffic Act was passed. This legislation includes a description of the standards required for vehicles wishing to make use of public highways.
The pedestrian's organization was founded in 1954. This fact seems to indicate that this particular group of road users felt increasingly threatened by the popularity of the car. Due to the efforts of this interest group supported by the Dutch Road Safety Organization a new profile was created for roads within built-up areas consisting of a carriageway of four to five metres wide with raised footpaths bordering either side.

3. The nineteen-sixties; increasing awareness

In this period the car became increasingly popular as a means of transport. In addition the automotive industry was regarded as the 'engine' of a growing economy. A left wing (socialist) politician of the time went so far as to remark that every worker should be able to own their own car.
This development was not without its' problems and no-one could identify exactly what the root of such was or more importantly, suggest solutions. For this reason the Dutch Foundation for Scientific Research into Road Safety (SWOV) was set up in 1963. In 1966 the Dutch Highway Code (abbreviated as RVV) came into effect. This comprises an extensive description of the rights and obligations of all road users.
Where new housing estates were built in this period increasingly wider roads were constructed as cars demanded more space. Carriage widths of ten metres were not out of the ordinary. Where possible older roads were adapted to accommodate the new demands of the time. This was not always possible however when taking account of the important historical value of certain buildings along such roads. In such cases the footways would be sacrificed for the sake of the 'precious' automobile. In the second half of the nineteen-sixties the residents of older streets and areas, rebelled against the prevailing thinking of 'always giving priority to the interests of the car', particularly those people with young children living in densely populated older residential districts where the streets were narrowest.
The parents of young children contended that the street was no longer a safe place for their kids to play and this contrasted starkly with their own memories of childhood. Streets in areas paved all around were regarded as being concrete jungles without character. As a reaction to such a bland urban landscape residents would often illegally place plant-pots on the pavement by removing a few paving stones or placing garden benches in front of their houses. This behaviour may have resulted from the rebellious attitudes of the times where an increasingly anti-authoritarian minded society allowed latitude for such expression. The view that the road

or street was not just for the car found strongest expression in older (historic) and heavily built-up town centres.
Through such developments it was became accepted that the street is as much the property of local residents as an area of land surrounding a farm house is to a farm dweller. Motorized traffic racing along the streets at high speed was largely regarded as being anti-social and also very dangerous.
In some municipalities certain public officials working in the Traffic Department or Public Works recognized the need to tackle these problems. The cities of Rotterdam and Utrecht and later on Delft were the first to experiment with the application of speed control humps (a.k.a. sleeping policemen), street narrowing or tapering and other speed inhibiting provisions. However due to the lack of any definitive legal framework for such, there was still no large-scale introduction of speed inhibitors in residential areas.

Figure 2. Residents demand the return of 'their streets'. The start of the phenomenon of the 'Woonerf'. Here indicated with the traffic sign in accordance with the relevant regulation dating from 1976

4. The seventies; the woonerf

Developments such as those applied in the nineteen-sixties were continued even more forcefully and formally in the nineteen-seventies. In 1972 a lobbying movement was founded known as the Stop the Child Murder Pressure group. The aim of this group was to consult with local residents and try to ensure that residential streets in particular be made safe for children to walk or cross, as well as safe for children to play on.
In 1974 the (SVT) study centre for traffic engineering was founded. This centre was particularly concerned with the standardization of various aspects of road layout design. This foundation also paid attention to speed inhibiting provisions such as the speed control hump.
In 1975 another interest group organization was founded as a reaction to the Dutch Touring Club (ANWB) having an obvious preference for the interests of the automobile, this group was known as the first Dutch cyclists association (EFNB).
In 1972 a separate section was established within the Dutch Ministry of Transport known as the 'Board of Traffic Safety'. A secretary of State was also appointed who was to have special responsibility for road safety.
The initiatives started in the nineteen-sixties were further expanded and continued by a few enthusiasts. The city of Delft was at the forefront in introducing the 'woonerf', which is a design concept for residential areas aimed at keeping traffic speeds low in set areas, and offering the possibility of (risk free) unimpeded play areas for children.

In 1976 the 'woonerf' was given a definite legal status by Royal Decree. For this purpose a number of requirements were formulated which a residential neighbourhood or street were

obliged to comply with before the term ‘woonerf’ could be assigned. This involved the following specific requirements:

1. The woonerf should mainly fulfil a function enhancing the residential nature of an area.
2. The road or road system within a woonerf should be constructed in such a manner that where motorized traffic is concerned these roads can only be used for access to and from destinations within the woonerf (thereby deterring any through traffic).
3. On any road within the woonerf the traffic volume involving motor vehicles should not be such that the character of the road as a component of a woonerf could be adversely affected.
4. The impression should not be given that the road is split into a carriageway and a footpath or footway. There should be no continuous height differential in the cross-section profile of a road within a woonerf. Kerbs which may give the impression of demarcating footpaths or footways from the carriageway should therefore be broken at intervals of approximately 25 metres and the presence of intervals between the kerbing should be obvious to road motorists.
5. Vertical elements (such as plant pots and shrubs) should not impede visibility.
6. The entrances and exits providing access to a woonerf should be clearly discernible from their construction and where they are to be used by vehicles should also be clearly indicated as being an entrance/exit, where the kerbing should preferably be continued but lowered at such locations. This requirement is also complied with if the entrance/exit to a woonerf is set some distance back from the junction with other roads. The road leading to a junction may not in such a case be regarded as an exit on the street traversing it.
7. The edges of that part of the road pavement intended for the parking of one or more vehicles should be clearly indicated by road marking of at the least the corners of such spaces. The colour of this marking and the letter ‘P’ should be clearly discernible from other road pavement at such locations. The letter ‘P’ may be applied on a paving stone.
8. There should be sufficient parking space within a woonerf to meet the needs of local residents. If unused parking facilities are available in the immediate proximity of a woonerf, then the demand for local residents within a woonerf for parking space may be allowed to be exceeded slightly. This may not however lead to a situation whereby the parking space available in the area immediately adjacent to a woonerf fails thereby to meet the demand of residents of said areas.
9. On the parts of the roads within a woonerf suitable for use by vehicles, provisions should be applied which induce a limiting of the speeds maintained by various types of vehicles. The intervals between these provisions should not exceed 50 meters.
10. The parts of the road referred to in Article 9 above should not have provisions applied which would result in motor vehicles driving close to housing located on short distance from the side of said roads.
11. The provisions intended in Article 9 should not be in any way hazardous to traffic passing through these provisions taking account of the legal speed limit prescribed as ‘walking speed’.
12. Adequate public lighting should be provided in a woonerf, so that any provisions, particularly those intended in Article 9, are also clearly visible at night.
13. Locations which have been especially laid out as play areas for children should be adequately marked as such, to distinguish them from areas intended for use by motor vehicles. If possible these areas would be cordoned off from other parts of the highways.
14. A sub-plate sign should be placed beneath traffic sign 57c with the word ‘woonerf’ marked.

In addition the Dutch Highway Code (RVV) was then adapted as the woonerf involves quite a few requirements for the behaviour of road users. The maximum speed is set at ‘walking speed’. Contrary to the situation on other roads, priority is given to all traffic approaching from the right on a woonerf. On other roads motorized traffic has right of way over non-motorized traffic. On woonerfs parking is only permitted on spaces specially indicated for that purpose. In addition pedestrians are allowed to use the full width of the highway and

children can play on the street. The rights of the motorist are expressly subordinate to the rights of other road users on woonerfs.

These new regulations were provided with sizeable government subsidies to help clear the way for the large scale introduction of the woonerf principle.
It soon appeared however that the formal regulation was too detailed. To reconstruct a traditional street and convert it to a woonerf would prove a very costly exercise.
Some local authorities experimented with a few speed-inhibiting measures from the full package of a woonerf and designated them as 25 km/h and 30 km/h residential streets.
The seventies closed with the introduction of the term ‘residential estates’.

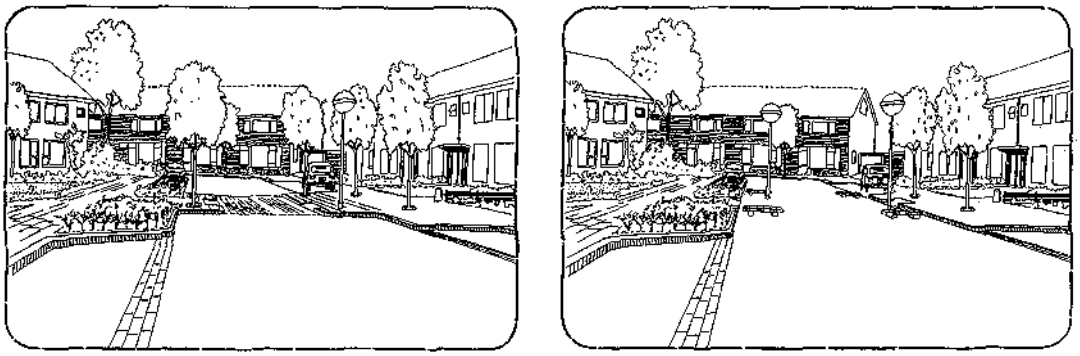

Figure 3. An example of road constriction (narrowing) in firstly a lavish design version (l) and in a cheaper design (r)

5. The eighties; 30 km/h zones

The nineteen-eighties opened with the first formal litigation against a local authority regarding the placing of speed control humps. The public prosecutor charged the municipality in question with being in contravention of the ‘Dutch Road Traffic Act’ The terms of this Act oblige local authorities to ensure facilitation of a smooth flowing and safe traffic flow on their roads. Speed control humps were deemed as contravening this obligation, therefore meaning that the local authority was acting in contravention of the law.
In a second appeal the public prosecutor lost this argument in a court case. The objection was not upheld. The highway should be safe for all road users, including cyclists and pedestrians. In order to ensure the safety of these other roads users there are clearly certain circumstances where the speed of traffic could be reduced using speed control humps.
Another important aspect during this period was the formalizing of the rights of residents to have a say before any traffic measures be applied.
The term residential area or zone was further expanded to make it legally possible to designate a zone as having a maximum speed limit of 30 km/h.

Figure 4. Traffic signs indicating the start and end of a 30 km/h zone

A Decree was published in 1984 concerning the requirements to be complied with by roads or road sections within built-up areas, where a maximum speed of 30 km/h was set, taking account of Article 132c, section 1 of the Dutch Highway Code (RVV) (STb. 1966, 181)(Abbreviated version).

I. Sign 1 (indicating a maximum speed limit of 30 km/h) and sign 1b (30 km/h zone) may only be applied in built-up areas if the following requirements are complied with:
   1. The nature and state of the roads and road sections concerned should be such that where speed-inhibiting measures have been applied on such roads or road sections, a maximum speed of 30 km/h is a reasonable and logical consequence of the application of such design measures.
   2. The roads or road sections where sign 1 has been placed should, as far as motorized traffic is concerned, only have a relevant function to traffic having its destination or original departure point on such a road or road section, or within the immediately proximity of said road. The same also applies to a 30 km/h zone.
   3. On the roads in question the directness and efficiency of public transport services should not be adversely affected to any significant extent.
   4. The impression should be avoided that the roads concerned are a constituent part of a woonerf.
   5. If those provisions referred to in point 1 are applied on the roads or road sections concerned, they should not interfere with or impede the smooth passage and accessibility to the emergency services (police, fire brigade and ambulance) or the efficient flow of access to goods traffic.
   6. If those provisions referred to in point 1 are to be applied, then adequate public lighting must be present in order that the provisions are also clearly visible at night or during the hours of darkness.
   7. If those provisions referred to in point 1 are applied they should not present any hazard to traffic passing these provisions at the permitted speed (30 km/h).

II That determined in section I shall not apply if a temporary situation arises which would require the placing of sign 1.

III The Decree of 16 March 1983 regarding the requirements which roads or road sections within built-up areas should comply with, shall be hereby revoked.

IV. This Decree was applicable from 1 January 1984.

The 30 km/h -zone was herewith formerly actuated. This legislation was also accompanied by substantial subsidy measures.

The introduction of a formal regulation for woonerfs helped to considerably enhance the popularity of the woonerf. It appeared in spite of this that the regulation was regarded as being too restrictive. The local authority Highways departments as well as local residents had more need for more latitude with regard to the design layout of woonerfs. As well as this the layout design is often also selected for areas other than housing estates or residential areas, for example shopping areas in town centres or a district shopping centre, or in an office complex situated in park-like surroundings. For this reason the woonerf legislation was revised in 1988. The newer revised regulation contained only six requirements instead of the fourteen in the old regulation. In addition the name ‘woonerf’ was amended to ‘erf’. The following requirements remained:

1. The estate should occupy a function mainly dedicated to housing of residency. This means that as far as motorized traffic is concerned that:
   - Roads within the designated ‘erf’ area should only have a function for facilitating the flow of traffic which has its’ destination or original departure point within this estate area and
   - The volume of traffic should not be allowed to adversely affect the character of the ‘erf’.

2. The nature and state of the roads and road sections on an estate should be such that where speed-inhibiting measures have been applied on such roads or road sections, a walking speed results as a reasonable and logical consequence of the circumstances created.
3. The impression should be avoided that the road is split into carriageway and footways. There should for this reason be no continuous differences in elevation occurring in the transverse profile of the road on such an estate. If the aforementioned is complied with then provisions for pedestrians may be realized.
4. The entrances and exits providing access to an estate should be clearly discernible from their construction and where they could be used by vehicles from an intersecting road they should be constructed as entrances/exits. It is also permitted to have the entrances/exits be situated at distances of a minimum of 20 metres from intersecting roads. Sign 57c was to be placed at every entrance to such an erf and sign 58c at every exit.
5. The edges of that part of the road pavement intended for the parking of one or more vehicles should be clearly indicated by road marking of at the least the corners of such spaces. The colour of this marking and the letter 'P' should be clearly discernible from other road pavement at such locations.
6. No sub-plate may be positioned beneath sign 57c indicating the character of an erf (woonerf, shopping street, office complex, etc.).

This particular period was characterized by three important developments in the field of standardizing road design particularly that within built-up areas:

- The introduction of the regulation of government subsidies for municipalities wishing to experiment with the traffic safe reorganization of various (residential) areas.
  This subsidy arrangement has contributed significantly to the introduction of this type of measures. Local authorities that wished to introduce these 'new' speed-inhibiting measures were able to get funding for this through the subsidy regulation from central government amounting to 85% of the total costs. Three important conditions were set for this however:
  1. The measure, or package of measures involved, had to contribute to renewing the character of an area.
  2. The measures had to be supported by preliminary and follow-up studies into the effects on road safety.
  3. The experiences gained had to cover a broad area.
- The realization of a large scale experiment with a traffic safe restructuring of residential areas in the cities of Eindhoven and Rijswijk.
  The design layout of three residential districts in each of these two cities was refurbished with a view to improving road safety. This refurbishment of the layout structures had three different variants:
  - the 'extensive' woonerf;
  - the simple woonerf;
  - mainly speed control humps used as speed inhibitors.

The experimental project has produced a lot of knowledge and data about the detailed effects of all sorts of measures. More important were the main lines of the conclusions i.e.:

- Woonerfs are safe if well executed, though construction and maintenance costs may be high.
- A simple design layout of streets, employing speed control humps in particular, is just as effective and much cheaper, though less attractive.
- The introduction of the first version of a national design manual for traffic provisions within built-up areas. The regulation described above dramatically improve the degree of willingness and inclination to take traffic measures to promote greater road safety. At the same time a certain degree of unfettered growth arose as a result. The existing regulation at that time only prescribed to a limited degree the execution of the provisions.
  The designers' manual was developed in order to try and control the unfettered growth

while simultaneously stimulating the taking of responsible measures. This manual both indicates the design principles and offers examples of possible measures to be taken. The emphasis was largely placed here on a traffic safe design layout and on a fair balancing of the interests of car traffic, cycle traffic and pedestrians. With this designers were given latitude to apply such measures in a responsible manner. They were and are also encouraged to really keep this in mind. Another product of this was that an express semblance of order was actuated, through the introduction of the manual, in the traffic safe (re)organization of residential areas.

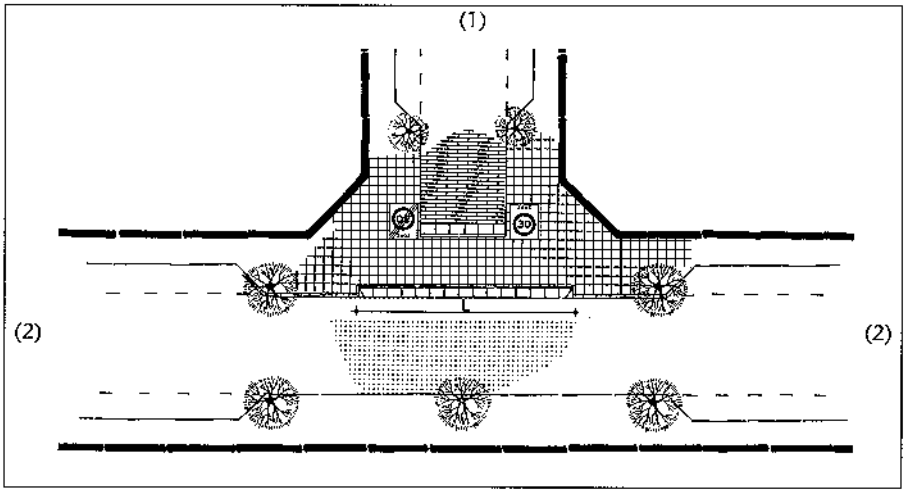

Figure 5. An example of a speed inhibiting measure at the start of a 30 km/h area (provision 10.6/21 of record 15)

This period ended with commercialization. Road safety enjoyed the formal attention, though less pronounced. The Board of Road Safety was discontinued and the function of separate Secretary of State charged with a special portfolio for road safety was abolished. Central government subsidies to local authorities for adopting road safety measures were drastically reduced.

A typical example of this commercialization was manifested by the amount of pressure put on the designers of housing estates and residential areas by those responsible for making best use of the available land. An area built as a woonerf can fit more dwellings into the space used than an area constructed with a conventional street design. The application of woonerfs may also be an attractive proposition in terms of optimum land use.
As the total amount of space allowed for traffic to use is relatively limited cars will pass very close to the front doors of the housing. This proved to be a less attractive and less safe situation than that originally envisaged at the inception of the woonerf design.

The only aspect left that was accorded any real attention was the reduction in road accident victims. This was manifested in a premium or bonus (NLG 1,000.-) for every individual reduction in accident victim figures in relation to the average number of victims per year over the years 1984, 1985 and 1986.

6. The nineties; sustainable road safety

At the start of the nineties the concept of sustainable road safety was introduced to avoid a situation from developing in the nineteen nineties where the attention paid to road safety would disappear from the (political) agenda entirely. As well as sustainable building (of housing and roads) and a sustainable social fabric (for social developments and health care) there was also a need recognized to have a traffic and transport system which would also be sustainable in the sense of durable and viable, and particularly in terms of safety. A

sustainable safe traffic and transport system has a lower incidence of traffic accidents and certainly fewer serious accidents. The aim is to apply preventative measures rather than measures after the fact. This long-term philosophy was further particularized through the nineties in terms of design guidelines based on three design principles:

- Prevent unintended usage of the infrastructure; the functionality of the road network.
- Prevent conflicts occurring at high speeds, discrepancies in direction and mass; the homogeneity of traffic.
- Prevent uncertain or erratic driving behaviour among road users; predictable traffic behaviour.

For the present sustainable safe traffic is translated as the sober layout design of large 30 km/h zones, the thinking being that fairly soon the maximum speed allowed in built-up areas will have to be set at 30 km/h.
A positive aspect prevailing during this period has been the heavy amount of attention paid to roads outside built-up areas, so much so that here too it has become possible to introduce viable residential areas. The maximum speed limit is then 60 km/h instead of 80 km/h.
The middle of the nineties was especially marked by the publication of the national traffic-engineering manual for traffic provisions within built-up areas (ASVV 1996).
In this manual all the experience has been grouped together and translated as design recommendations for a safe design layout for public space.

7. Speed inhibiting measures

The first designs of speed inhibiting measures were clearly experimental and simple. In the nineteen seventies, influenced by the 'woonerf concept' there were several extravagant and relatively opulent designs put forward which were also therefore susceptible to the need for heavy maintenance. This included things such as wooden plant pots, soft lighting and ornamental paving in various colours, materials and shapes.

Due to the slight economic recession in the eighties many people reverted to simpler designs. It was not just that the constructions were generally more sober, but often only speed control humps were applied as a speed inhibiting measure. This did not however have any negative effects on road safety or the quality of life.

In the nineties designs become once more slightly more opulent, though not as extravagant as they were at the period when they first appeared. The new formal regulations also placed less emphasis on design. Partly due to pressure from modern town planners, with the accent being tilted towards straight and long lines of sight, the space available for an expansive design is limited at the present time. Once again the prefabricated elements have reappeared. With these highways authorities are allowed some latitude to decide on their own design of speed inhibitor: rounded, square, rectangular, oval etc.

At present the following speed inhibiting measures are to be found:
<u>In residential streets:</u>

- At the start and end hump-like provisions on the roads demarcating the areas. In The Netherlands these are referred to as gateways or thresholds. They are often constructed with a continuous footway cutting across the approach road (the exit construction) (see Figure 5).
- At intersections the intersection area is usually raised and a ramp (or half hump) is used to drive on to this raised area.
- On longer road sections road narrowing, tapering, centreline shifts and speed control humps are applied.

<u>On access roads:</u>

- As many segregated cycle tracks as possible.

- Roundabouts used as intersections.
- Speed inhibitors (50 km-hump) on road sections.

As an aid to designing speed inhibiting measures the following design manuals are presently relevant:

1. The ASVV manual (CROW-publication 110; or in English record No. 15).
   This is a broad traffic engineering design manual which includes an extensive section on speed inhibiting measures and - equally importantly - the selection process used to arrive at these measures.
2. Manual categorizing roads on the basis of sustainable safety (CROW - publication 116).
3. Grouping of ideas 'Sustainable safety in development'.

8. Conclusions

Speed inhibiting measures applied to control traffic speeds, generally on roads and streets with mixed traffic and especially in residential areas, are a common sight in the Netherlands. Such measures have a long history.
In order to apply such measures the primary responsibility lies with local authorities. However right from the outset this has been stimulated by central government.
The legislation and regulations covering roads and traffic also provide clear frameworks for applying good speed inhibiting measures.

With the general responsibility for road safety the Dutch Central government provides encouragement to ensure that this sort of measures are applied.
The taking of such measures is not prescribed in any compulsory sense, just like the detail of constructions isn't pushed onto local authorities.
Local authorities have free latitude to decide on the application as well as on the design. They are however obliged to adhere to general design principles for a 'responsible' design, but are not forced to adhere to a prescribed construction.

Through the support of the development of the ASVV manual and the stimulating of its application, central government seek to promote good design and avoid unfettered growth. Practical experience has shown that this is an effective strategy.

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