

TRAFFIC CALMING DIRECTIONS IN URBAN MANAGEMENT

Hassan Abdel-Salam

Department of Architecture, Faculty of Engineering, Alexandria University

ABSTRACT

Traffic Calming is a new approach for managing traffic inside the city residential and central public spaces. It is increasingly addressed by professionals and researchers, and adopted by policy makers, especially those concerned with the impact of traffic on the quality of streets and public spaces. This research is an attempt at defining the term, and highlighting the new directions associated with it. Traffic Management is discussed as the broader field, where different practices are currently found, with the key objective of alleviating the growing problems caused by traffic in cities. These include such concepts as Woonerf, shared surfaces, transit malls, and street playground, as found in many countries around the world. The research consists of four main parts. First a definition is presented of the topic, then different approaches to address traffic-caused problems are reviewed. The second part explains a number of strategies and measures implemented collectively towards traffic management. In the third part, a more recent direction, or a "Second Wave" of traffic calming is discussed. Finally, a conclusion and set of recommendations for application are presented in the last section of the paper. Thus, a key objective of this research is to guide future intervention in urban areas, aimed at improving the design of streets, to better serve the co-existence of people and vehicles.

Keywords: Traffic calming, Traffic management, Urban circulation, Vehicular movement control

INTRODUCTION

Traffic Calming is an approach to Environmental Traffic Management (ETM) chiefly applicable in residential areas and neighbourhoods, to address the local problems caused by increased traffic volume. It consists of a set of measures, formulated as solutions to the different impacts of motorised traffic, which are threatening the quality of streets.

Traffic Calming is about creating safe and attractive streets. In its simple and most direct definition, it is a way of slowing down cars, reducing accidents, and cutting down the environmental impact of traffic. In addition, it is an approach aimed at improving

living conditions for residents, and reclaiming the role of street-space, along with its potential to accommodate outdoor activities, to better community.

The objective of this research is to highlight this approach in urban management, which has become widely adopted, and especially successful within many cities in Europe and around the world. The forward discussion reveals the obvious goals such as pedestrian safety, and noise control, and also the related environmental gains.

On a city-wide level, residential area traffic calming depresses car use, encourages environmentally friendly modes such as

walking and cycling, and provides the impetus for restraining traffic throughout towns. Increasing car dependence, and car-oriented intervention in the physical fabric of cities, has an impact on inner areas, both residential and mixed-use. Recently, most decision-makers and management bodies are considering extending the approach and developing the inherent measures, to be widely applicable in the busier multi-functional, city-centre areas, and central commercial areas [1].

Within the new approach, there are a number of distinctive features, which could be classified into three categories: First, the approach represents a different philosophy of "Traffic Management", in that physical intervention is no longer designed to get the best out of the street system for traffic. Instead, it is designed to manage the traffic for the benefit of local residents and the environment.

Second, the traffic calming approach has evolved from the initial idea of treating individual streets, such as "play streets", to broader concepts of treating whole networks of residential streets. Implications for traffic are thus wider, with more benefits for a greater sector of the city residents.

Lastly, the approach is based on a re-appraisal of the relationship between the pedestrian and the vehicle, and seeks new/better forms of safe co-existence. It involves an *unusual* acceptance of various levels of traffic mixing, i.e. cars and people, but under radically strict assumptions about pedestrian priority, or at least equality. This approach thus applies principles, and

theories, of integration of modes of circulation, in contradiction to the more familiar traffic segregation [2].

Initially, Traffic Calming was nothing more than a collective noun for a wide range of often very divergent solutions aimed at making a given residential environment more agreeable and safer [3]. Recently, there have been lots of new terms coming into use concerning traffic management schemes. While all of them mean a sort of reorganisation, they also illustrate diverse and new developments in urban planning and renewed attention to the proper functioning of communities. The following is a brief outline of the most relevant ones, directly related to, and applicable in residential areas.

Traffic-Restrained Area

Referred to as Traffic-Managed Area is the case where traffic calming is applied across a group of streets, whole neighbourhoods, or even larger areas of towns including main roads. The wider interpretation is the more recent, and it overlaps with environmental traffic management [4, 5].

Woonerf or Woonerven

Best referred to as residential yard, or residential precinct, where space is shared between motorised modes and pedestrians (Figure 1). Driver behaviour is modified by new regulations and physical alteration of street layout. When provided in a shopping area (Figure 2), it is known as "erf", simply meaning "yard", whether in commercial or central areas [3, 6 and 7].

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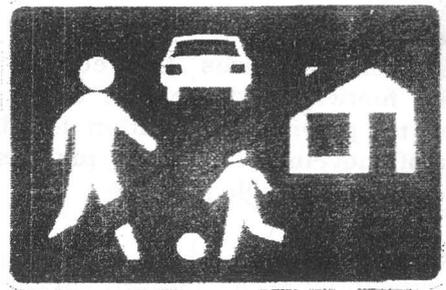
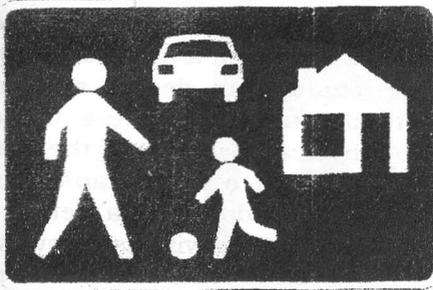


Figure 1 The traffic signs denoting the "Beginning" and "End" of a Traffic Calming Area or Woonerf, adopted in many countries across the European Union [3].

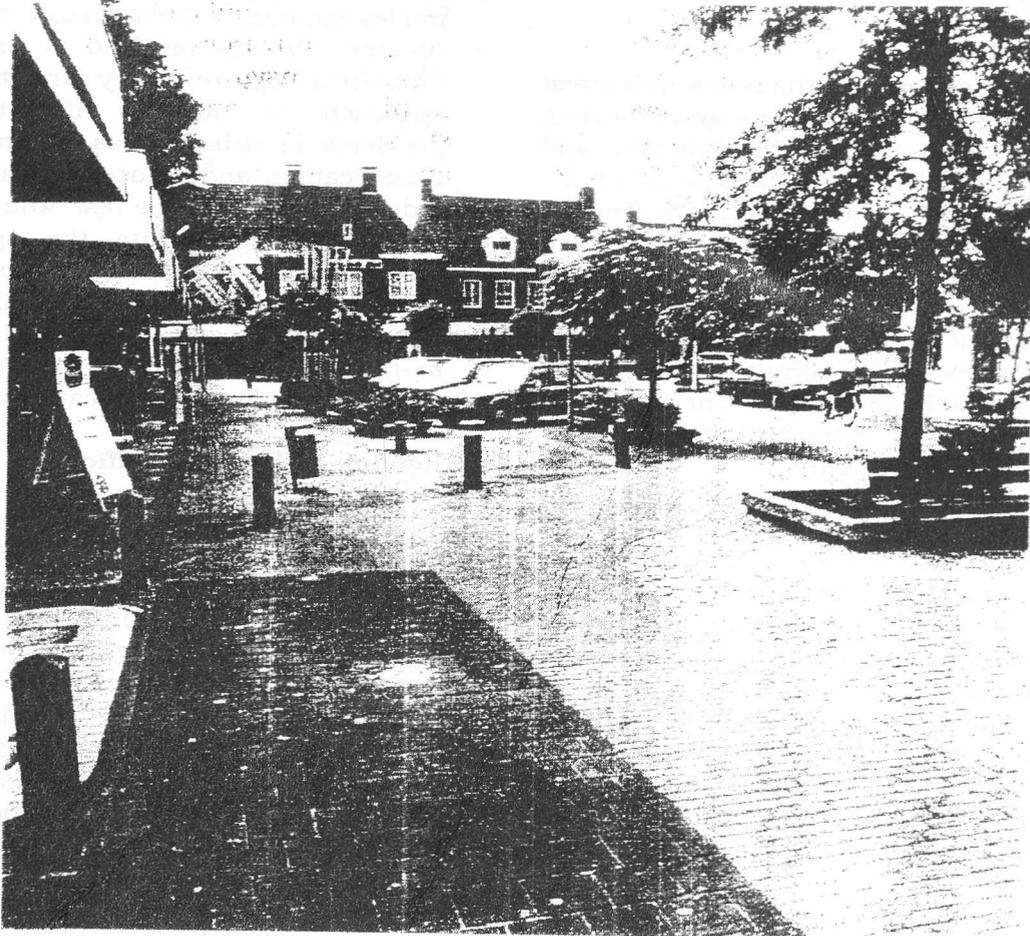


Figure 2 Traffic Calming application within a shopping area: the modified layout of streets in Goor, the Netherlands [3].

Shared Surfaces

This term involves the elimination of separate footway and creation of a curbless profile, to provide integration for different modes of movement, so that motorised and soft modes may mingle [1].

Liveable Streets

A concept first introduced in the United States in the early eighties, to study all initiatives, and collective efforts taken by residents along busy streets, to alleviate the problems caused by heavy traffic flow through their neighbourhoods [8].

Street as Playground

A term highlighting the renewed interest in reclaiming the street space and providing better conditions primarily for child play, and amenities conducive to outdoor activities [9].

In their book *Housing Design in Practice*, Colquhoun and Fauset [10] show a marked interest in the concepts of traffic management adopted in different cases, throughout Europe, particularly in recently designed housing estates. They point that the country that has made the greatest advances and use of shared surfaces is the Netherlands. Since the early 1970s the Dutch Government has been pursuing a policy of making vehicular traffic more compatible with pedestrians and cyclists in residential areas. Following several years of experiments, by a number of local authorities, new legislation governing Woonerven was introduced in September 1976. They add that the legislation was in two parts: (a) a code of behaviour prescribing regulations road users must observe in a Woonerf, and (b) minimum design and furniture requirements which contain detailed regulations governing the design of streets to

ensure that a Woonerf is clearly distinguishable from a traditional street.

The change in design and layout of a residential street to achieve traffic calming has to physically interpret the fact that cars are subordinate to pedestrians. This could be expressed by adopting a set of measures (Figure 3). The following is an overview of the most pertinent to reflect the above-mentioned priority.

TRAFFIC CALMING: WHAT DOES IT INVOLVE?

There are several policies, strategies, and implementation measures, which have become directly involved in this approach. Combined together, they constitute a holistic approach to alleviate the traffic-caused problems in urban areas. However, a sound classification, and a closer look at each policy, independently from the rest, would surely give valuable insight into the specific aims, requirements, and implications related to such individual policies. The following part is an attempt to categorise the policies involved in the broader approach to Traffic Calming. They fall into five distinct categories.

Reducing Through-Traffic

Less through-traffic is the key to any environmental improvement in inner city areas. Much of the congestion and bottlenecks, which are found in residential areas within or around busy centres, are caused by vehicles which are just driving through. Since this is often a considerable portion of the total flow of vehicles, a process of screening becomes necessary. Motorised traffic for which a certain area is not an origin nor a destination, ought to be diverted to alternative "outer" routes [11].

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1. no continuous kerb
2. private access
3. bench around low lighting column
4. use of varied paving materials
5. private footway
6. bend in the roadway
7. empty parking lot; place to sit or play in
8. bench/play object
9. on request: plot with plants in front of facade
10. no continuous roadway marking on the pavement
11. tree
12. clearly marked parking lots
13. bottleneck
14. plant tub
15. space for playing from facade to facade
16. parking prevented by obstacles
17. fence for parking bicycles etc.

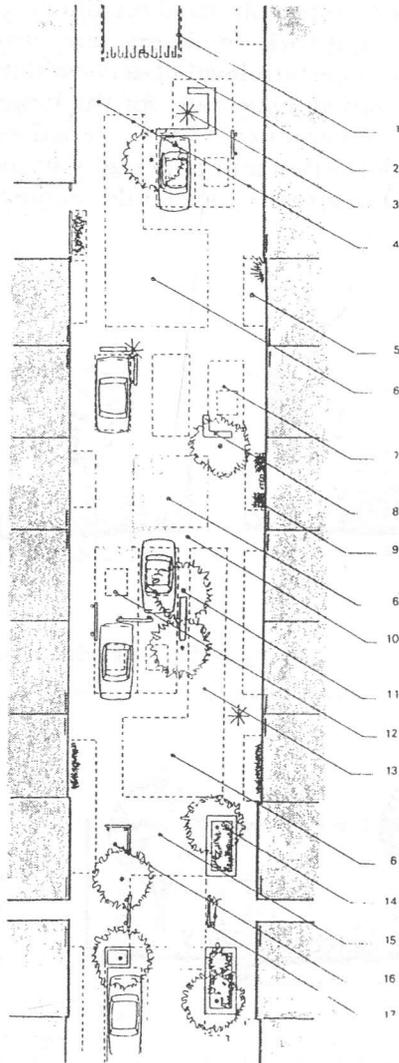
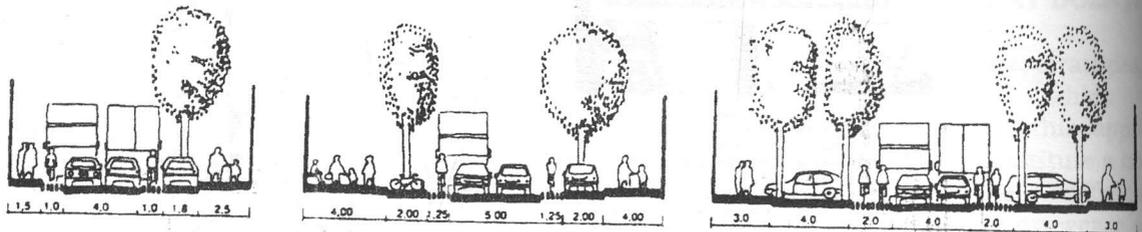


Figure 3 The Woonerf Sign, Speed-Restricted Zone Sign, and Characteristic Design Features of a Woonerf. [2 and 10] respectively.

This requires some physical modification of the streets network to divert non-local traffic. However, a certain level of accessibility must be maintained, especially for the larger vehicles of emergency, fire engines, maintenance, deliveries and policing. Varying modal allocation of street space could achieve

more efficiency in the use of available road width (Figure 4). Also it is necessary to avoid large vehicles having to reverse out of the *Woonerf*. The network of streets must therefore allow vehicles to drive around blocks.



Many traffic lanes do not need to be lorry-widths as 95% of traffic is cars

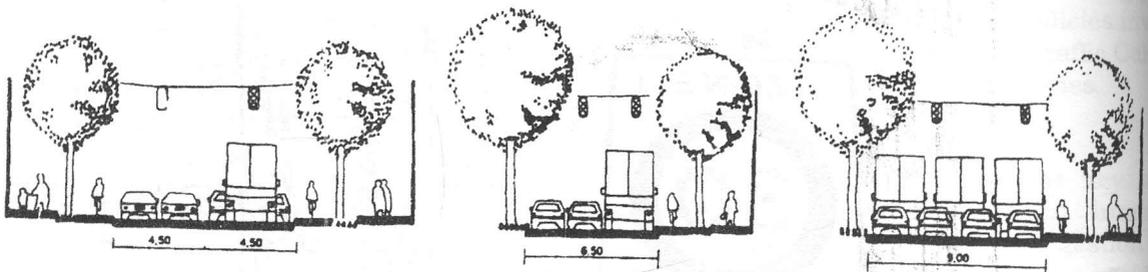


Figure 4 Varying modal allocation of street space to increase efficiency and fulfil more needs of different types of movement within available road width [2].

Slowing Cars Speed

The objective is to achieve a traffic behaviour pattern, chiefly characterised by lower speeds. With that in view, several devices are used such as speed tables. A speed table is an elevated plateau in the roadway, with a descending ramp on each

side. It is usually made from distinctive materials such as paviments, tiles or setts, and often installed at crossing zones (raised crossing) and junctions (raised junctions). As the plateau has the effect of raising the roadway to the level of the bordering footway, it is also referred to as a raised pavement [2].

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Substituting speed humps for speed tables is the chief alteration. Further elements include barriers, equipment, guardrails, and bollards. Enforcement and engineering are also necessary to assist in slowing traffic, and to control the behaviour of drivers using the residential streets, particularly to direct the vehicles path. In several countries, evaluations have been carried out on traffic calming devices in use. The goal is providing standards for marking, signs, and geometric organisation.

Redesign of Street Layout

The street layout is redesigned with the broad objective of avoiding linearity and excessive clarity, which inevitably encourage higher speeds and reckless behaviour on the part of drivers. General practice has the

converted streets made narrower, linearity avoided, visibility is maintained yet with repetitive shifts in sight-lines (Figure 5). Twists in the roadway are introduced, at least 45 degrees if they are to have any effect. Intersection design, pavement and shoulder management are of particular importance to form *Necked-down Junctions*. The narrowing of the roadway is preferred at junctions by projecting the footway into the road, particularly used where residential roads make a T-junction with local distributors. The resulting tight radius of the entry reduces the space available for vehicles, thus reducing speeds, while the narrower road lessens the time that the walking/crossing pedestrian is at risk [11].

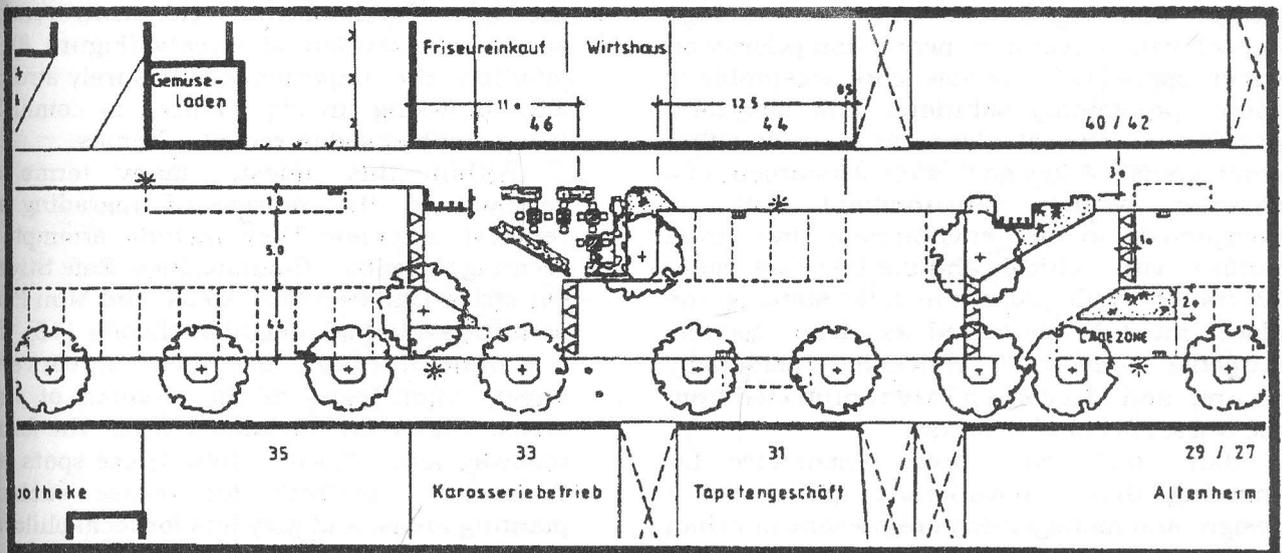


Figure 5 Redesign of street layout to control the behaviour of drivers and provide for better coexistence between people and cars, Liebnitzstrasse, Germany [2].

Better Conditions for Pedestrians

It is now argued that road safety is best achieved through integrated strategies, simply because of the low political priority attached to road safety on its own. Therefore pedestrian safety should be made an integral part of development and urban renewal plans. Such integrated approach is well illustrated in traffic calming schemes of individual streets. The earlier single-street treatment could be extended to an area-wide approach.

While formulating a broad strategy for intervention in inner-city areas, urban planners and designers should consider viable solutions for co-existence between vehicles and people, not simply those streets where traffic can be altogether removed and re-routed to peripheral collectors. Every effort must be taken to ensure better conditions for pedestrians, even at different degrees of priority (Figure 6). A piecemeal approach using skill and imagination, within limited budget and legislation, can have a high impact which restores pedestrian priority on street space [12]. *It is now more acceptable to adopt preliminary solutions, and long-term phasing of renewal plans, as a trade-off for other gains. A key goal is the attainment of a pleasant walking environment. This is interpreted in an environment free from conflict with vehicles and the inevitable side-effects of traffic. Also the new state of the place must be perceived as clean, visually attractive, comfortable, convenient, personally secure, and to a certain extent protected from the worst effects of weather.*

Jan Gehl has been responsible for ensuring that innovations in public space design and management are present in urban design literature. In his book, *"Public Spaces - Public Life"* [13], he shows ways in which Danish policies and attitudes, regarding street-life and pedestrian-use have been developing, together with a synthesis of the

major factors affecting use patterns, walking routes and outdoor activities.

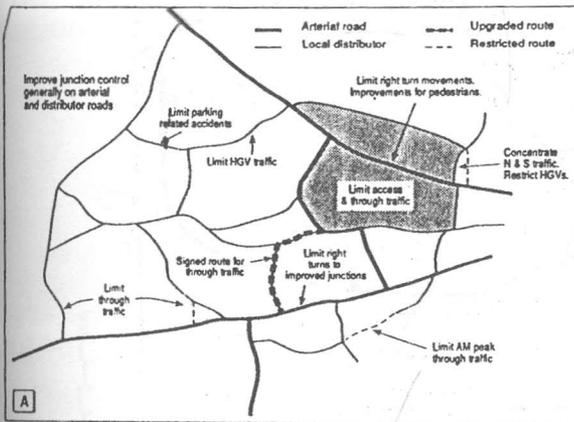
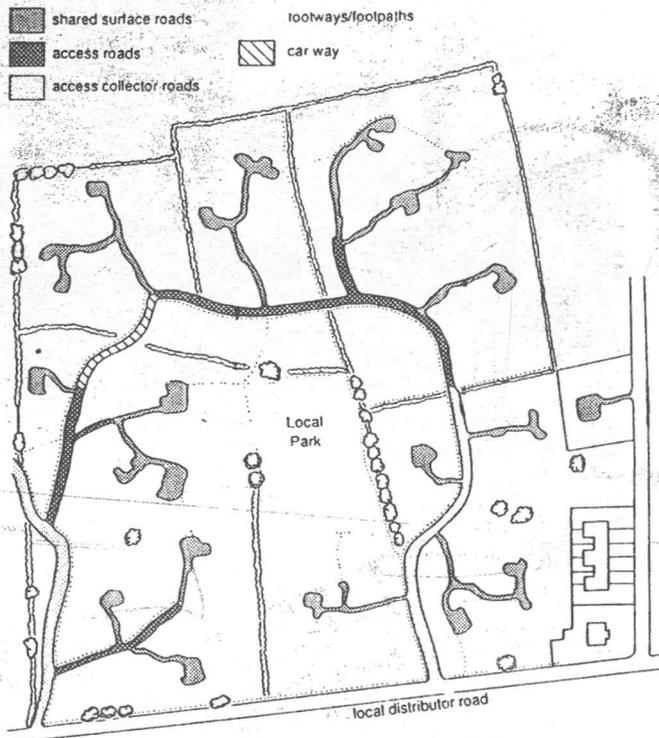
Attention must also be paid to slower (also referred to as **Green**) modes of movement, primarily cycling as another green mode of transportation, which ought to be encouraged (Figure 7). Priority must be restored and conditions in favour of cyclists provided [14].

Recreational Opportunities within Neighborhoods

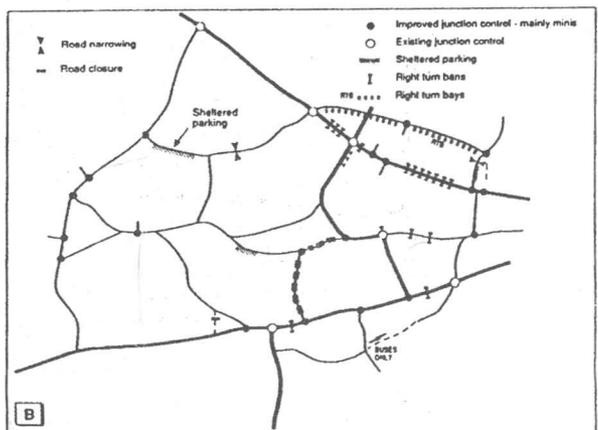
Achieving this goal would require both positive and negative actions, the one to promote pleasure and safety, and the other to eliminate present practices that lead to unpleasant and unsafe conditions [2]. If traffic-caused disturbance could be eliminated, or even reduced, the underlying potential of street space would be revealed and the chance available for adding recreational amenities. Many cities are recognising the importance of recreation on the micro-level, at the local easily reached spots from residential streets (Figure 8). *In addition, the importance of leisurely strolling and browsing in city centres is commonly being emphasised in recent schemes.*

Within this quest, many terms are common in the process of upgrading and renewal of cities. They include attempts at creating Liveable Communities, Safe Streets, On-street Children Play Areas, and Mini Parks within residential neighbourhoods [15]. The non-uniform nature of Woonerf, or converted street, often leads to the creation of small areas, which are reclaimed from the former roadway and adjacent lots. These spots lend themselves perfectly for re-use such as planting areas, and play lots for local children. Thus they are creating a whole new ambience of informality and leisure, amidst what was previously a network of rigid streets lined with sidewalks and buildings on both sides

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Safety Objectives



Measures

Figure 6 The Typical designs to re-allocate road space as to be shared by pedestrians and vehicles, thus restoring the lost balance between each group's priorities[2].

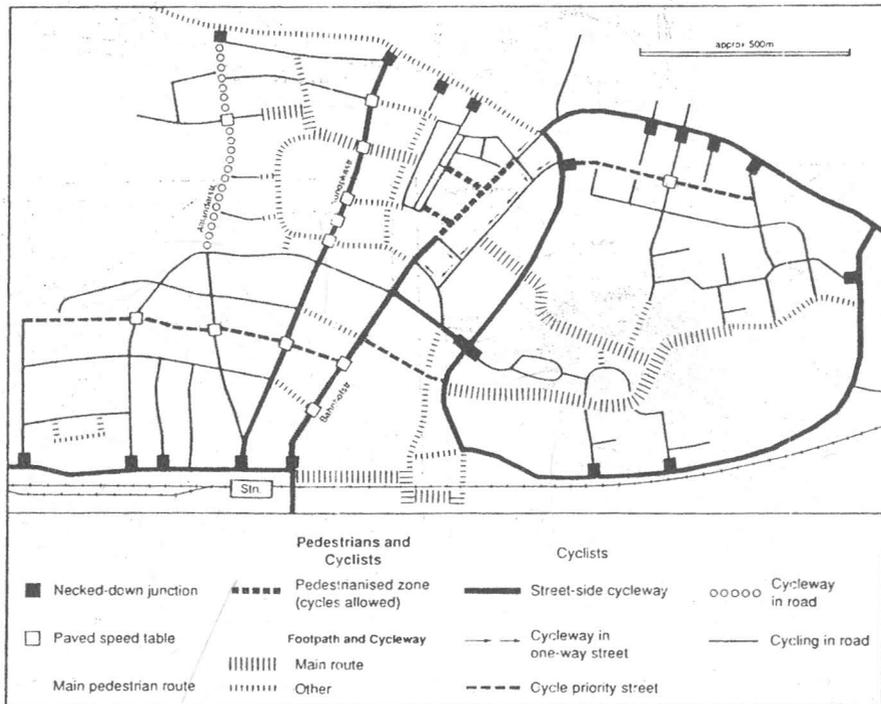


Figure 7 Care for Green Modes such as walking and cycling is a primary motive to introduce Traffic Calming measures. Area-wide modification plan to provide a hierarchy of facilities for walking, motorised access, and cycling, in Buxtehude, Germany. [3 and 2] respectively

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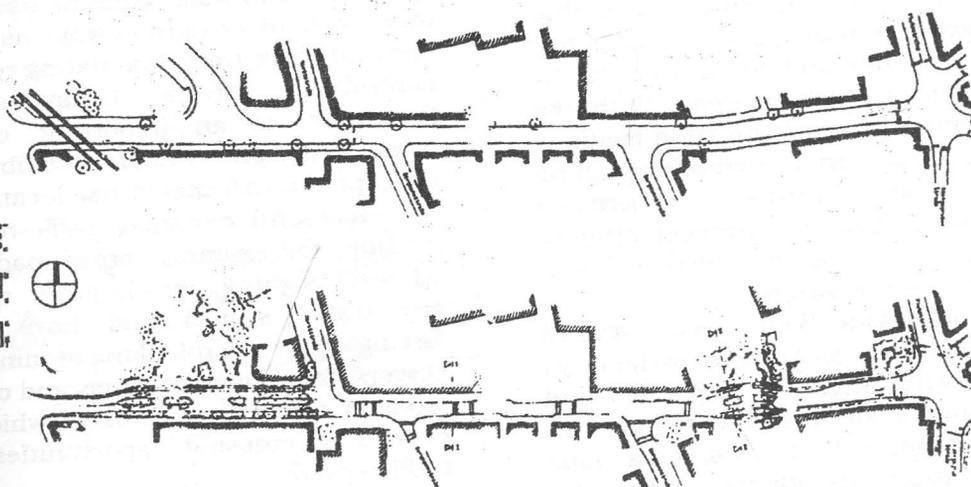
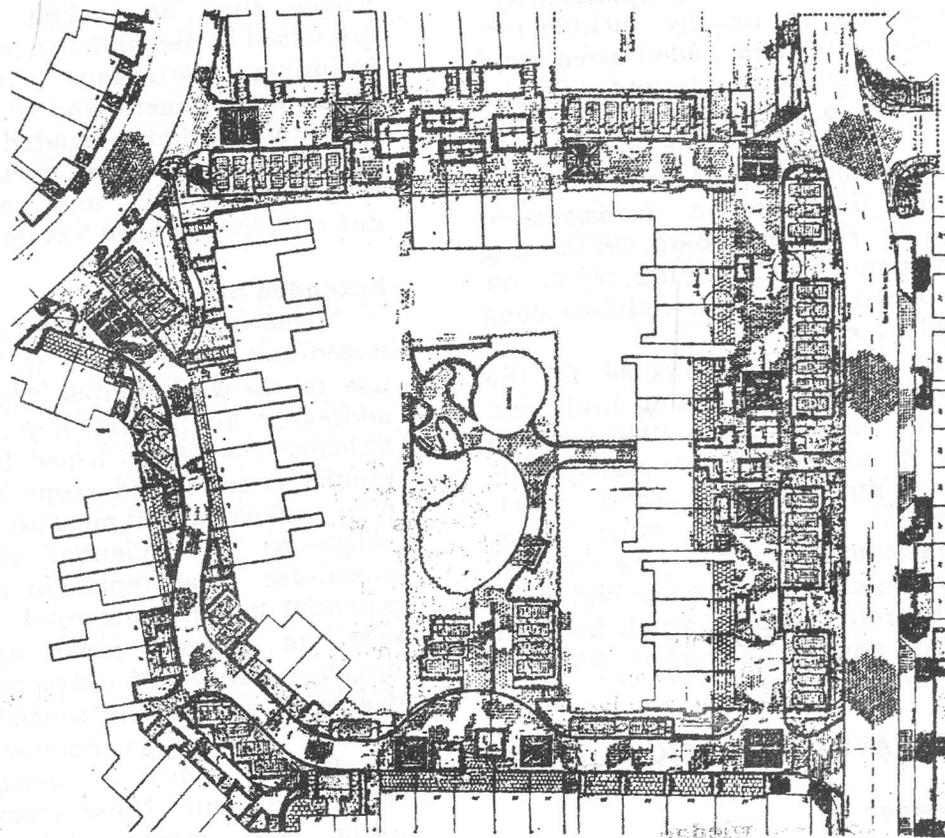


Figure 8 A proposal for a Woonerf Loop, utilised to provide multi-use surfaces, and introduce recreational opportunities within residential areas [10].

Maintenance and Collective Responsibility

Converted streets usually include new landscape elements, and added streetscape units such as benches, sheds, and child play areas. To ensure a continued role for such amenities, a system of administration is needed. This is often referred to in different terms, such as collective management, sponsorship, or residents board. On the long term, maintenance and regular repair are needed to upkeep favourable conditions along the converted streets.

Identifying a body responsible for the processes of management, raising funds, and supervision of maintenance is a key factor to the success of any intervention project. This of particular importance in areas which include several functions other than residential, e.g. commercial. Creating a shared sense of responsibility, partnership, and pride among the different groups of people involved will certainly ensure a higher level of participation and involvement.

THE SECOND WAVE OF TRAFFIC CALMING

Shared Knowledge

At the present time, there is a growing public awareness of the environmental damage caused by traffic. More and more groups of people and local bodies realise that it is no longer acceptable, not even possible, to cater for all demand for movement by private vehicles in urban areas. With the advent of electronic communication media, a wide body of information is currently reaching concerned groups world-wide. Experience about proposals, policies, implementation, and projects, is easily shared, and professional advice exchanged.

On the World Wide Web (www.), several sites discuss the topic, and offer experience in appraising environmental impacts, and preparing solutions such as identifying road hierarchy, management devices, area bans and traffic routing. In addition, particular emphasis is directed to accommodating green

modes such as cycling and walking. Also discussed is the guidance for implementation, including discussions on neighbourhood traffic management and strategies. To list a few, traffic calming related web sites include www.mobility-net.com, www.city.victoria.bc.ca, www.usroads.com, and more (among 30 different sites verified November 1998)

Extended Scope

Mixed-use areas of the city also require a mixed-use public space to enable choice of use to the widest public. This point of view is addressed by Smith [14] in his article "Traffic Calming: The Second Wave". In his discussion, Smith extends the scope of application of early traffic restraint measures, far beyond the single-use or residential areas alone. Thus mixed-use areas represent a new field and potential for environmental improvement. In order to improve public open spaces, the broadest range of users must have a fair degree of equity. The second wave of traffic calming is said to employ concepts and installations which are designed to change driver behaviour. These changes are effected using both more subtle and dynamic, sometimes fixed and brutal means, than the now familiar first phase of traffic calming.

Dynamic traffic calming uses uncertainty (over activity or right of way) as a principle to demand care from dominating road users, i.e. controlling drivers behaviour. This is forwarded as an important component of urban design, which contributes to the concept of a *safe* mixed-use location.

Successful dynamic traffic-restraint ideas include, for example, cross-roads with "stop all way" signing, which gives no priority for any traffic stream and have the effect of forcing drivers to roll along at minimal speeds. Drivers take turn to cross and consequently streams of cars are broken which increases pedestrian crossing opportunities and slows traffic speeds.

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With this initial aim attained, the second phase has moved to incorporate the following features:

- Children's play spaces located in areas where cars park, previously considered a shortcoming of design;
- Pedestrians invited to accept priority and actually move along the road itself;
- Cyclists also invited to use more parts of the road fully and freely;
- Providing for servicing and parking in the centre of streets, previously reserved for vehicular through-movement.

Most of these measures were previously seen as major causes of injuries, which ought to be removed to improve road safety, visibility, ... etc. In the present time after many trial periods in West-Europe, research shows that greater visibility for instance is associated with a greater number of accidents. The reconstruction found on many roads, in Dutch cities for example, seem as fascinating installations which combine play and cars (Figure 9). Dangerous as it might

appear, the safety record of these cities is strikingly among the best on the European level [14].

RECOMMENDATIONS: AN APPROACH FOR CHANGE

Prior to introducing Environmental Traffic Management ETM schemes, careful consideration ought to be paid to the particular contexts found in different cities. There are many differences in culture, history, living arrangements, and attitudes to circulation that might affect the application and intervention in residential as well as in mixed-use areas. Concerns and priorities do vary between different groups involved such as residents, local authorities, and landlords. Thus levels of acceptance, or resistance, of change. A true challenge thus lies in introducing the subject, building a certain awareness of benefits and objectives, and achieving widespread interest in, and public support for, any proposed management policy.

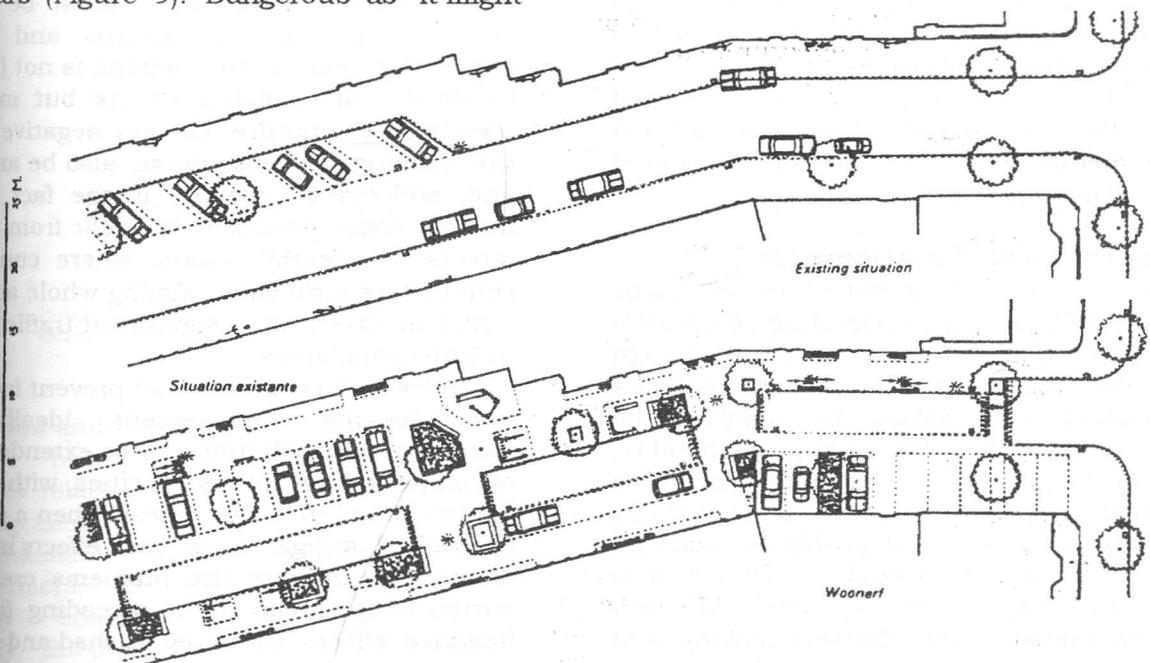


Figure 9 Re-organisation of an existing street into a Woonerf, illustrating the trend towards combining play and parking, as part of a "Second Wave" of Traffic Calming [10].

What needs to be done: An Overall View

To achieve the valuable prospect at hand, four essential tasks must be considered:

- First, it is vital to reduce the number and length of trips by private vehicles, through improved land use planning. Shorter trips will encourage a transfer to softer modes, and will produce less deleterious effects from the trips that remain motorised, since these will now be fewer and shorter.
- Second, there should be promotion of the soft modes and public transport. This is a case of giving people a sound and attractive alternative mode of transport to use, rather than their private cars.
- Third, whatever motorised traffic remains after implementation of the above approaches should be calmed along lines suggested in this research, using legal and infrastructural measures in combination.
- Last, converted streets and central spaces, whether in residential or mixed-use areas, must be studied and redesigned, as to fulfil further crucial aims such as pedestrian amenities, child play lots, and recreational opportunities.

Further crucial issues must be addressed to develop a sound approach towards environmental trma. They are outlined under the following topics:

Raising the Public Consciousness

As the rate of introduction of traffic restraint schemes is accelerating on a world-wide level, it is important to raise enough awareness about the approach, and its effectiveness, both among the public and the officials (Figure 10). Issues such as mobility, accessibility, safety, and liveability must be explained, so as to form a consensus regarding the nature of problems, and the range of solutions available. This is also needed in order to form a single and firm basis for consultation, decision-making, and involvement, which always take place before, during and after, the implementation stage of any urban management project.

Local government and municipal bodies, along with other institutions, have a major role to play in this direction. By releasing publications, manuals, research and survey data, it is possible to advocate the improvements in pedestrian movement, cycling, traffic safety as well as the many environmental benefits to the city areas, where traffic management is to be applied. Designers and planners could also promote the public, and other groups, awareness regarding such potential gains as the stimulation of central residential and shopping areas, less pollution, less noise, greenness, and less disturbance by traffic.

Larger Areas: Traffic Restraint on a City-Wide Level

The message should be emphasised by stressing the street as part of a system, whereby disadvantages may sometimes have to be accepted in one place for the sake of the whole network. Using particular suggestions for network treatment, it must be clearly demonstrated to the groups and bodies concerned that traffic calming is not just the treatment of isolated streets but must be area-wide in nature. The key negative side of the calming process, must also be analysed and addressed, which is the fact that it implies some diversion of traffic from treated streets to nearby roads, where conditions could worsen. So does calming whole areas, in terms of diverting a significant traffic load to neighbouring areas.

Indeed, this should not prevent localities from seeking improvement. Ideally, the calming process should now be extended as to encompass large areas of cities, with careful identification of target areas. Then a process of gradual mitigation of side effects must be devised to alleviate the problems created in surrounding areas in a cascading fashion. Negative effects could be pushed and spread over adjacent zones, till reaching suitable areas where adequate conditions could be maintained in favour of through and inner-

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ring traffic flow. However, this must proceed from overall considerations of the network and priorities of a particular community as a whole. The best preparation for traffic calming is through a clear traffic management plan,

which lays down the priorities and viable phasing for intervention in city areas as a whole.

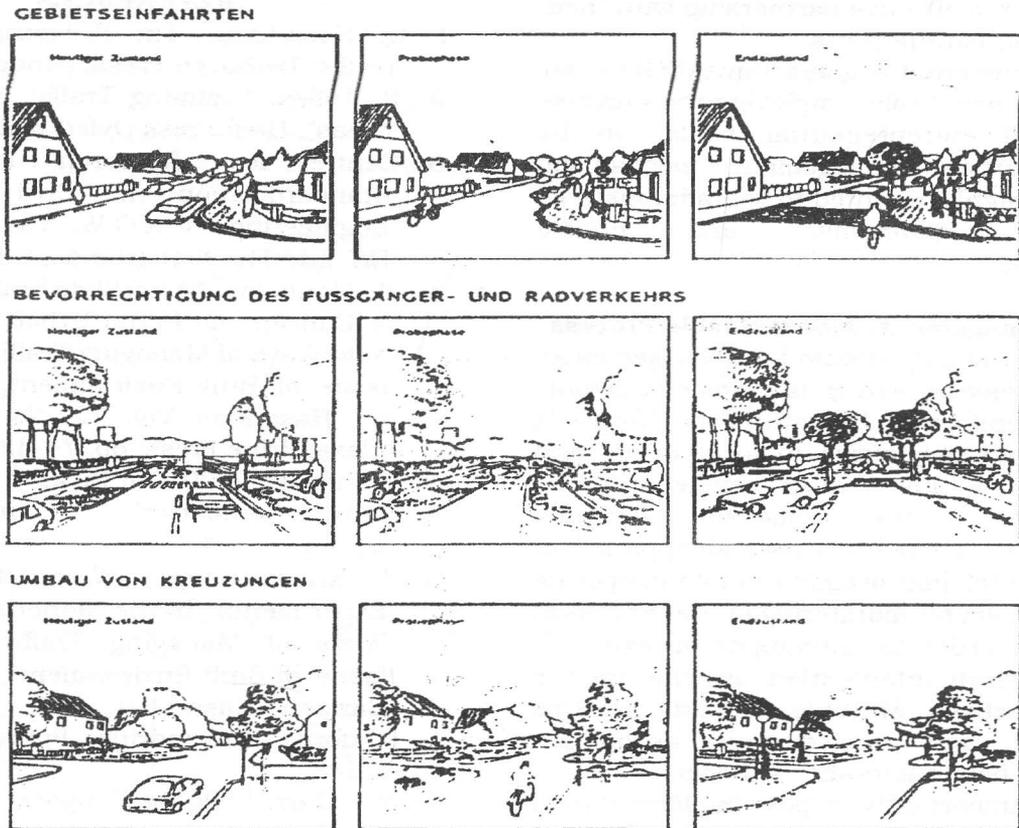


Figure 10 Publicity Briefs used to raise community awareness about the potential benefits, and to lobby for support in German cities, through simple illustrations of "Before" and "After" conditions [2].

Legislation and Funding

There has to be a combination of measures relating to legal matters, financial encouragement, and non-technical considerations. Devising a framework of empowerment for the fresh ideas, will certainly enable more effective action. Similarly, the presence of a financial strategy, would serve the smooth implementation of consecutive stages, for any proposal of change. These are important aspects which

are required to support the intended approach for environmental upgrading, particularly when it involves expensive infrastructural and engineering work. Legal and financial mechanisms also assist the implementation of an integrated package of schemes, which serve a diversity of aims sought by planners, and not necessary linked to circulation within cities.

Major and direct policy statements must be utilised, emphasising the growing need for

road safety, and better environmental quality. In addition, a funding strategy must be provided to encourage more investment from the local authorities budget into the traffic management process. Non-governmental bodies should also be encouraged to take part, and come into effective partnership with their public-sector counterparts.

Non Governmental Organisations (NGOs) can play a significant role, employing their diverse assets and entrepreneurial skills, in the present urban management mechanism, which is highly oriented to self-administered initiatives, autonomy, and private sponsorship.

Traffic Management: A Sustainable Process

Traffic calming should be envisaged as an ongoing process, which is primarily flexible and self-reinforcing. By nature, the process is gradual, and responsive to local needs and problems. It must also invite dynamic participation of the public and concerned local groups. Therefore an overall approach of environmental improvement must incorporate a mechanism for monitoring of the process of change, in order to investigate the extent to which physical intervention is achieving the initial objectives. Multiple methods must be considered, and utilised such as opinion polls, and before-and-after surveys.

Most importantly a post-implementation evaluation is necessary to identify any shortcomings, and negative results. Evaluation of single-street as well as area-wide traffic restraint is difficult because the new nature and multi-disciplinary interests in the field could be interpreted in different ways. However, all results should be fed back into the decision-making process, and amendments to subsequent plans, or applications, introduced accordingly.

The final aim is indeed the provision of an integrated continuous, somehow cyclical, process of urban management, which is regularly reviewed, assessed by different groups involved, and re-adjusted to serve

communities and circumstances, as they both evolve. Such strategy would be a key achievement to complement other movements towards comprehensive management, with broader environmental and socio-cultural goals.

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تهدئة المرور: اتجاه حديث في الإدارة الحضرية

حسن عبد السلام

قسم الهندسة المعمارية - جامعة الإسكندرية

ملخص البحث

تهدئة المرور أو ما يتعارف عليه بالإنجليزية بمصطلح "Traffic Calming" هو اتجاه حديث في التحكم وإدارة مرور السيارات داخل المدن ، سواء في الأحياء السكنية أو في الفراغات العامة بالمراكز الحضرية. تتم الإشارة لهذا الأسلوب بصورة متنامية في أوساط المختصين و الباحثين و كذلك المسؤولين عن وضع سياسات لتنظيم الحركة الآلية داخل المدن و الحد من تأثيرها السلبي على نوعية الشوارع و الميادين بما. البحث هو محاولة لتعريف هذا المصطلح ، و توضيح الاتجاهات و الأهداف المرتبطة به مثل الأمان و تقليل التعارضات و الارتقاء بوظيفة الفراغ الخارجي. الهدف الأساسي هو دراسة هذا الإطار الذي يمكن من خلاله توجيه القرارات التخطيطية المستقبلية ، سعياً إلى تحسين التصميم الحضري للشوارع و الفراغات كي تخدم بصورة متزنة وسائل الحركة و الأنشطة المتعددة خلالها. يستعرض البحث عدداً من نظم التحكم في المرور المطبقة في أماكن عدة من العالم، و التي تعددت و اتسعت في الوقت الحالي، لتشمل أنظمة أكثر فعالية تسمح بالترج بين بعض الوسائل بما يخدم بصورة أوقع التجمعات و الأحياء الحضرية. يتكون البحث من أربع أجزاء ، الأول هو مقدمة و تعريف لموضوع "تهدئة المرور" ، كمدخل لمواجهة المشاكل الناجمة عن تزايد حجم السير داخل المدن. الجزء الثاني يقدم شرحاً لعدد من الإستراتيجيات و أيضا الأبعاد التطبيقية لعملية التحكم في المرور. الجزء الثالث يستعرض الاتجاهات الحديثة و التطورات الأخيرة في مجال تهدئة المرور. أخيراً، يحتوي الجزء الرابع من البحث على الخلاصة و بعض التوصيات المتعلقة بالنواحي التطبيقية.