

Calm, safe and secure in Göteborg

Positive effects of traffic-calming countermeasures

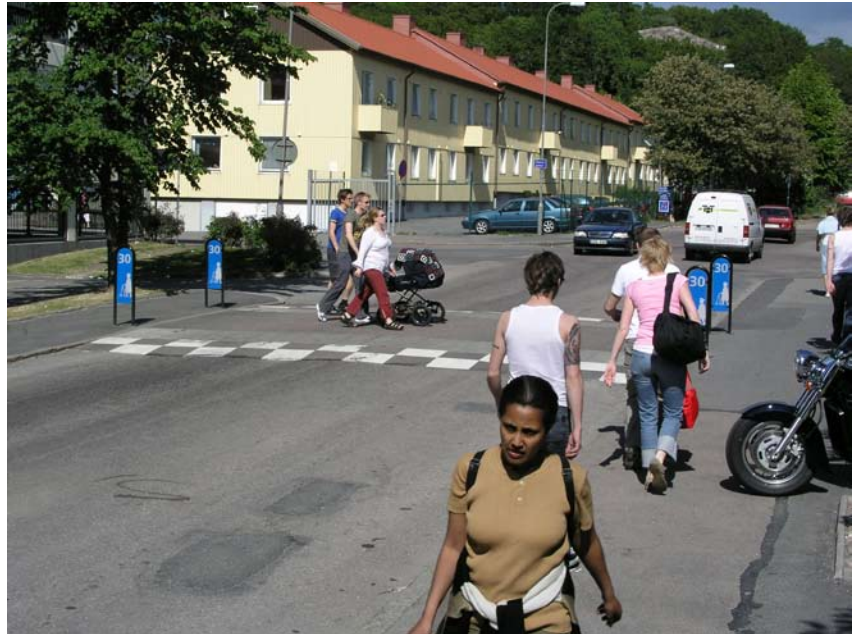


Preface

Traffic-calming countermeasures constitute a successful toolbox with which to create safe and secure traffic environment. This report is primarily concerned with highlighting the effects these countermeasures have. The report describes also the level of acceptance that has grown among decision-makers, planners and citizens. Further, a comparison is made between those goals and targets that have been set for traffic safety related work and the effect that the traffic-calming countermeasures have brought about.

Traffic-calming countermeasures represent one of several tools available for managing the traffic system in towns. The aim is to contribute towards creating a traffic-system that supports town development by providing good accessibility and counteracting the negative effects of traffic.

In the Spring of 2004, the Swedish Association of Local Authorities and Regions (SALAR) published the report: "Positive effects through traffic-calming". The report is a summary of international experiences with traffic-calming countermeasures and also explains what is meant by this term.



SALAR's report has been the main source of inspiration for: "Positive Effects of Traffic-calming Countermeasures in Göteborg". The main aim of this report is to show concrete examples of experience and results that have been achieved in Göteborg, and to make them available for those that are interested. The report can be seen as a complement to the SALAR-report: "Positive effects through traffic-calming". It is useful to read both of these reports together.

Two of the main sources used in this report are: "Traffic-safety development in Göteborg, VTI

503:2004" and: "The Bräcke report", written by Trivector and published by the Traffic and Public Transport Authority. For those who want to look deeper into any of the respective areas discussed, these reports are strongly recommended. Other sources are listed in the References-section at the back of this report.

This report has been written by Roger Johansson of "Gatubolaget" in Göteborg in co-operation with, and sponsored by, Lennart Adolfsson of the Göteborg Traffic and Public Transport Authority. Göteborg, January 2006

Content

Preface	1
Summary	3
Vision Zero	5
The traffic-system	6
Traffic-calming countermeasures	7
Acceptance	9
Effects	11
References	15

© Swedish Association of Local Authorities and Regions 2006

Second edition 2007

Address: S-118 82 Stockholm, ph +46 8 452 70 00

Email: gata@skl.se

ISBN: 978-91-7164-120-5

Text & photo: Roger Johansson

Translation from Swedish: Jeffery Archer

Editor & production: Björn Hårdstedt

Distribution: ph +46 8 709 59 90, fax +46 8 709 59 80

Summary

Traffic-calming countermeasures have many positive effects. This report is concerned with such effects. The effects are part of a series of town-planning related qualities such as the design of street-areas accessibility, personal safety and security, traffic safety and the environmental effects of traffic. Furthermore, it concerns also how our travel-behaviour is affected by the changes in the traffic-system and the economic effects of the traffic-calming countermeasures.

Vision Zero represents the basis for Swedish traffic-safety related work and policy. From the beginning Vision Zero takes an ethical standpoint to the problem of traffic safety.

"The long-term target is that nobody should be killed or seriously injured as the result of traffic-accidents in the road-transport system", Swedish Parliament, October 1997. A short-term national goal is that "The number of people killed as a result of road traffic accidents should be reduced by 50 % by year 2007, based on the statistics for 1996", Swedish Parliament, 2001.

In Göteborg the superior goal is described as follows: "The number of killed and seriously injured road-users should be reduced by 60 % before the year 2005 based on an average value for the years 1985–89", City of Göteborg Local Traffic Authority 1997. "... traffic safety for cyclists shall be improved – the total number of injured cyclists shall be reduced



by 25 % and the number killed and injured should be reduced by 35 % before the year 2008, Göteborg Traffic and Public Transport Authority 1999. "...the number killed and seriously injured shall be reduced by 50 % by year 2010 calculated on the basis of the statistics for 2004", Göteborg Traffic and Public Transport Authority 2004.

The traffic-calming countermeasures are a part of the traffic-system. The system must be developed so that it contributes to those town-planning and architectural qualities we seek to achieve, and contribute towards preserving the many advantages associated with different forms of transport. It should support the kind of town development we strive after.

Work with the traffic-calming countermeasures has been intensified during the 1990s.

Primarily, this work is concerned with countermeasures that benefit vulnerable road-users, particularly pedestrians, who are over-represented in the traffic-accidents occurring in town. The most important countermeasures are concerned with speed-assurance in relation to vehicle-traffic. This implies the use of countermeasures that are intended to ensure a reasonable speed-level with regard to safety and security. Lower speeds always reduce the consequences of accidents when they occur. Furthermore, the number of accidents is reduced, as more road-users manage to control and overcome situations that arise.

Work with traffic-calming countermeasures began in Göteborg in 1978. Since then, hundreds of streets in Göteborg have been adapted to provide calmer traffic through the use



of different countermeasures. Depending on the situational requirements, these measures have been introduced more or less systematically. For example, in Bräcke the whole town-area has been adapted to meet people's needs and demands for safety and security. In other cases, dreary backstreets have been transformed into pleasant commercial streets. By the end of 2004, a total of nearly 3,000 countermeasures have been implemented.

Many studies have shown that the citizen's demands for traffic-calming measures are great. In a questionnaire among 4,000 inhabitants of Göteborg, two-thirds of those asked suggested that speed-humps in conjunction with footpaths were a good measure. The level of acceptance for roundabouts was also found to be high.

Traffic-safety effects have been evaluated by Swedish National Road and Transport Research Institute (VTI). "Traffic-safety development in Göteborg, VTI 503:2004". VTI concluded that there had been a large reduction in the number of killed and seriously injured. Three-quarters of this reduction were attributed to the effects of the implemented traffic-calming measures.

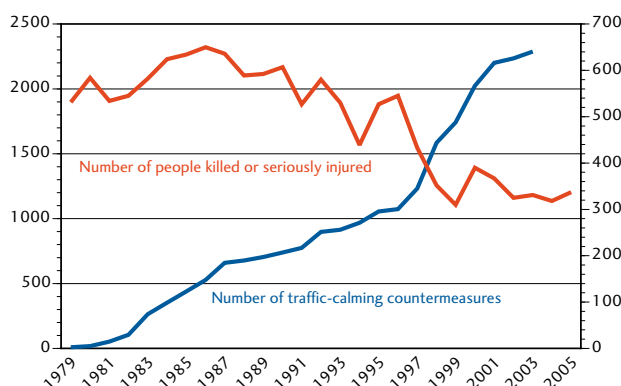
The goals of the Göteborg Traffic and Public Transport Authority to reduce the number of killed and seriously injured by 60 % by 2005 have been achieved for pedestrians and cyclists, but not for other road-user groups. The total reduction by year 2003, based on the statistics for years 1985–89, was approximately 2,460 people, in other words a reduction by 47 %. Approximately 110 of these would have been killed if the accident rate had

been at the same level as it was during 1985–89.

The pedestrian and cycle-networks have been expanded and inter-joined. Accessibility in the public transport network has been improved as a result of reduced traffic levels on many main streets. Bus and tram-stops have become more accessible, safer and more secure. Vehicle-traffic has been redistributed from the local network to the main traffic network and from the main network to the superior network. Some 267 relatively large streets now have reduced levels of traffic. In total, approximately 650,000 vehicle km/per day have been transferred to more suitable roads.

From an economical perspective, the traffic-calming countermeasures have had a socio-economic benefit of more than 850 million euro. Direct investments in traffic-calming measures amount to approximately 18 million euro. Yearly maintenance and drift-costs have also been increased by 3 million euro during the period 1990–2003 as a result of these countermeasures.

A pre-requisite for the countermeasures to have reached their full potential was the further construction of the national vehicle traffic-system during the 1960s and 70s and the redistribution of vehicles to this network.



The diagram shows how the number of traffic-calming countermeasures in Göteborg increased until 2003 and how the number of killed and seriously injured developed during the period.

Vision Zero

Vision Zero represents the basis for Swedish traffic-safety work. The starting point for Vision Zero is an ethical standpoint. No-one should be killed or injured for life in road-traffic. The only acceptable figure for the number of people killed and seriously injured is zero. In October 1997 the Swedish parliament suggested that Vision Zero should be the basis for all traffic-safety related work in Sweden. The year after, in June 1998, Parliament also suggested that Vision Zero should be a part of the superior policy for the country's transport politics. Everyone is given responsibility for safety. Traffic-accidents can not always be avoided due to that fact that people frequently make mistakes. On the other hand, it is possible to stop accidents leading to death and serious injury. Roads and vehicles can also be made safer. Similarly, people's insight regarding the importance of safe traffic-behaviour can be improved. This concerns both decision-makers, planners, local and national road-authorities such as the Swedish Road Administration (SRA) and local traffic authorities, vehicle-manufacturers, transport companies, and citizens.



Goals and Targets:

Parliament

"The long-term target is that nobody should be killed or seriously injured as the result of traffic-accidents in the road-transport system", Swedish Parliament, October 1997.

"The number of people killed as a result of road traffic accidents should be reduced by 50 % by year 2007, based on the statistics for 1996", Swedish Parliament, 2001.

Göteborg

"The number of killed and seriously injured road-users shall be reduced by 60 % before the

year 2005 based on an average value for the years 1985–89", Göteborg Traffic and Public Transport Authority 1997."

"... traffic safety for cyclists shall be improved – the total number of injured cyclists shall be reduced by 25 % and the number killed and injured should be reduced by 35 % before the year 2008, Göteborg Traffic and Public Transport Authority 1999.

".....the number killed and seriously injured shall be reduced by 50 % by year 2010 based on the statistics for 2004", Göteborg Traffic and Public Transport Authority 2004.

The traffic-system

The starting point for traffic-planning lies in the citizen's demands for good accessibility, personal safety and security, traffic safety and the environment. Awareness regarding the importance of a good town environment has increased. Acceptance for the design of the town environment in accordance with people's abilities, needs and demands has also grown. A well-constructed environment is a fundamental part of our welfare. This includes, amongst other things aspects such as equality, accessibility, health, identity and beauty. A good living environment with meeting places has also a large importance for our sense of well-being.

The transport of goods and people requires a well-functioning traffic-system. The system consists of a traffic-network, where each form of transport has its own sub-network. The traffic-network

is the collective structure of inter-joined connections that are used by each respective form of traffic.

To effectively take into consideration the advantages of the different traffic-networks the necessary underlying conditions must be adapted in accordance with the respective forms of traffic that use it. Furthermore, it is important that these co-operate well with each other. Co-operation entails, for example, that bus-stops, connection-points, and parking places for vehicles and cycles are well-designed in accordance with the town's requirements.

It is possible to influence our choice of transportation and route. We can be enticed to choose alternatives that are better from an environmental and health-perspective. Our choices are motivated by our own requirements, as well as the alternatives that are available and how we experience them.

The character of a street-area is affected by traffic, physical design factors and liveliness. Character consists of many factors.

Structure, design and liveliness are easy to understand. How we choose to direct traffic and design the street-area has large effects on how it is experienced.

Accessibility, the ease by which our destinations can be reached, is a primary function of the traffic-system. Accessibility is affected by how well we design the system. Different levels of accessibility exist, and are dependant on how we give priority to different forms of traffic.

Personal safety and security, and traffic safety are necessary pre-requisites in order for us to participate in the life of a town or city. These qualities are affected by, amongst other things: the speed of vehicle-traffic, size of traffic-flow, traffic composition, and the physical design of the roadway.

Noise, emissions, vibrations etc. are negative environmental effects caused by vehicle-traffic. The speed of vehicle-traffic, size of traffic-flow, and traffic composition are those factors that have the greatest influence on the environment.



Free space

Common space

Traffic space

Figure – Multi-spatial model, a way of showing how street-areas in a town can be organised and how traffic is integrated.

Traffic-calming countermeasures

Traffic-calming countermeasures affect the traffic-system of a town and therefore also many of the qualities associated with town-planning and architecture such as: the town's character, accessibility, personal safety and security, traffic safety and the environmental influence of traffic. Traffic-calming countermeasures also have economical effects.

Traffic-calming countermeasures represent a powerful set of tools for the support of a balanced traffic-system. Traffic-calming countermeasures push aside vehicle-traffic in the multi-spatial model. In this way vulnerable road-users are provided with better conditions and vehicle traffic is redirected to its own space.

The pedestrian and cycle-networks are expanded and brought together in order to build a unified network. The public transport-network is given better conditions as a result of the fact that part of the other traffic is transferred to the national network. A proportion of the vehicle traffic chooses, to a larger extent, the arterial and local networks

The first traffic-calming countermeasures, in Kapplandsgatan, Askims Sörgårdsväg and Grinne-kullegatan, were introduced in Göteborg in 1978. Initially, place-specific countermeasures were used solve particular problems



and were carried out according to standards using relatively simple means. Progressively, these came to be used systematically in entire areas or along complete stretches of road. The design of these countermeasures was adapted in accordance with the requirements suggested by the character of the street.

In the Bräcke-area a large number of traffic-calming countermeasures were implemented. These countermeasures were implemented both in the local and arterial networks in order to give a calm and consistent speed among vehicles. Countermeasures were implemented when the Lundby-tunnel was opened and

Type	Countermeasure	Number
1	Raised pedestrian-crossings	162
	Raised footpaths	252
	Raised footpaths and cycle-paths	207
2	Bus-stop, central island	26
	Bus-stop, hour-glass.	38
3	Road-humps, varying types	1,232
	Bus-humps.	83
	Lateral deflections.	145
4	Roundabouts	102
	Raised intersections.	38
	Total	2,285

Table – Number of traffic-calming countermeasures in the Göteborg municipality up to 1st January 2005.



were in part a necessary pre-requisite for the re-construction of main streets.

In addition to the traffic-calming measures there has also been a reallocation of street-area that benefits vulnerable road-users. By providing a more generous area to pedestrians, new cycle-paths and

special areas for public-transport, a safer and more secure form of traffic is created. The table on page 7 shows the traffic measures divided into four different groups.

1. Speed-assurance of footpaths and cycle-paths
2. Assuring footpaths when buses are waiting at stops and the other traffic stands still in one or both directions.
3. Speed-assurance of vehicle traffic at crossings and intersections, and on stretches of road.
4. Speed-assurance at crossings. Countermeasures provide a safer and more secure traffic situation for all road-users. The consequences of accidents at these crossings are seldom serious.

Countermeasures of type 1–4 can be combined in different numbers over a whole area or entire system.

The speed-reduction that is imposed by different traffic-calming measure varies depending on how they are constructed. A large number of measurement studies have been conducted. A collection of results is specified in the table given below.

Countermeasure	Speed km/h, 85 th percentile	Number of measurements
Standard hump, with 1 m ramp	27–28	> 30
Standard hump, with 2m ramp	28–33	10
Standard hump with 2m ramp on entry and 4m ramp on exit	37	2
Hump with plateau, 1 m plateau and 2 m ramp	30–32	4
Raised pedestrian-crossing with 2m ramp	38–39	3
Road-cushion	25–33	13
ERGO-hump	30	
Hour-glass bus-stop with hump with plateau and 1 m ramp	22	2
Hour-glass bus-stop with hump with plateau and 2 m ramp	30	2
Hour-glass bus-stop with 8cm raised footpath and 1 m ramp	22	2
Hour-glass bus-stop with 8cm raised footpath and 2 m ramp	30	2
Hour-glass bus-stop, completely raised with 1 m ramp	22–35	4
Hour-glass bus-stop, completely raised with 2 m ramp	34–41	12
Hour-glass bus-stop, non-raised	45–50	3
Lateral deflection	37	> 5
Main-street with cobble-stoned surface-area, 3m	47–49	2

Table – Measured speeds in relation to implemented traffic-calming countermeasures.

Acceptance

Decision-makers

Members of the City of Göteborg Traffic & Public Transport Committee have during the time-period 1991 to 2004 made policy-decisions and set quantitative goals. Furthermore, the City of Göteborg Traffic & Public Transport Committee has reserved yearly resources for traffic-safety countermeasures. Together this has given a clear signal to planners and citizens regarding just how the decision-makers have given a greater priority to traffic safety. Within the City of Göteborg Traffic & Public Transport Committee there were also parallel discussions regarding alternative methods in order to reach the intended goals. The interest in alternative methods has been considerable. However, at present the implemented countermeasures represent the best technique available.

An important decision is represented in the so-called “Göteborg-agreement”, in which state funds were allocated to improving the traffic situation in Göteborg. Initially, this agreement included a great deal for vehicle-traffic but relatively little for vulnerable road-users and public-transport. Later, as the negotiations progressed, the inclusion of countermeasures increased to the benefit of vulnerable road-users and public-transport. Thereafter, traffic-calming countermeasures became an important part of the main content.



Planners

The change to right-side traffic in 1967 played an important part in making traffic safety an important issue for traffic and transport-planners. The change to right-side traffic was quickly followed by the establishment of suitable speed-limits, and legislation for the obligatory use of seat-belts and helmets.

During the 1970's the TIG-group was established, an acronym for the “Traffic-safety group in Göteborg”. The group was built around the existing Göteborg Traffic and Public Transport Authority, together with the City of Göteborg Office of Architecture and NTF, a traffic safety NGO. Work in this group meant that traffic-safety issues were brought to a new level and that the demand for new technology was introduced. Traffic-calming countermeasures were often based on ideas from Central Europe.

In 1978 it was time to begin with a speed-hump on Kapplandsgatan. The reactions were strong among citizens, decision-makers and

planners. This countermeasure led to several other pilot-projects, such as those for Danska vägen and the Källtorp-area. The Lund University LTH), Dept of Technology and Society, and the Swedish National Road and Transport Research Institute (VTI), analyzed the countermeasures that were implemented and thereafter reported the results.

Acceptance for these measures grew in conjunction with the increasing level of insight into the traffic-calming effects that resulted. Planners were quick to grasp the new techniques and use these to adapt the traffic-system to the needs and demands of the people that used it.

By the 1980's the group was well-established. However, the number speed-reducing measures increased relatively slowly. This was because of the fact that it takes time to adapt to a new technique.

A common basic perspective for what the traffic-safety problem actually looked like was also



Work with traffic safety was on this way given a clearer and more direct priority.

Regular meetings between Göteborg Traffic and Public Transport Authority, the police

In Källtorp, an area with 2,500 inhabitants, a large number of traffic-calming countermeasures were implemented in 1980. A representative selection of these inhabitants were interviewed before and after the countermeasures were introduced in a study conducted by LTH. In LTH's report it was clear that: "The inhabitants are clearly positive to the countermeasures", "More than three-quarters think that the accident-risk level has been reduced", "The speed-reducing effect is greatest where a speed-hump is used". From the report it is evident that the inhabitants and workers in the area are positive till countermeasures.

established through a systematic collection of accident data. Accident data was reported by both the police and hospitals. Accident reporting by hospitals is considered particularly important in built-up areas where the number of accidents resulting in pedestrians and cyclist injuries is known to be under-represented in police-reported accident statistics.

During the 1990's traffic safety related work was brought to a new level. TIG, was used as a platform to write the traffic-safety program: "Safer Traffic in Göteborg", for the City of Göteborg in 1992. "Vision Zero" also provided a new level of support for traffic-safety work.

When Göteborg Traffic and Public Transport Authority was established in 1990, work with traffic safety and the environment picked-up speed and special target-groups were established.

authorities, the emergency services and public-transport company have meant that the majority of countermeasures are now accepted. Discussions have influenced the choice, design and placement of these measures.

Citizens

There are many studies that show that citizen's demands for traffic-calming measures are great. In a questionnaire among 4,000 inhabitants of Göteborg, two-thirds of the respondents stated that speed-humps in conjunctions with footpaths were a good countermeasure. Acceptance for roundabouts was also high.

Citizens demand lower vehicle speeds. Every year Göteborg Traffic and Public Transport Authority receive 200-300 letters where the main content is related to anxiety in direct relation to traffic. Personal safety and security are recurring issues.

In the Bräcke-area, a project was conducted that involved the systematic placement of approximately 200 traffic-calming countermeasures. The project was evaluated in association with the traffic-consultancy company Trivector. A questionnaire was sent to 1,500 of the 5,000 inhabitants in the area. Approximately 70 % of those asked responded. The questionnaire suggested that 97 % of the respondents (inhabitants from the Bräcke-area) think that traffic safety is important or very important. Compared to other health-problems, the respondents suggested that traffic safety was valued quite highly.

Approximately 92 % of the respondents were positive to the opening of the Lundby-tunnel, which is part of the national traffic network. Approximately 84 % were positive to countermeasures on primary roads and 72 % were positive to countermeasures on secondary roads. The majority thought that the implemented countermeasures were well-spent money.

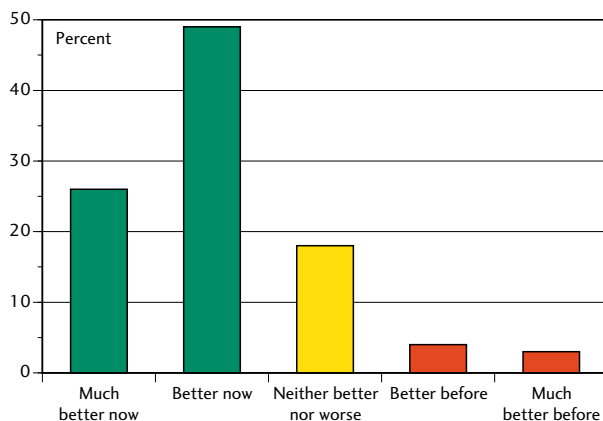


Diagram – What the inhabitants in the Bräcke-area thought about traffic-safety on streets in their residential area, a comparison of opinions before and after the implementation of countermeasures.

Effects

Traffic-calming countermeasures influence several architectural qualities. Furthermore, these influence the traffic-system, our travel- habits and the economy. In the so-called "value-rose" evaluation method below, a collective picture of the effect of different traffic-calming countermeasures is given. The "value-rose" evaluation method represents a relatively simple way of generating a summary. The summary is based on facts and subjective evaluations, and is intended to represent a visual picture of different effects.

The "value-rose" evaluation method – The diagram shows a comparison between several architectural qualities and aspects before and after countermeasures are implemented.

Comparisons between different quantities is difficult when they lack a common scale. Here the different quantities own scale is used. Furthest from the centre are qualities or aspects that are completely satisfied according to the desired goals.

Street-areas

Traffic-calming countermeasures were successively incorporated into the redesign and reconstruction of whole streets and areas. It became clear that the calm, safe and secure environment that was created by speed-assurance measures were something that citizens strongly demanded. In accordance with the "Göteborg-agreement",

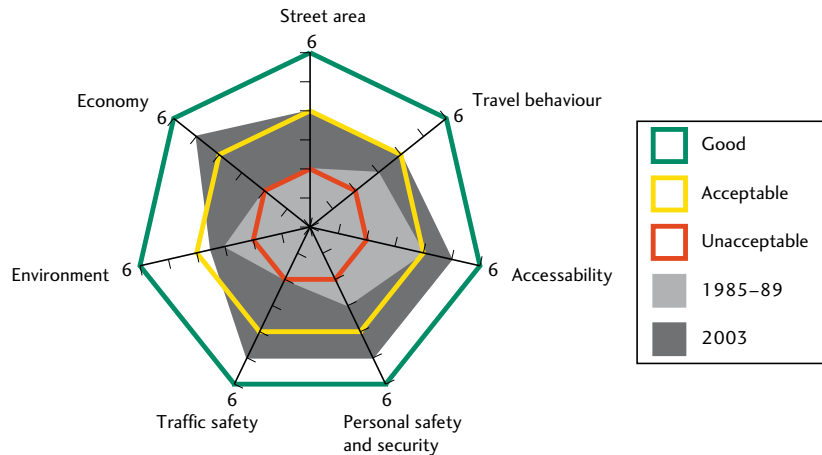
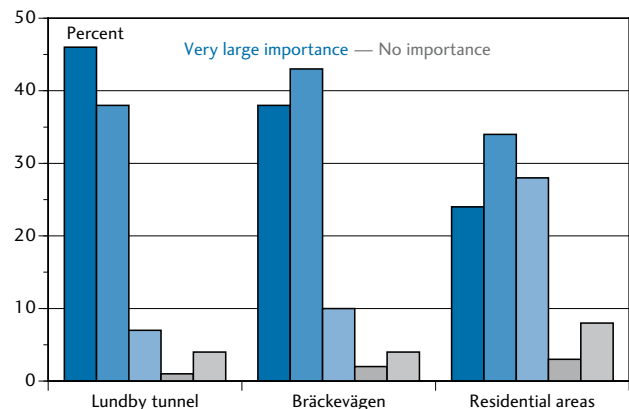


Diagram – The "value-rose" evaluation method. The diagram shows a comparison between several architectural qualities and aspects before and after countermeasures are implemented (the two grey areas). Comparisons between different quantities is difficult when they lack a common scale. Here the different quantities own scale is used. Furthest from the centre are qualities or aspects that are completely satisfied according to the desired goals.

resources were allocated to both improve traffic safety and make the city safer, securer and more beautiful. As a result, reconstruction-projects for entire road and street-stretches, and speed-assurance for whole areas, could be achieved. Where part of the street-area adjoined commercial property, the property-owners were invited to participate in issues concerning design and project-financing. After negotiations, several

streets could be reconstructed. The reactions from workers and property-owners were positive. A positive comment by one

Diagram – The importance of countermeasures reported respondents in three main areas that resulted in a 30 % increase in pedestrian and cyclist-activity in the Bracke-area. The five columns indicate the alternatives "very great importance" (dark-blue) to "very little importance" (light grey). From the diagram, it can be concluded that the Lundby-tunnel was of greater importance than the other measures for pedestrian and cycle traffic.





Personal safety and security

Personal safety and security is related to the subjective concept of traffic safety, and/or experiences safety and security in relation to such events as theft, assault etc. When the street-area is redesigned it becomes possible to improve personal safety and security. Street-areas can be designed to be more lively, lighter and brighter, and more spacious and airy. Personal safety and security can be measured using questionnaires. Furthermore, there are a number of indirect measures of personal safety and security. Indirect measures were recorded in the Bräcke-area where inhabitants stated that they are, to a greater extent, out in the street-environment as pedestrians and cyclists after the redesign and reconstruction work was completed.

Traffic safety

Results show that the majority of improvements of the traffic-safety situation in Göteborg can be attributed to the implemented speed-reducing measures and countermeasures that separate vulnerable road-users from the vehicle-traffic.

If isolated from the effect of other contributing factors, speed-reducing and separation measures are believed to be responsible for three-quarters of the reduction in the number of serious injury cases that have occurred in Göteborg traffic, VTI report 503/2004, "Traffic-safety development in Göteborg."

A summary of the changes that have been brought about for the years 1990–2003 are shown below in comparison to an average value

of the property-owners from Vallgatan in conjunction with the reconstruction work was: "This is a cheap measure in order to move my building from a backstreet to an elegant parade-street." The reconstruction of the street-area has given the inhabitants and workers in the area a new public place to reside in. Examples of such reconstruction include, amongst others: Slotsskogsgatan, Djurgårdsgatan, Danska vägen, Vallgatan and Magasinsgatan.

Accessibility

Accessibility has been developed in order to improve the situation for pedestrians, cyclists and

public-transport road-users. Vehicle-traffic, goods-transport and emergency-services vehicles have been given an adapted accessibility so that their requirements can be met to such an extent that the countermeasures are accepted.

In the Bräcke-area approximately 30 % of the inhabitants reported that they walk and cycle more now than before the countermeasures were introduced. That which is considered to be of greatest importance for this increase, is the opening of the Lundby-tunnel followed closely by Bräckevägen and thereafter the countermeasures introduced in residential areas.



Diagram – Reduction in the number of killed and seriously injured road-users 1990–2003. The base "0"-level is the average for years 1985–89. In total, 2,463 people are estimated to have escaped serious injury, a further 110 of these should have been killed.

for the 5-year period between 1985 and 1989. The changes are calculated from an accident level that is judged to be unchanged for the period after 1985–89, in other words as if no countermeasures were introduced and no pre-requisites changed. From the values in the VTI-report, an estimation is made for the number of road-users that have escaped death or serious injury in Göteborg-traffic as a result of different traffic-technical, or other countermeasures. Within such a restricted area as the Göteborg municipality, accounting for the accidents resulting in death alone provides a relatively random picture. This is because the actual numbers are small and vary considerably during these years. For this reason, the number of killed and seriously injured are summated. This gives more stable values. Such values are also used as a measure in conjunction with Vision Zero.

Despite the fact that there have been considerable improvements it is still the case that vulnerable road-users account for most of the deaths and serious injuries. Proportionally, pedestrian-accidents have been reduced most (41 %) for the entire period. In comparison with the average for years 1985–89, the reduction in pedestrian accidents during recent years is over 60 %.

Environmental influence

Vehicle-traffic has been redistributed from the local to the arterial network and from the arterial to the national network. The changes in the flow of vehicle-traffic are considerable. Traffic has been deferred to sites that are more traffic-tolerant



where fewer people are exposed. The effect of this is that the degree of disturbance is reduced for those who live close to streets in the local and arterial networks. The table presented below shows the differences in noise levels for those streets that have received the greatest reductions in traffic and noise for the time-period 1975–2000.

Travel-behaviour

How people choose to travel is influenced first and foremost by the location of different town functions, the town structure and design, the way the traffic-system is constructed, and also the way

personal values are assigned in accordance with the different pre-requisites people have.

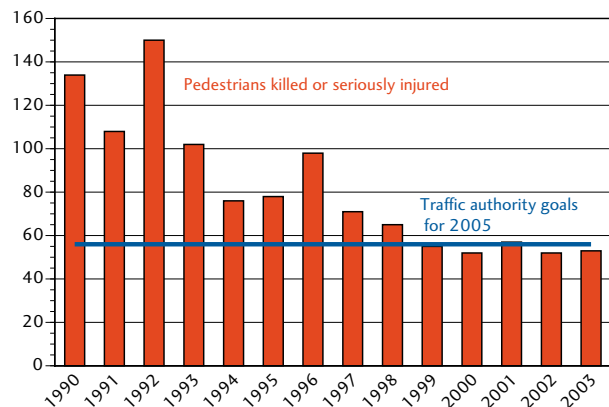
Vehicle-traffic has been redistributed in the traffic-network from the local to the arterial network and from the arterial to the national network.

Approximately 650,000 vehicle kilometres/per day have been moved from inhabited town streets to roads that are more tolerant to traffic. Travel-times for road-users have only been changed marginally.

Economy

The socio-economic benefits achieved through a reduction of

Diagram – Killed and seriously injured pedestrians during the time-period 1990 – 2003, shown in comparison with City of Göteborg Traffic Committee targets for 2005.





the numbers killed and seriously injured in Göteborg-traffic during years 1990–2003 has been estimated to a figure of at least 1 billion euro. The traffic-calming and separation countermeasures represent by far the most effective and can, using VTI:s estimation as a basis, be judged to account for approximately three-quarters of the effects. This

corresponds to a socio-economic benefit of more than 850 million euro for the years 1990–2003.

Investment costs for the traffic-calming and separation countermeasures are 16 million euro during years 1990–2003, which corresponds to less than 5 % of the municipality's total investments in the traffic-system during this period. These traffic-calming

costs do not include expenditure such as the adaptation of bus-stops for the handicapped and other costs not directly attributable to traffic-calming or separation. A calculation has also been made for the yearly increases in costs for damage, cleaning and maintenance related to speed-reducing measures. These costs amounted to approximately 550,000 € during the year 2003. The total cost for maintenance for the period 1990–2003 can, with regard to the rate of redevelopment, be estimated at 3 million €.

The total costs for investment and maintenance for the traffic-calming and separation measures during this period therefore amount to 21 million euro.

A socio-economic estimation shows that the above measures have been extremely profitable. Every invested euro is estimated to have given a socio-economic benefit of approximately 40 euro in return.

Table – A selection of streets that have experienced a decrease in noise-levels as a result of the reduction in traffic, LAeq 24h, a daily equivalent average sound-level value at a facade.

Street	Traffic-flow statistics		Noise levels Laeq 24h		Difference in noise dBA
	1975	2000	1975	2000	
Bräckevägen	19 000	4 600	67,0	57,8	-9,2
Stålhandskegatan Väst	31 000	11 500	69,1	61,8	-7,3
Landsväggsgatan	2 117	500	57,5	50,2	-7,3
Arkivgatan	5 400	1 300	61,5	54,3	-7,2
Sankt Sigfridsgatan	27 800	11 200	68,6	61,7	-6,9
Norra Hamngatan Öst	2 900	800	58,8	52,2	-6,6
Dysiksgatan	12 600	6 100	65,2	59,1	-6,2
Kärrsmossegatan	594	182	51,9	45,8	-6,1
Postgatan	1 781	700	56,7	50,6	-6,1
Anders Zornsgatan	1 500	600	56,0	50,0	-6,0
Kapplandsgatan	3 400	1 100	59,5	53,6	-5,9
Eketrägatan	3 900	1 600	60,1	54,2	-5,9
Smedjegatan	2 300	1 000	57,8	52,2	-5,6
Chalmersgatan	1 838	800	56,8	51,2	-5,6
Ovädersgatan	4 889	1 700	61,1	55,5	-5,6
Welandergatan	1 650	600	56,4	51,0	-5,4
Plantagegatan	5 600	2 700	61,7	56,5	-5,2
Von Utfallsgatan Väst	5 325	2 600	61,5	56,3	-5,1
Stigbergsliden	12 200	6 000	65,1	60,0	-5,1

References

The literature listed below has been used as a background for the text in this report. The list and accompanying comments also provides a small indication of the content in each respective report. A number of the reports can be obtained relative easily by loading down pdf-files from the Traffic and Public Transport Authority website.

Please note that all reports are written in Swedish.

Children injured in traffic-accidents in Göteborg 1992 – 1997, TK 2:1999

Children get injured during their spare-time, and if they are injured at school this is also counted as spare-time.

”The Bräcke report” and ”From arterial road to village street?”

98% think that it is important with a high level of traffic safety, 84 % think that the reconstruction of Bräckevägen is good. 70 % think that the reconstruction in Bräcke is well-spent money. 30 % report that they walk and cycle more after the reconstruction.

Effective speed reductions on through-streets, TSV 1985

Three streets were given countermeasures including Myntgatan in Göteborg, speed was reduced by 7 km/h, noise was reduced, complaints from bus-drivers resulted in the countermeasures being taken away.

Speed-humps, TK 6:2000

Speed-reducing effects of the different types of countermeasures are described. Furthermore, a discussion is given regarding the nomenclature.

Fotgängarolyckor vid bus-stops åren 1994–1998, TK 8:1999

46 % of the pedestrians injured in Göteborg get injured within 50m from their homes, on 8.4 % of the road-length. 60 % of all school-children ...ditto....within 5m from....

Positive effects of Traffic Calming, SALAR 2004

A summary of several hundred researchreports, effects of traffic-calming countermeasures are good and depend on the majority of the town-planning qualities used in relation to traffic.

Grinekullegratan/ Kapplandsgatan/Askims Sörgårdsväg

Many positive to traffic-calming countermeasures according to a questionnaire

Hammarvägen

Many positive to traffic-calming countermeasures according to a questionnaire

How traffic-safe is your city district?, TK 2:1997 (rev juni 1998)

Men are over-represented; whiplash is a problem even in built-up city areas.

Källtorp, LTH report 1983

Effects of countermeasures, from 1,8 personal injuries per year to 0, speed reduced, traffic remains unchanged. 85 % of the 2,500 residents want speed-reducing countermeasures to be kept. 70 % think that the accident-risk level is reduced. 24 of 27 businesses think that the countermeasures do not influence them.

Lillhagsvägen, TK 1996

The design of bus stops

Calm streets, Göteborg 1981

Concepts for how traffic-calming countermeasures should be brought about in Göteborg. Test-areas are named. Different countermeasures are tested.

The long-term effects of speed-reduction VTI 234:1980

The effects of countermeasures are sustainable, speeds do not go up long after the introduction of countermeasures.

Do vehicle-drivers give-way to pedestrians at unsignalized pedestrian-crossings?, TK 10:1994

5 % av vehicle drivers give-way to pedestrians at normal pedestrian-crossings. At pedestrian-crossings with speed-reducing countermeasures drivers give-way 3–6 times more frequently. The speed is 10–15 km/h lower at pedestrian-crossing as a result of speed-reduction countermeasures. Detailed design is important in order that pedestrians should behave correction at pedestrian-crossings.

Vision Zero and injured cyclists , TK 1:1998

Accident types: cycle/single, cycle/car and cycle/cycle represent 90 % of personal injury accidents for cyclists. 80 % of the places where accidents occur are the main and local vehicle traffic networks and cyclepaths. Countermeasures should be implemented at these places. (As an example permanent obstacles should be removed from cyclepaths)

Vision Zeros application in Bräcke, TK/Trivector

Acceptance among those concerned is very high.

Personal injuries in Göteborg 1990–1999, TK

A summary of the 1990s, a large reduction in the number of killed and seriously injured despite a considerable increase in vehicle traffic.

Tests with speed-reducing countermeasures VTI 176:1979

Reduced speed and much easier for pedestrians to cross the street, the majority of those living in the surrounding area are very positive.

Hospital-based analysis and follow-up studies

Days at the hospital and "accident-prone people". By also reporting days at the hospital a further measure of the effects of traffic accidents can be obtained. "Accident-prone people" is a method to graphically show a figure for different types of road-users, and also show by the size of the injured bodypart how serious the injuries are. A useful way to show how different injuries are for different road-user groups.

STACH, CTH report 1997:1

A way to account for the speed-profile along a stretch using speed-reducing countermeasures.

Safer for pedestrians in the city, TK 1992

There is a powerful support for traffic-calming countermeasures in this remittance. The speed of public transport is a difficult question

Safer traffic in Göteborg, TK 5:1992

The traffic-safety program for Göteborg. A new traffic-picture – a picture of how things might look after the countermeasures are implemented.

Traffic and traffic safety in Göteborg, a questionnaire to 4000 inhabitants of Göteborg, TK 6:1996

8 % 1994 and 6 % 1996 say that they have been injured in traffic. 80 % of Göteborgs inhabitants believe that there is a traffic problem in Göteborg – primarily emissions, followed by traffic-queues. Children, pedestrians and cyclists should be given priority in traffic.

Traffic-measurements in Göteborg, TK

Redistribution of traffic to the superior network gives a reduction in traffic in the main and local-networks.

Traffic-accidents in Göteborg 1998, TK 3:1999

Serious personal injuries reduced by 35 % in 2 years

The traffic-plan for Majorna, TK 1992

Classification of the traffic-network and suggestions regarding countermeasures

The traffic-plan for the Skårs-area, TK 1992

Classification of the traffic-network and suggestions regarding countermeasures

Traffic-safety development in Göteborg, VTI 503:2004

75 % of the traffic-safety effects achieved during later years are the result of traffic-calming countermeasures

Traffic-safety countermeasures during the 1970s, an effect-analysis 1982

The effects of traffic-calming countermeasures.

Vallgatan 2002 – Follow-up study, TK

Walking-streets are rated very highly by pedestrians.