

Traffic safety, usability and streetscape effects of new design principles for major urban roads

HARTMUT H. TOPP

Architektur, Raum- und Umweltplanung, Bauingenieurwesen, Universität Kaiserslautern, Paul-Ehrlich-Strasse 14, D-6750 Kaiserslautern FRG

Accepted 10 April 1990

Key words: compensatory measures, speed reduction, traffic concentration concept, urban arterial roads

Abstract. An important aspect of area-wide traffic calming concepts is the integration of major urban roads, because 70 to 80 percent of all urban accidents occur on major roads. Traffic calming which is primarily based on the locational shift to such main thoroughfares is socially unjust, because — in spite of all disturbances on those streets — about one quarter of the urban population live there. Social justice can only be somewhat achieved if the expenditures for traffic calming and streetscaping are not used — as today is most common — for accumulating the advantages in the low traffic side streets, but aimed at a partial balance and compensation for the strains caused by car traffic on the major streets. Some compensatory measures and new design principles will be discussed. Backgrounds are the experience in six German model cities of area-wide traffic calming, several research projects and the discussion about new guidelines for major urban roads. Where traffic and environmental burdens focus, the concentration concept should be extended by compensatory measures. That is the state of discussion in Germany exemplified by nine topics.

Where traffic and environmental burdens focus

Since Buchanan's "Traffic in Towns" was published in 1963, the organization of urban road networks has been the concentration of car traffic on main roads, and the relief and reduction of traffic in the adjacent residential areas. Two coincidentally incompatible demands for reduction of car traffic on the one hand and for easy flow on the other hand were locationally separated and perfected — this applies to many measures of traffic reduction as well as for the one-sided car traffic oriented urban structural devastation of many main thoroughfares.

Traffic reduction which is primarily based on the locational shift of

traffic to main streets, means redistribution of environmental stresses. This kind of traffic reduction is socially unjust, but nevertheless still quite common: so far traffic has often been reduced in streets which were already relatively quiet; often traffic calming is started where it is easy, and not where it is urgently needed.

About 75% of all urban traffic accidents occur on main thoroughfares — particularly those on which pedestrians and cyclists are involved. Especially dangerous are main streets in central areas with their varied usages and interactions: thoroughfares as main streets of villages, feeder and business streets with through traffic, and peripheral streets of residential areas.

To be deplored, along with traffic accidents, are noise, exhaust, and space consumption caused by high volumes as well as by high speeds of automobiles. A lack of character and the dominance of the automobile shape the streetscape. The street area in many major streets is first of all a traffic area at the cost of leisure, perception and experience area.

The concentration concept should be extended . . .

The concentration concept is based on two fundamental ideas. The first being the objectively slight increase of environmental stress — especially of the noise-level — by relatively slight increase in traffic volume, when the basic volume is high anyway. The second basic idea is in many cases a false pretense, in that a main street should be changed into a main thoroughfare through the suggestion of land use changes along the street; that means that flats should become offices or flats should be oriented away from the street to the back of the building. In fact, along those streets we often find the urgently needed cheaper flats (for low income people in particular).

The concept of concentration of traffic on main thoroughfares is in conflict with two facts:

- Many main thoroughfares with high volumes of traffic are also main residential or shopping streets.
- The quality of the surrounding area of many of these streets is already unbearable, even without the additional stress.

Is this the end of the concentration concept since it betters what was already better, it quiets what was already quieter and it worsens what was already bad? Would the alternative be: to equal noise for all, traffic into the residential areas?

. . . by compensatory measures

Certainly not. But what we urgently need is a further development of the concentration concept in a manner that we still try to make the different street functions at least somewhat more compatible, preferably on main roads with dense traffic, for which a reduction of traffic volume can hardly be achieved in the short term. Even where the traffic volume cannot be changed in the near future, it is possible in many cases to lessen the threat to the residents and passers-by, through compensatory measures such as improving the streetscape by planting of trees, and reducing the speeds. Such measures affect as much a psychological, in the sense of reducing stress, as also a real objective improvement: consequently, slower car traffic with equal or slightly higher density is safer for the use of the street by pedestrians and bicycle riders; thus a wider pavement allows more non-traffic usage than a narrow pavement; thus streets become safer for pedestrians and bicycle riders by aiding them to cross the street with traffic islands and center strips; and thus a street planted with trees appears friendlier, more pleasant and, at the same time, improves the climate.

Because there is no meaningful alternative in respect to a moderate concentration of car traffic on major urban roads, social justice can only be somewhat achieved if the expenditures for traffic calming and street-scaping are not used — as today is most common — for accumulating the advantages in the low traffic side streets, but aimed at a partial balance and compensation for the strains caused by car traffic in the major streets. Further concentration and traffic separation in pedestrian zones at one end and car-oriented, devastated ring, radial and relief roads with subways for pedestrians at the other end, should be replaced by an integrating approach of town compatible car traffic.

Among all compensatory measures, speed reduction has a key function. Car traffic in towns is usually, except during peak hours, too fast — on feeder streets as well as on major streets. High speeds rank first as a cause of accidents. Speed restrains the freedom of pedestrians' movement, and leisure and access functions of a street, more than traffic volume.

A reduction of speeds on major urban roads from the presently common 65 to 70 kph to the legal speed of 50 kph would already cause a noticeable steadiness of traffic flow, leading to a noise level reduction of approximately 3 dB (A). That is about the same noise level reduction which would be achieved by halving the traffic volume. Apart from this, a considerable reduction of injuries and fatalities, especially those involving pedestrians and cyclists, could be achieved.

This is the state of discussion in Germany . . .

One of the most important points of the area-wide approach of traffic taming is to include the main thoroughfares in the planning concepts. Of course, this does not mean to transfer the “woonerf” concept to the major urban roads, but to find solutions which meet the very different uses and functions of those streets. The rebuilding of major urban streets is discussed extensively in Germany. The results of this discussion thus far are some good examples, new research approaches, and a first draft of the new guidelines — or better to say of the new recommendations — for major urban roads (EAHV), which will probably become available within this year.

. . . exemplified by nine examples

1. Pedestrians belong to the normal level, to the natural ground of the city

Pedestrian zones, roofed malls, and passages are all too often isolated islands surrounded by ugly inner city rings with heavy car traffic which form a barrier for pedestrians and cyclists. In many such cases, pedestrians are supposed to use subways. Even if subways are well equipped with elevators, they are against the natural behavior of people. Only in special cases with “natural” grade separation avoiding “steps down/steps up”, with shops and kiosks accompanied by high pedestrian frequencies might subways be acceptable or even comfortable. Most subways are far away from such ideal standards, usually they are chilly and refusing, and marks of vandalism induce a feeling of danger. Subways of this type are against the nature of people and against the tradition of cities.

The pressure forced by motorized traffic on other street usages is remarkable: basic claims of pedestrians get “under the wheels”. For instance, until 1989 the “legal” pedestrians’ route between the main railway station and the city center of Hamburg led exclusively through a cornered subway. In commission of the body of merchants (!) a surface crossing was examined with the following results (Planungsbüro Retzko & Topp 1989): improvements for the subway, a reduction of the carriageway from six to four lanes, a signalized cross-over without a break on the center strip and twice per signal cycle. The three months test was a big success.

2. "Pedestrian zone crosses main thoroughfare" instead of "main thoroughfare crosses pedestrian zone"

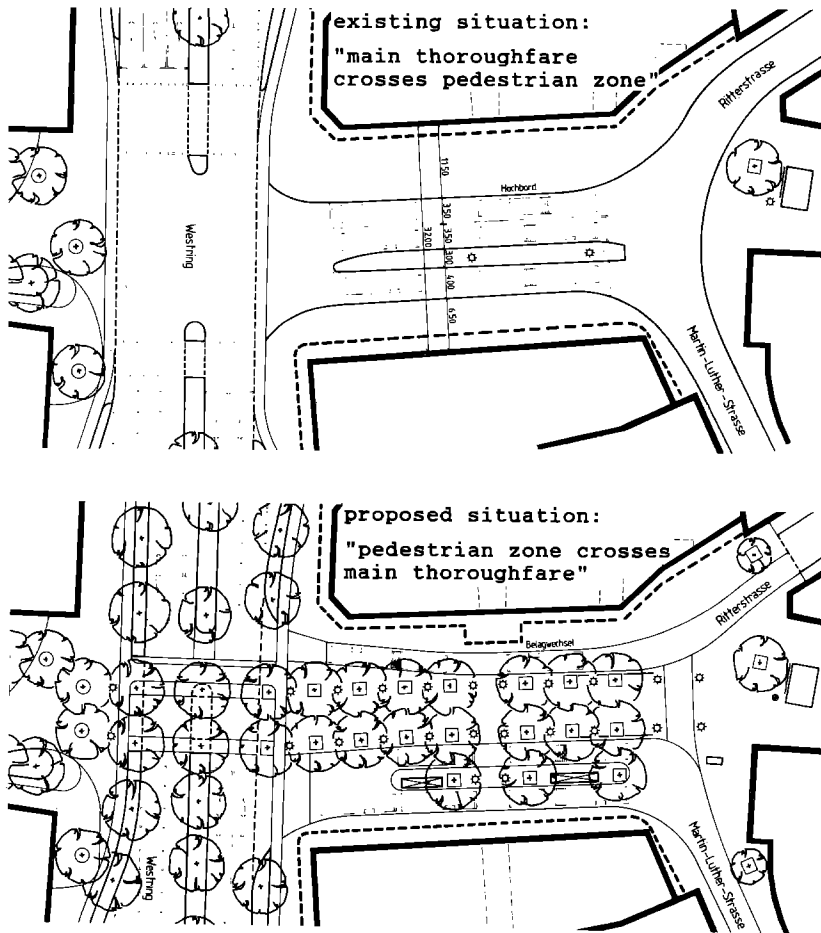


Fig. 1. Main thoroughfare, central bus station, pedestrian zone in the inner city of Hamm.

Having the right priorities in mind — pedestrians produce urbanity — in most cases amenable at-grade solutions for pedestrian crossings are obtainable. In Hamm for example — a medium sized city in West-Germany — the pedestrian zone was divided into two parts by a main thoroughfare and a central bus station. Without changing the traffic functions — neither that of car traffic on the major road nor that of the central bus station — a new quality of streetscape and environmental amenity for pedestrians is to be achieved while trees hide the bad architecture dominating the situation (Fig. 1).

3. *Centre strips ease pedestrians' crossing and save injuries and fatalities*

A highly trafficked four lane main thoroughfare in Saarbrücken connecting the inner city with a motorway access was rebuilt during 1983/84. It had excessive accident rates with more than 20 injuries per year on a shops and services on both sides of the street, resulting in frequent pedestrian's crossing. Such streets are the most dangerous in cities (Fig. 2).

The rebuilt street is characterized by a center strip and two 5.7 m wide carriageways without any markings. The visual appearance of the street is surely improved. The number of all accidents is reduced by about 30%,

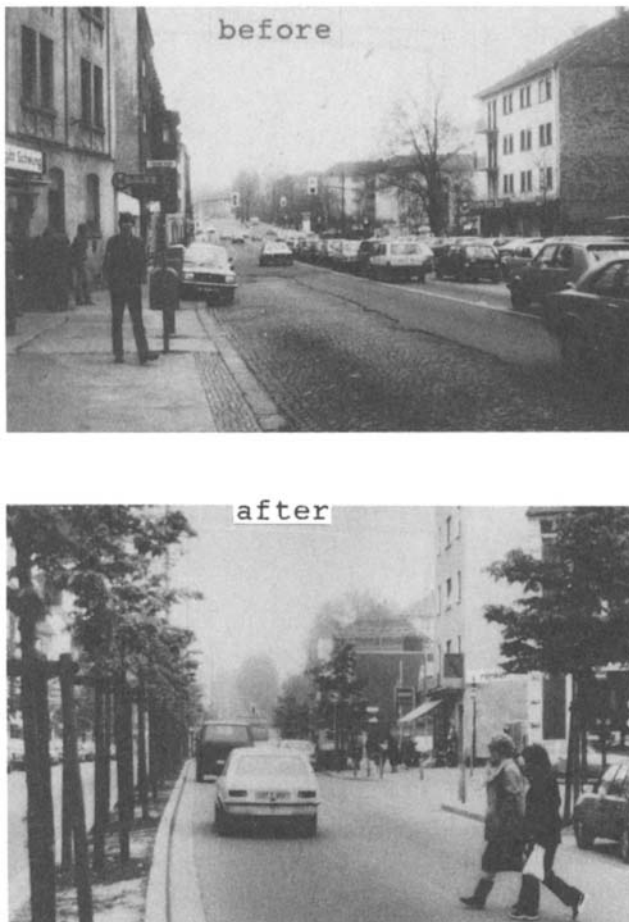


Fig. 2. The rebuilding of a main thoroughfare in Saarbrücken.

the number of accidents with injuries by about 60% and those involving street crossing pedestrians by about 80%.

On streets with dense traffic and a lot of pedestrians using the center strip as a crossing aid at the expense of the driving lanes' width — connected with speed reductions — is by far the most effective safety measure.

4. *“Almost four lane carriageways” give space for center strips, cycle lanes, trees . . .*

In many four lane streets there is no space available for other usages and four lanes are needed. In such cases the “almost four lane carriageway” might be a remedy — that means, lanes in the same direction about 4.5 m wide, which can handle cars in two lanes, but trucks in only one lane. Two 4.5 m-lanes and 1.0 m-center strip lead to a total carriageway width of 10 m compared to a four lane carriageway without a center strip, which is usually about 12.5 m. Since rush hour traffic in many major urban roads contains only about 5% trucks and buses the capacity at homogenous traffic speeds below 50 kph of a 4.5 m-lane is slightly less than that of a 6.5 m-lane (Fig. 3).

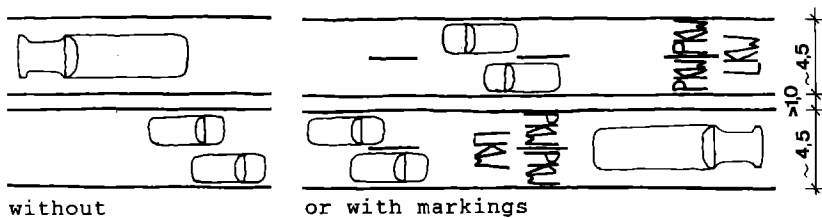


Fig. 3. Narrow lanes for two cars, but only one truck.

Investigations into drivers' behavior (Götttsche 1987) in respect to side-to-side distance, passing and speed have shown that streets with “almost four lane carriageways” of lengths up to 800 m are not any worse by comparison than usual four lane streets in similar situations. The effect of speed reduction is, however, slight, unless the “visual width” of the carriageway is reduced at the same time as the “useable width”. Furthermore, the question whether streets with “almost four lanes” are basically acceptable — that means without limit to length — cannot be finally answered by the investigations conducted until now.

5. A T-junction according to the guidelines of the 60ies has large spare space

The T-junction in Buxtehude (Fig. 4) — one of the model cities of area-wide traffic calming (BfLR, 1988) — gives an impressive example, how to rebuild junctions at major roads. The traffic volumes are about 600 veh/hr in the joining street and about 700 and 1,000 veh/hr, respectively in the

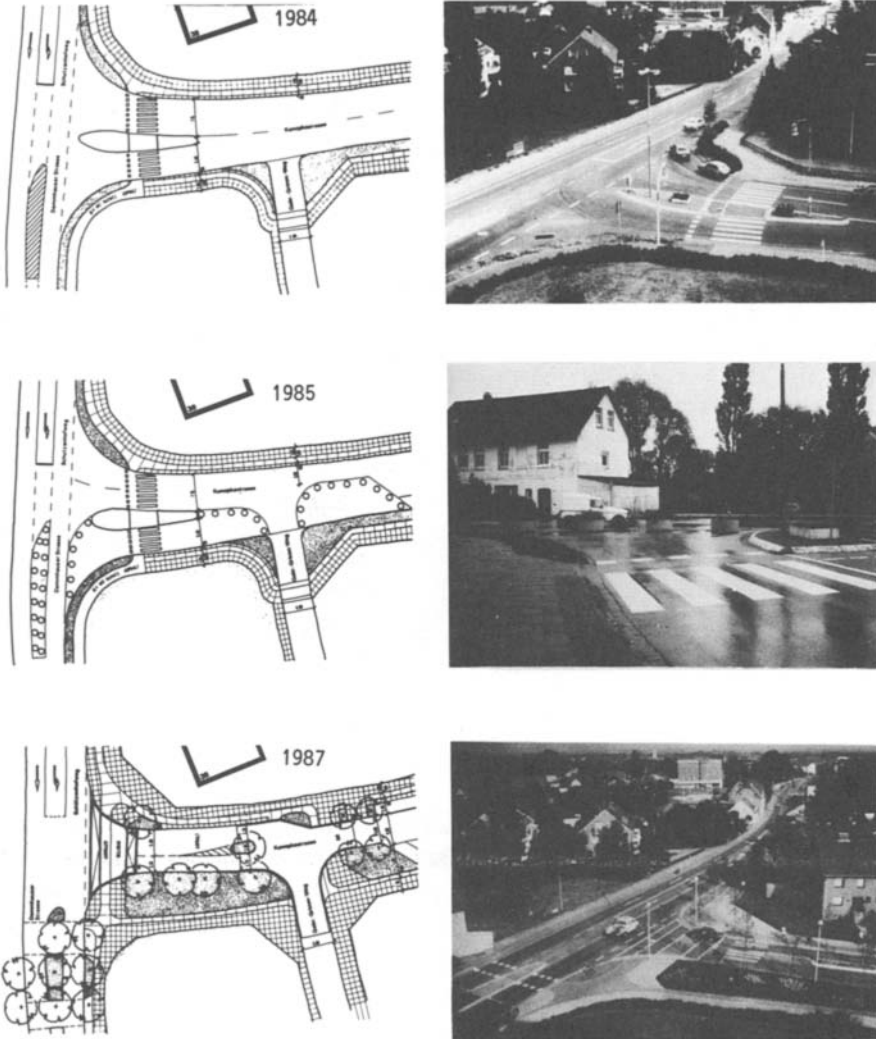


Fig. 4. Three stages of rebuilding a junction in Buxtehude.

through-running street. Because of disputes between local and county authorities firstly driving experiments with buses were carried out; secondly a provisional lay-out was provided with removable tubs. In the final rebuilding large spaces of former carriageway were converted into greenery and in the through-running street a gate formed by trees was provided.

6. *Functions and character of streets are closely connected*

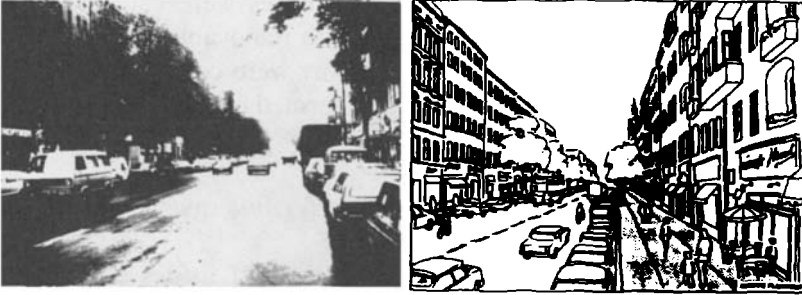
A wider carriageway at the expense of space on the sides means loss of function in the areas of leisure, non-motorized street usage and residential environment and, simultaneously, a loss of character by giving up the traditional proportions, scales and segmentation of the streetspace. The reduction of the “visual width” through narrowing the carriageway, extending the sidewalks, installation of bicycle lanes, planting of trees in the parking strips does not only have functional effects such as speed reduction, compensation, separation of bicycle and car traffic, more justice in the division of the street area. In addition there is an urban design effect: the traditional and generally accepted proportions are regained. Belonging to that is the division of the total street area into three parts: side area, carriageway, side area, approximately in proportion 3:4:3. Here trees are by far the most important segmenting element, because of their vertical impression.

7. *After a long and heavy dispute the Beusselstrasse in Berlin will be rebuilt*

One of the main thoroughfares within the model area Berlin-Moabit (BfLR, 1988) is the highly trafficked Beusselstrasse with about 20,000 veh/day — about 10% being heavy vehicles. We have two-lane traffic flow, though the carriageway is 15 m wide but used for parking on both sides — sometimes even in the second row for short stay deliveries. The total width between five- to six-storey buildings is 26 m. The buildings contain shops and other commercial usages on the street level and flats in the upper storeys. Usages and the location of the street lead to high frequencies of pedestrians.

The concept of the research project (Gruppe Planwerk) to rebuild the street is characterized by reducing the carriage width to 8.5 m and by providing cycle paths on former carriageway area. The traffic authorities opposed this proposal with the argument of insufficient capacity, though also today we have two lane traffic and capacity is determined by the

Present state:



Planned:



(Schilcher/Tibbe/Guggenthaler, 1988)

Fig. 5. Present state, concept and counter-proposal for a main thoroughfare in Berlin.

neighboring intersections. The traffic authorities developed a counter-proposal keeping the old width of the carriageway and providing cycle lanes on the pavement (Fig. 5).

There was a two year dispute about which proposal should be realized, and despite of the opinion of a local residents' and shopkeepers' initiative the counter-proposal was nearly realized. Finally, the newly elected senate of Berlin decided to realize the first proposal. This dispute is difficult to understand, and can be only explained as an ideological resistance against including main thoroughfares into concepts of area-wide traffic calming.

8. *A two-way left turn center lane combined with trees gives character to a car-dominated street*

Figure 6 shows a typical entrance situation into a small town — characterized by a four lane carriageway which is unnecessarily wide, since capacity is determined by the following junction. The traffic volume is about 18,000 veh/day, which can be handled on two lanes. We have flats

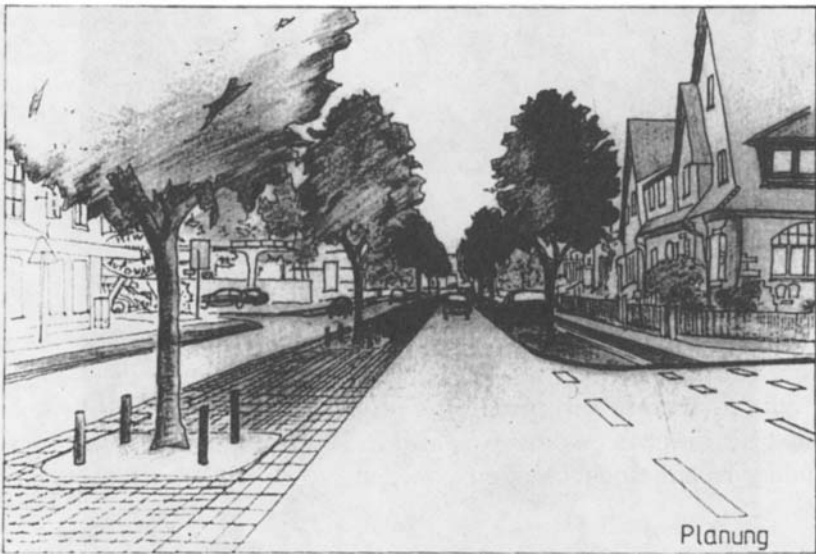


Fig. 6. "Repairing" a car-oriented entrance situation into a small town (Bensheim an der Bergstraße).

on one side of the street and some super-markets and filling stations on the other. Because of the usages along the street and several side streets, we have left turning traffic continuously along the street.

Our proposal to rebuild the street is characterized by a two-way left turn center lane of 2.5 m divided by trees into short sections. The remaining driving lanes are 3.5 m wide. This proposal is under heavy discussion, it is highly accepted by the city and by the residents and rejected by the road administration.

9. *“Soft separation” is easier to integrate into historical situations*



Fig. 7. *“Soft separation”* in Moosburg, Kreis Freising (*top*) and in Landshut, Kreis Landshut (*below*).

Figure 7 shows what “soft separation” means. It is usual in residential streets, but its application on major streets in special cases such as places of special architectural, historical or functional importance is not yet cleared. The two examples with traffic volumes of 8,600 veh/day (top) and 13,800 veh/day (below) and high frequencies of pedestrians and cyclists work obviously without any problems.

Some dozen examples of “soft separation” in major urban roads were examined within a research project (Schweig 1989) regarding vehicle speeds, pedestrians’ crossing behaviour and interactions between vehicle drivers and pedestrians. All cases show easy and safe interactions at significant low vehicle speeds.

What do we learn from the examples?

Of course the nine examples cannot be generalized in all points, but I think the main trends how to improve traffic safety and the usability of major urban roads including the streetscape effects became obvious.

There is no real alternative to a moderate concentration of car traffic on major streets, but despite high traffic volumes many of these streets can be improved considerably. The roots of urban street layout are function and character combined and simultaneously. Major urban streets have to be a focal point in concepts of area-wide traffic calming.

No further separation but more integration of the different street usages is needed. Integration leads nearly necessarily to a self-evident, common quality of urban space instead of the breaking in well-designed, attractive spaces and ugly, dull spaces.

Finally, the discussed treatment of major urban roads is vital for living and moving in cities but it does not solve the conflict caused by growing motor vehicle traffic. Urgent strategies to reduce car traffic in urban areas cannot be replaced by streetscape measures.

References

- Buchanan, Colin et al. (1963) *Traffic in Towns — a Study of the Long Term Problems of Traffic in Urban Areas*. (The Buchanan Report). London: Her Majesty’s Stationery Office
- Bundesforschungsanstalt für Landeskunde und Raumordnung (BfLR) — Editor (1988) 4. Kolloquium zum Forschungsvorhaben “Flächenhafte Verkehrsberuhigung” — Ergebnisse aus drei Modellstädten. Buxtehude/Bonn
- Forschungsgesellschaft für Straßen- und Verkehrswesen — FGSV (1990) *Empfehlungen für die Anlage von Hauptverkehrsstraßen — EAHV ’90*. Köln

- Göttsche, Jürgen (1987) Einsatzbereiche überbreiter — von Pkw zweistreifig, von Lkw einstreifig befahrbarer — Fahrstreifen auf städtischen Hauptstraßen. Grüne Reihe des Fachgebietes Verkehrswesen der Universität Kaiserslautern Nr. 7
- Planungsbüro Retzko & Topp (1987) Verkehrskonzept und Platzgestaltung Westentor in Hamm. Auftraggeberin: Stadt Hamm (Westfalen). Darmstadt/Düsseldorf
- (1989) Verkehrsgutachten Glockengießerwall Hamburg. Auftraggeber: Trägerverbund Projekt Innenstadt. Darmstadt/Düsseldorf
- Schilcher, Johann, Guggenthaler, Heribert, Tibbe, Heinz (1988) Flächenhafte Verkehrsberuhigung — Ergebnisse aus Berlin-Moabit, Darstellung der Maßnahmen. In: BfLR — Herausgeber (1988)
- Schweig, Karl-Heinz (1989) Ist "weiche Trennung" ein Entwurfsprinzip für Hauptverkehrsstraßen? In: Verkehr aktuell: Straßenraumgestalt. Grüne Reihe des Fachgebietes Verkehrswesen der Universität Kaiserslautern Nr. 12
- Topp, Hartmut H. (1987) Ways to more Compatible Urban Transportation. Proceedings of the Seminar "Transport Policy" at the PTRC Transport and Planning Summer Annual Meeting in Bath, Great Britain