

STRATEGIES TO RID THE ENVIRONMENT OF POLLUTION BY INNER-CITY FREIGHT TRANSPORT – CASE STUDIES IN COLOGNE AND GELSENKIRCHEN

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SUMMARY

The most important measures in strategies for relieving the environment of pollution caused by goods traffic in towns are those aimed at a dispatch of goods traffic compatible with town life. This can be achieved through a guiding concept for motor lorries.

Specific problem situations arising from goods traffic in towns, and recommended measures contained in a guiding concept for motor lorries are given in two representative cases.

1. INTRODUCTION

The larger part of goods traffic in towns is carried by motor lorries. Apart from its significance to business life and therefore to the proper functioning of towns, this motor lorry goods traffic is also a major factor in pollution e.g. because it produces emissions of noise and noxious matter, takes up a lot of space and is accident-prone. Whereas up till now research used to concentrate mainly on the effectiveness of city goods traffic, today the environment impact has added greatly to potential conflicts.

Superproportional nuisance for traffic, infrastructure and environment is caused especially by big and heavy motor lorries. Therefore problems and ideas for solutions of conflicts involving big and heavy motor lorries will be prominent in the following exposition:

This is based on case studies in Cologne (Poll) and Gelsenkirchen which were made in connection with the project 'Strategies for goods traffic for the purpose of improving the environment'¹. The following exposition highlights a few high-priority problem areas:

- (1) dangerous goods - heavy traffic resp. - example Gelsenkirchen, and
- (2) a town area with a highly mixed utilisation and a sharp rise in motor lorry traffic - example Cologne-Poll.

The specific problem in Gelsenkirchen is the sharp rise in mineral-oil transports operated by tankers calling at a total of

four loading stations in the town area and plying between these stations and the nearest motorway junction.

The specific problem in the Cologne-Poll town area lies in the circumstance that not only the Deutzer Hafen (port), but also the companies established in the industrial areas generate considerable lorry traffic, which travels through residential areas and the centre of the suburb Poll.

Figure 1 shows selected areas for possible measures and starting points for municipalities to develop strategies for the reduction of pollution in towns by goods traffic on the basis of the main fields of research currently carried out in Gelsenkirchen (GE) and Cologne-Poll (K).

M E A S U R E	Main field of research	
	GE	K
Space utilisation		
Land-use planning in industrial areas		■
Connection points - Longhaul and local traffic - Rail- and waterways		■
Transfer stations for goods (storage and transshipment facilities/Parking lots/ Branch depots)		
Function-related reconstruction of roads	■	■
Design of road areas		
Definition of delivery zones with specialized utilisation		
Cross-sections - division and realisation (Traffic moderation)		■
Low-noise road-surface coating		
Traffic management		
Separation of passenger cars and lorries		
Concentration on main roads and bypasses	■	■
Priority roads for dangerous goods/ heavy traffic	■	■
Guiding systems for direction-finding	■	■
Municipal regulations policy		
Regulating/controlling stationary traffic		
Regulating traffic flow - right of way rules - turn filters - dosage of feed-in traffic - speed - traffic direction signs	■	■
Closing roads to traffic - temporary - local - depending on type of vehicle (length, weight, noise emission)	■	■
Road tax		

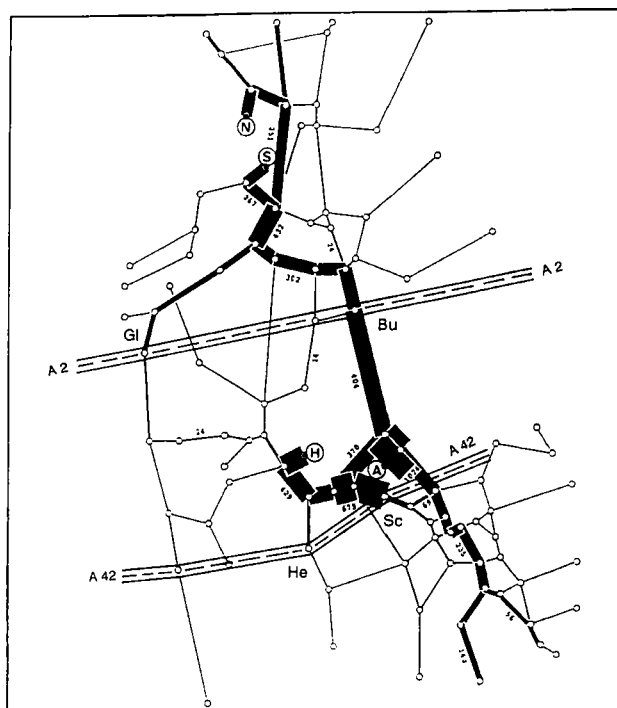
FIGURE 1 Main research points for municipal approaches to strategies for reduction of pollution by freight transport in towns.

In the following test results and resulting recommendations for measures to be taken in both examples are presented:

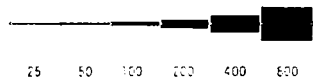
2. EXAMPLE GELSENKIRCHEN

2.1 Description of problem

In the Federal Republic of Germany the town of Gelsenkirchen has the largest refinery capacity. Whereas the feedstock products are delivered almost exclusively by pipelines, water and rail, the distribution of the refined products mainly takes place by road.



Number of trips:



BAB - access roads

Bu = GE Buer

GI = Gladbeck

Sc = GE Schalke

He = GE Hessler

FIGURE 2 Routes to and from the four loading yards (N = Scholven-Nord, S = Scholven-Süd, H = Horst, A = Aral) with the extrapolated sector loads of mineral oil- or heavy transports over 24 hours on a typical workday.

The special nature of the pollution by road transport is based on the fact that the vehicles employed are chiefly heavy motor lorries and trailer trains and that essentially dangerous goods are transported (basically inflammable liquid substances).

The available data on nature, place, time and quantity of the environment load in the town area were insufficient. Therefore close to 600 drivers, who operate their vehicles to the four big

loading yards of the oil- and plastics industry, were polled during 24 hours on a normal workday regarding:

- the quantity, time and nature of their loads
- the origin and destination
- routes selected in the town area and
- their own specific problems.

The opinion poll covered 670 of the total of 1,076 transports that were handled at the loading yards. 80% to 90% of all transports consisted of dangerous goods of class 3, i.e. inflammable, liquid substances and roughly 75% of all vehicles had a maximum total weight of 40 tons.

Figure 2 above shows the position of the loading yards and the routes of the vehicles in the town area with the extrapolated sector loads of mineral oil and heavy transports during 24 hours on a workday.

The roads to and from the four loading yards are concentrated in certain sectors and lead partly through residential areas and short-cuts in the inner-city.

A special problem for the residents is the sometimes considerable traffic density in the city streets generated by motor lorries travelling to and from the loading yards between 22.00 and 6.00 hours. They are partly in the order of 30% of the daily density.

2.2 Recommendations for measures

The research in Gelsenkirchen leads to the following recommendations, which may be conveyed to other town areas:

- o The definition and the positive identification of a local network of roads for heavy and dangerous transports, connected with a corresponding regional network. Strict requirements in respect of practicability and environmental feasibility should be enforced for such priority roads. Residential areas should always be avoided.
- o Traffic-technical procedures on the priority network. These should in principle be aimed at stabilizing traffic flows at a relatively low speed (in relation to lorry-compatibility). This can, for instance, be achieved, when traffic lights are phased enabling lorry drivers to carry on at a steady speed without racing or stopping all the time. Moreover all streets, where at present speeds of over 50 km/h are permitted, should be checked to find out if speed limits can be reduced.
- o A guiding concept for a priority network, efforts to arrive at information to operators and publicity in general. This is necessary for the realization of the network and for the acceptance by lorry drivers, forwarders and the general public.
- o Restrictive measures for streets outside the priority network, where nevertheless heavy and dangerous-goods transport as discussed here, takes place. Measures that are feasible are: Closing of certain sectors, closing certain sectors at night (possibly with an exception for low-noise vehicles); speed limits cut back to 30 km/h for motor lorries and a general overtaking prohibition; rebuilding of roads.

3. EXAMPLE COLOGNE-POLL

3.1 Description of problem

Figure 3 shows the situation in the researched area Cologne-Poll within the Cologne town-area.

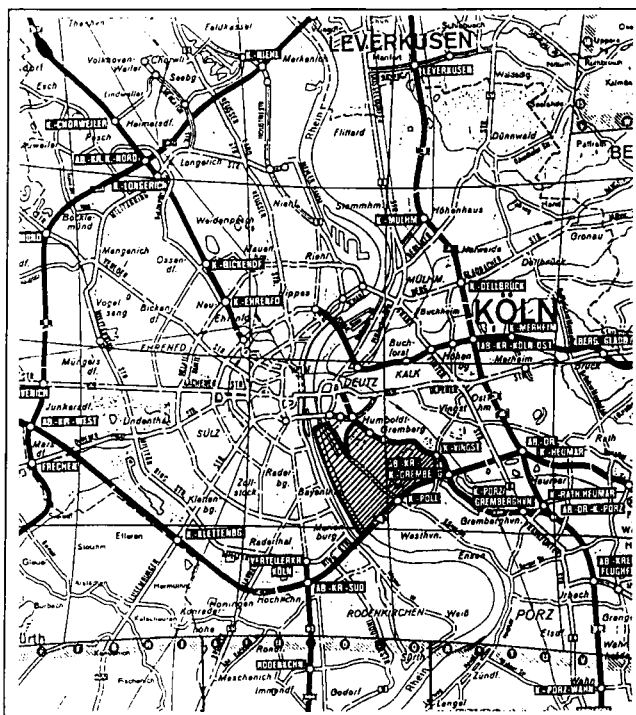


FIGURE 3 Situation in the researched area Cologne-Poll (cross-hatching)

The utilisation of the various sectors in the area where our research took place shows all the important categories in built-up areas: residential areas, trading- and industrial areas as well as smaller mixed areas.

The researched area has motorways running on two sides (see figure 5).

The main road in Poll is the Siegburgerstrasse with a traffic density of 1000-1500 vehicle during peak hours in the northern section and of 1500-2000 vehicles during peak hours in the southern section. The Siegburgerstrasse simultaneously carries traffic supplying the inner-city.

The Siegburgerstrasse serves as a shopping street and a residential street for Cologne-Poll. The users and the residents are exposed to a high degree of noise and pollutants emissions caused by motor lorries in particular. Measurements by the Environment Department of the city of Cologne showed average noise levels of 73-76 dB(A) in the daytime and 62-65 dB(A) at night.

Figure 4 shows the comparatively high proportion of motor lorries in the Siegburgerstrasse.

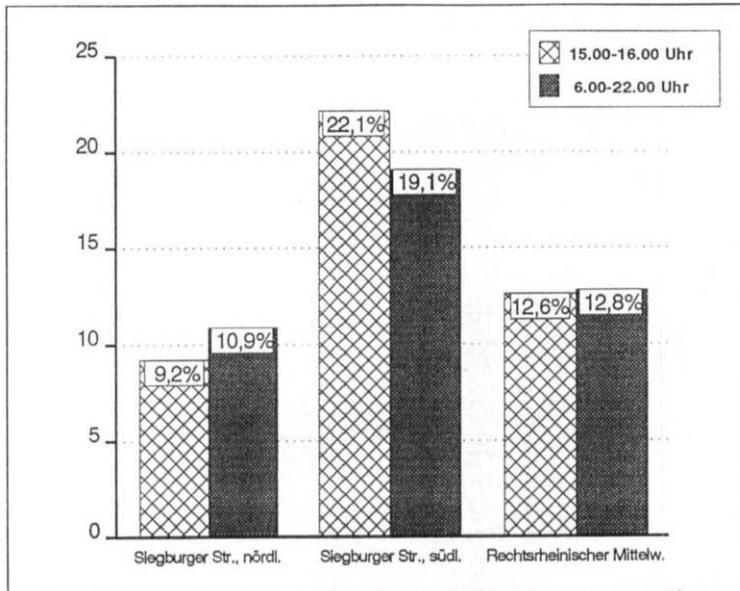


FIGURE 4 Proportions of motor-lorry traffic of the total lorry traffic at specific times; Lkw = motor lorries and trailer trains in passenger-car units [Source: Cologne municipality, Townplanning department: Traffic statistics 1981-1984].

In the past years individual measures were already taken in Cologne-Poll in order to reduce nuisance from motor-lorry traffic. For instance, road signs were installed prohibiting entry into the Siegburgerstrasse in the direction toward the inner-city by motor lorries exceeding a total weight of 7.5 tons. However, this failed to accomplish a significant reduction in motor-lorry traffic. Since so far no inquiry into the originating/terminating lorry-traffic - exempted from the entry prohibition - was carried out, it was not possible up till now to supply information on the question whether the reason lies in lacking acceptance by lorry drivers of possible by-passes or in the high density of originating/terminating lorry traffic.

The question in how far a by-pass, indicated in the zoning plan (figure 5), will relieve the Siegburgerstrasse, especially from lorry traffic, can likewise only be answered on the basis of inquiries into originating, terminating and transit traffic.

A precondition for the processing of effective proposals for solutions to improve the environment is that the flows of freight and lorry traffic are known. Such data should be differentiated per branch to allow deduction of intelligible information. For this purpose the following data are required:

- (1) basic details of operator (situation, branch, number of staff),
- (2) Structure of lorry fleet,
- (3) Nature and relationships of goods,
- (4) Frequency of lorry trips (origin, destination, routes, times)

- (5) Average loads on specified sectors,
- (6) Freight carried by rail,
- (7) The number of residents and, where applicable, also the values characteristic of the environmental sensitivity.

Data under (5) to (7) are available from the Cologne municipality. Data under (1) to (4) were not available in the required differentiation for the area of our research. They were determined by means of an opinion poll among certain companies and can be complemented for the purpose of detailed examination by taking averages and by 'cordon' counts.

3.2 Recommended measures

As is shown in the research carried out in Cologne-Poll, the crucial point in developing strategies for measures to relieve the environment from nuisance caused by freight transport at the level of a town district is a traffic management of motor lorries which is compatible with the town in all its aspects. This can be achieved with a guiding concept.

The development of a guiding concept for motor lorries at town district level can be divided in three main steps:

The first step is the definition of an overriding priority network for motor lorries. The second step is the development at town district level of a comprehensive concept for small scale lorry traffic aimed at channeling the lorry flows along the desired routes. The third step is directed at measures to control traffic in such a way that lorry traffic on these routes is compatible with town life, for instance with a view to lowering and stabilising speeds.

The initial steps toward a priority network for motor lorries have been taken in Cologne and in Hamburg.²

For the priority network for lorries in the examined area Cologne-Poll the Östliche Zubringerstrasse with the access roads Deutzer Ring, Rolshover Strasse, Am Grauen Stein and Im Hasental as well as the A4 with the access road Cologne-Poll are recommended. The motor-lorry guiding concept should be directed at these access roads in order to relieve the traffic in the Siegburgerstrasse.

The routes to be taken by motor lorries are determined on the basis of the average lorry-flows and road sectors sensitive to traffic. The criteria for sensitive roads are zoning, the number of residents and town planning standards.

As is shown by the valuation of the poll among operators there is a lot of traffic between the industrial area Deutzer Hafen and the BAB-access road Cologne-Poll on the one hand and between the industrial area Vingster Strasse and the BAB-access road Cologne-Poll on the other.

This causes a heavy load, especially by lorry traffic to and from the harbour area, on the sensitive sectors of the Siegburger Strasse and the Hauptstrasse in Poll. The frequency of lorry movements between Vingsterstrasse and the BAB-access road Cologne-Poll causes corresponding nuisance to the residents of the street 'Auf dem Sandberg' (cf. (13) in figure 5).

In the southern part of the Siegburger Strasse the nuisance

factors accumulate due to the heavy traffic from the harbour and the Vingster Strasse to the BAB-access road Cologne-Poll (cf. (14)-(16) in figure 5).

Therefore the object of a guiding concept for motor lorries in Cologne-Poll should be to direct the flow of lorry traffic in such a way that:

- from the harbour area more traffic will use the access road Deutzer Ring, and
- from the Vingster Strasse more traffic will use the access road Rolshover Strasse.

This would reduce the load on the sensitive sectors in comparison with the present situation.

In figure 5 examples of possible separate measures within the framework of a guiding concept for lorries for the research area Cologne-Poll are indicated.

The guiding concept for lorries is composed of measures which will guide lorry traffic onto the desired lorry-routes and of measures restricting lorry movements where these are unwanted. These should be integrated in planning at a higher level.

3.2.1 Guiding lorry traffic onto desired lorry routes

The following areas provide opportunities for measures which would make the guiding of lorries onto desired routes more attractive:

- guiding and information systems
- extension of roads
- stabilisation of the flow of lorry traffic

Examples of recommended measures have been indicated and localized separately in figure 5:

Guiding and information systems: For companies in the town area maps showing the recommended lorry routes should be prepared. In addition signposting of lorry routes from the priority road network to the industrial areas or to important factory sites should take place. (cf. (1), (19), (20)).

Extension of roads: Drivers mentioned the short accelerating lane at the junction Deutzer Ring as a problem. In order to improve the connection for lorries from the harbour area to the Deutzer Ring an extension of the acceleration lane at the junction Deutzer Ring should be considered (cf. (2)).

For the lorry guiding concept the construction of a by-pass provided in the zoning plan would seem to be rather counter-productive, as it does not strengthen the connections to the North for originating/terminating lorry-traffic in the area, but the lorry connections to the South, to the Cologne-Poll access road. Since the transit lorry traffic is far less significant than the originating/terminating traffic, there is no need for the planned by-pass, even from the point of view of the total lorry traffic.

Homogeneous traffic flow: To achieve this measures aimed at speed restrictions and at phasing of traffic lights for the benefit of lorries in the Siegburger Strasse south of the business area

should be investigated (cf. (15)).

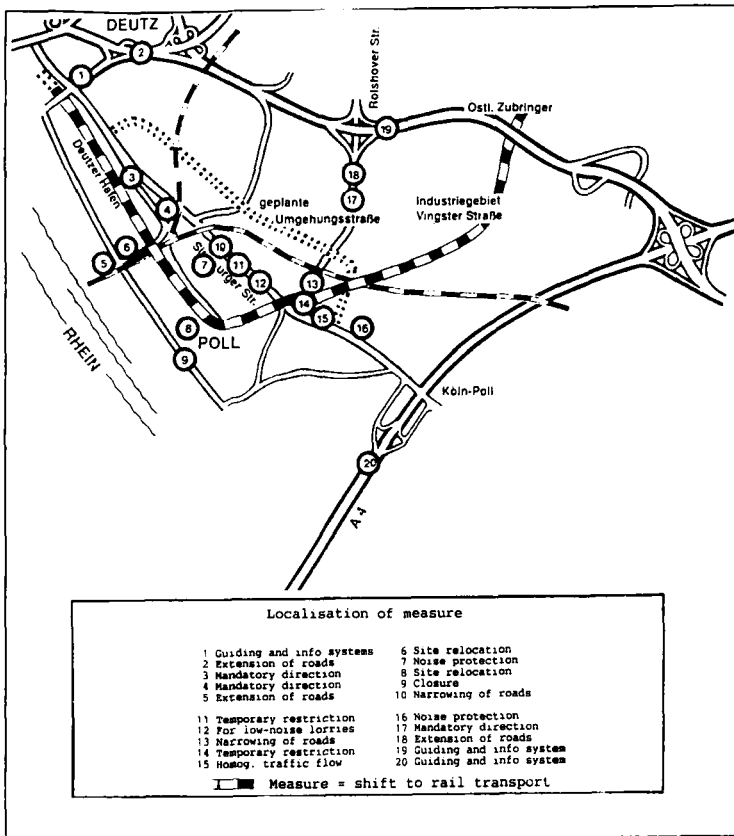


FIGURE 5 Localisation of measures for a guiding concept for lorries at town district level.

3.2.2 Guiding lorry flows by means of restrictions

Restrictive measures as part of a guiding concept for lorries comprise the following areas where measures can be taken:

- Narrowing of roads,
- Closure of roads,
- Mandatory directions and
- Temporary restrictions.

Narrowing of roads: In order to discourage the use of the connection between the harbour area and the BAB access road Cologne-Poll a narrowing of the Siegburger Strasse, especially in the shopping sectors, is recommended. The same goes for the street 'Auf dem Sandberg' in respect of the aggravating connection from the BAB-junction Cologne-Poll to the industrial area Vingster Strasse (cf. (10), (13)).

Closures: The route Alfred-Schütte-Allee / Poller Hauptstrasse/ Im Wasserfeld should be completely closed for lorry traffic to

the harbour area, in order to guarantee the protection of the narrow Hauptstrasse in the old village centre. It would be sufficient to close a small section of the Alfred-Schütte-Allee south of the Schütte factory; this would leave the adjacent estates accessible to traffic, and passenger car traffic would still be able to reach the Alfred-Schütte factory. (cf. (9)).

Mandatory directions: Mandatory directions are a very effective method to guide traffic, as there is no need to supplement them with exception regulations that are difficult to test, and they can easily be supported by constructional measures. In Poll they are feasible as they will guide the (lorry) traffic coming from the harbour area and turning into the Siegburger Strasse toward the north (see (3) and (4)) to the Deutzer Ring (see (1)); it will also guide the lorry traffic from the industrial area Vingster Strasse turning into the Rolshover Strasse to the north to the access road Rolshover Strasse (see (17)).

Temporary driving restrictions for lorries: These are meant in particular to ensure quiet during the resting times of residents and should be imposed by narrowing the sensitive road sectors. In Cologne-Poll night-driving bans in the Siegburger Strasse (in the actual business area) (see (10)) and in the street 'Auf dem Sandberg' should be investigated (see (13)).

3.2.3 Integration of the guiding concept for lorries in overriding planning

Both the definition of a road system for the entire town with priority roads for lorries and the guiding of lorry traffic in a town district requires the integration into the overall traffic and town planning. Only with this integration will separate measures in the guiding concept (e.g. the narrowing of a thorough fare) and positive retroaction (e.g. by issuing licences to low-noise lorries as an incentive) be at all realizable. The integration includes in particular land-use planning, reconstruction of roads and protection against immissions.

4. SUMMARY

Even today municipalities have a variety of tools for control at their disposal, which enable them to control the lorry traffic in towns. As is evident from the research in Gelsenkirchen and Cologne, measures to arrive at a guiding concept for lorry traffic compatible with urban life should be oriented towards the following guide lines:

- Definition of a concept for a road system for lorries, whereby a concentration on transport of dangerous and heavy freight should result in a positively defined road system.
- Keeping transit traffic well away from sensitive town areas (e.g. residential areas) and channelling lorry traffic on the town roads by means of constructional measures and/or effective traffic routing systems.
- General protection of zones and periods with low emissions against lorries over a certain weight (e.g. 3.5 tons at night); this should also encourage the purchase of low-noise and low-emission lorries or smaller delivery vans.

- Taking into account lorry movements in the land-use planning of companies generating lorry traffic and in the planning of traffic infrastructure in order to safeguard essential freight transport.
- Promotion of driving attitudes that are environmentally acceptable (phased traffic lights to accomodate lorries, low maximum speeds).

As freight traffic is closely interconnected with the operativeness of towns and their business activities, general approaches to solutions for the elimination of problems are not adequate. Local and detailed research is much more desirable, so that the specific structure of problems can be defined and fitting approaches to solutions based on the typical situation in an area or location can be pursued.

REFERENCES

- 1 cf. Bracher, Garben, Krafft-Neuhäuser, Schneewolf, in: 'Strategies to relieve the environment in connection with freight transport in towns', commissioned by the Ministry for Town Planning, Housing and Traffic (MSWV) of Nordrhein-Westfalen, IVU final report, Berlin, 1989. (German)
- 2 cf. Bublitz, in: 'Risks in Distribution of Goods - Proposals for Solutions in Hamburg', in: Research company for roads and traffic (Hg.) Report on meeting 'Freight transport in town and district', Cologne, 1988. (German)
 also cf.: Hölsken, in: 'Aids to Function Definition in Road Networks - Design Study Cologne', in: Research company for roads and traffic (Hg.) Report on meeting 'Freight transport in Town and District', Cologne, 1988. (German)
 cf. also: Gütter, in: 'Problems and Proposals for Solutions in the Example of the Town Cologne', in: Report on meeting 'Compatible Freight Transport in Towns', SRL list of publications, part 26, Bochum, 1989. (German)