

FREIGHT TRANSPORT AND THE QUALITY OF THE ENVIRONMENT IN TOWNS

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SUMMARY

Motor lorry traffic may have only a share of roughly 10 per cent in all road vehicle transport in towns, but the pollution it causes, both in air pollution and in noise, is much more than that percentage. An extensive set of instruments is available which should be able to help us bring about freight transport which is not harmful to the environment in towns. Among these are, for example: Avoiding unnecessary transports, the use of low-emitting vehicles and operating methods, concentration of freight traffic on major thoroughfares and loading and unloading methods that are not harmful to the environment. If, however, traffic continues to increase as it does now, then government measures to control traffic as well as protect the environment over and above the measures outlined above will be inevitable in order to safeguard the essential economic traffic and to ensure environment protection.

1. INTRODUCTION

A properly functioning freight transport system is one of the most important conditions for the efficiency of trade and industry. Due to the unchecked increase in motor traffic, however, a situation has been created in our streets, which threatens not only the proper functioning of freight transport, but also the entire economic traffic. From traffic, and here in particular road traffic, emanates environmental pollution to the extent that the population refuses to live near the polluted road sectors if in any way possible, mainly because they fear that this may impair their health.

Therefore measures to ensure the continued operation of essential transport services and at the same time measures to reduce the environmental deterioration caused by motor vehicles are urgently needed. To this end integrated concepts 'Environment and Traffic' must be prepared in a cooperative effort by all interested parties at all planning levels. The concept for action which has been developed in the 'Second Structural Notice for the Development of Traffic in the Netherlands' may be mentioned as an example for such programmed and coordinated concepts (1). In Germany the initial steps have been taken to start such a concerted programme 'Environment and Traffic' (2). Unless it is stated differently, the following statements apply to Germany.

2. ENVIRONMENTAL POLLUTION CAUSED BY FREIGHT TRANSPORT IN TOWNS

Traffic is one of the main causes of environmental pollution. Without countermeasures this pollution can hardly be expected to diminish, as traffic is steadily on the increase. The total distance covered in 1988 amounted to 427 billion kilometers, representing an annual rise of some 5 per cent since 1985. The share of motor lorries (including semitrailer trucks) in this total is roughly 8.5 per cent. The share of the total distance travelled within towns so far amounted to over 30 per cent (3). If we assume that the relative proportion of lorries and passenger cars is the same inside and outside towns, then we arrive at a result of goods traffic movements within towns of approximately 11 billion kilometers per annum.

As it is, lorry traffic takes a share in urban traffic of less than 10 per cent. However, the share in the pollution caused by this traffic in the form of air contamination is considerably higher, especially in the case of nitrogen oxides and sulphur oxides and of soot (9d). Moreover with regard to traffic noise, which upsets the population in particular, it is the lorries, apart from motorcycles, people really complain about.

The following expositions relate especially to air pollution and noise. On the one hand these are, according to an opinion poll of experts (4), the admittedly most gravitating pollution, on the other hand the availability of data regarding other pollutions in towns that are typical of freight transport (water and soil pollution etc.) are at present far from complete.

2.1 Air pollution

The air pollution caused by traffic leads to dangers to the environment and risks to public health. In addition to carcinogenic substances (in particular soot particles) nitrogen oxides and HC-emissions deserve special attention, as they, being the initial substances producing oxidants such as ozone, are considered the chief causes of damage to health and nature. Great importance from an environmental point of view should also be attached to carbon dioxide, which affects the climate.

Table I shows the share of traffic-related emissions in the total emissions, based on figures for the year 1987 and a prognosis of the Federal Environment Office for the year 1989. It is obvious that the share of traffic in the total emissions is considerable. In the Federal Republic of Germany traffic accounted for shares of the total emissions of 62 per cent of NO_x, 53 per cent of HC, 75 per cent of CO, 30 per cent of soot particles and 20 per cent of CO₂ in 1987. Approximately 25 per cent of the total energy consumption is used up by traffic. These values should first of all be attributed to road traffic, which is responsible for 82 per cent of passenger traffic and 58 per cent of goods transport in an upward trend. At present motor lorries account for almost 20 per cent of the nitrogen oxides and soot particles and in future this will be an even much higher relative share.

So far the nitrogen emissions of utility vehicles have not been reduced to a degree corresponding to the efforts made in respect of passenger cars. Therefore motor lorries will be the worst source of NO_x emissions in traffic by the turn of the century.

Measurements on the main roads in towns in Germany showed as an average over one year 98 per cent-values ranging from 0.15 to

0.22 mg/m³ of NO₂. These values are, compared with the appropriate limiting value of the EC-directives applicable to public health (0,2 mg/m³), in the critical range. This shows very clearly the urgent need for action to reduce the pollution burden caused by traffic in town areas. It is unlikely that the situation is any different in other European countries.

TABLE 1

Air pollution and its share for traffic and motor lorries in the Federal Republic of Germany (Source: Federal Environmental Office 1990).

Emissions		1987	1988
NO _x	Total in 1000 tons	2900	1970
	share in per cent:		
	traffic	62	70
	utility vehicles	18	31
HC	Total in 1000 tons	2470	1380
	share in per cent:		
	traffic	53	49
	utility vehicles	4	9
CO	Total in 1000 tons	8770	5110
	Share in per cent:		
	traffic	75	60
	utility vehicles	1	3
CO ₂	Total in 1,000,000 tons	719	720
	Share in per cent:		
	traffic	20	23
	utility vehicles	4	5
soot	Total in 1000 tons	220	179
	Share in per cent:		
	traffic	30	35
	utility vehicles	17	22

2.2 Noise

In discussions about the effects of pollution on individual citizens it is said that noise is the worst offender. In opinion polls held in 1989 the population left no doubt that traffic noise is the dominant source of nuisance: close to 70 per cent of the West German population feel that traffic noise in the streets is a nuisance, 24 per cent even call it a grave nuisance (6). In the effects of noise nuisance the motor lorries take the major share. They are classified as the second noisiest source, second only to motor cycles. Figure 1 shows the average noise levels of various types of motor vehicles passing (7). It is clear that motor lorries in actual operation produce noise emissions to

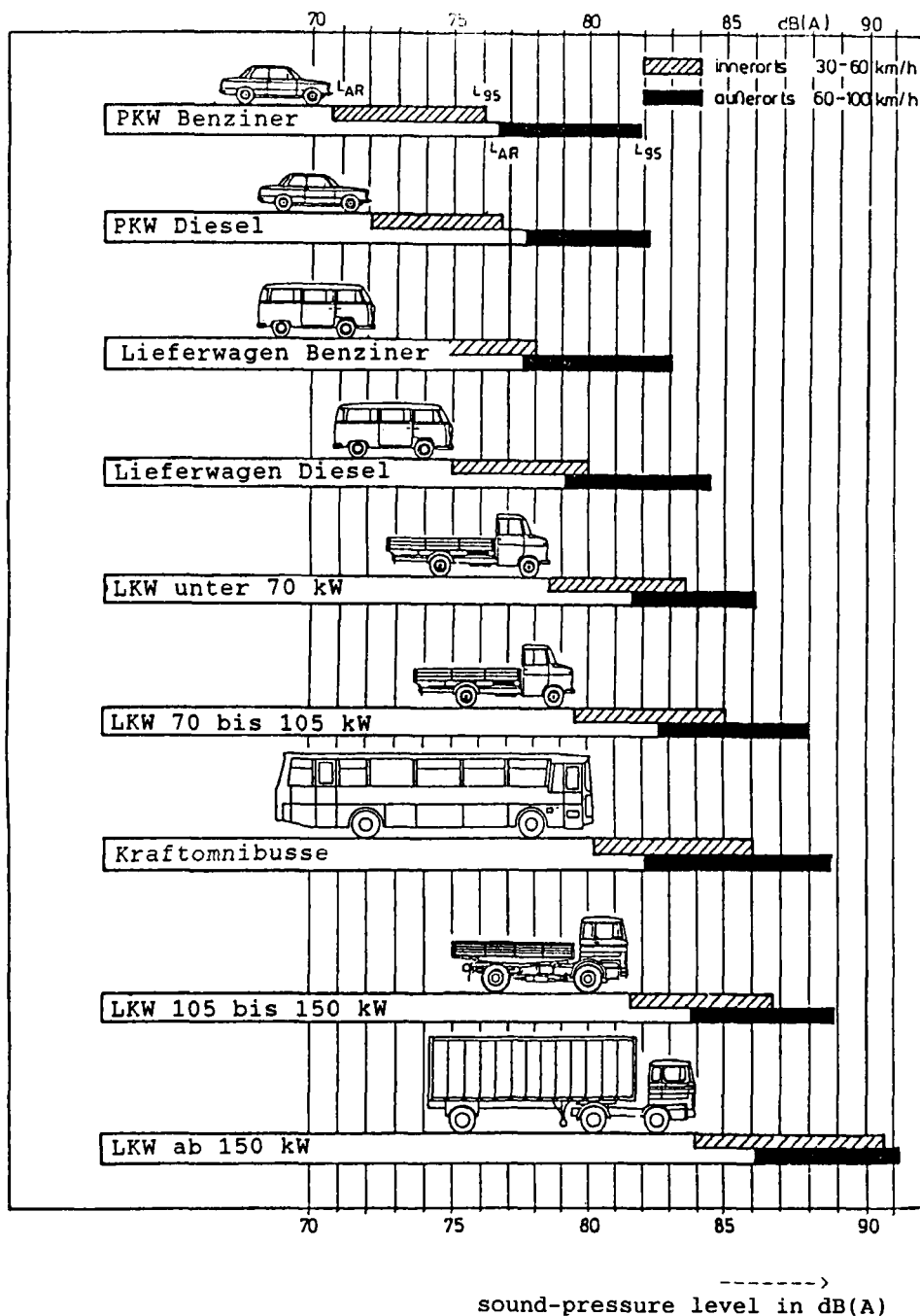


FIGURE 1. Passing-by noise levels of different types of vehicles (7) (L_{AR} = arithmetic average of noise levels; L_{95} = noise levels only exceeded by 5 per cent of vehicles)

values exceeding those of passenger cars and small delivery vans by as much as 10 dB(A), which means that it will take ten small delivery vans passing simultaneously to produce the same noise as the passage of only one motor lorry.

If the relevant calculation procedure (8) is applied to ascertain the average noise level e.g. in inner-city traffic, then the noise from motor lorries is already preponderant if the number of motor lorries exceeds 4 per cent of the total number of vehicles. For main streets in residential areas a share of 10 per cent to 20 per cent is estimated for motor lorries (8), in mixed-use areas a share of motor lorry traffic of as much as 20 per cent may occur, depending on the type of street examined, whereas in residential areas an average of motor lorry shares of well below 5 per cent should be reckoned with (9c).

From these figures it becomes clear that the greatest potential for reduction of noise lies in a changeover to smaller types of motor lorries and in the reduction of the share of motor lorries especially in main thoroughfares with mainly residential buildings.

3. REDUCTION OF POLLUTION CAUSED BY FREIGHT TRANSPORT IN TOWNS

One needs little foresight to recognize that a further growth in traffic at the present rate will lead to serious problems in maintaining a minimum quality level for the livability in town centres and in guaranteeing the execution of the tasks of economic traffic. In the meantime it is hardly disputed that additional streets will inevitably result in still more traffic and consequently in even greater traffic and environmental problems. Meanwhile this has been recognized not only by town planners and environmentalists, but also by responsible traffic planners, and so the, until recently, frequently heard demand that the traffic problems mentioned should be solved by building more roads, is heard less often today. In addition, the city areas are far too valuable to leave them solely to the mercies of road builders and car owners (parked vehicles).

For a long time it was assumed that the environmental problems caused by traffic could be solved by technical measures. Meanwhile it becomes clear that an adequate reduction in traffic-related environmental pollution cannot be achieved in this manner, if traffic will increase at a rate it has so far.

In the following some possibilities to reduce environmental pollution caused by freight transport in towns are presented. Many of the suggestions have already been published by other authors (9). This publication, however, intends to work out the common interests of trade and industry, traffic and environmental protection and, in addition, certain specific conflicts as well.

3.1 Case studies and location specific analysis

The general problem situation has been sufficiently set out in the above expositions. Each reduction in air pollution within towns contributes to a global reduction in air pollution. To achieve this first of all technical measures and especially reductions in numbers of vehicles are a very simple and always effective concept. The solutions for certain cases and locations

which are suitable for the latter can, however, only be determined on the basis of detailed analysis geared to each investigated case and to action plans based thereon.

In particular in respect of the avoidance of noise pollution small scale considerations are inevitable. Because the sound decays quickly near its source and the spreading can be influenced by obstacles, the avoidance of noise pollution is primarily a matter of local problems for which local solutions must be found.

3.2 Planning and legal possibilities

One of the fundamental possibilities of reducing traffic, which could only be realized in the long term, would be the implementation of traffic-preventing town planning. This, however, requires first of all traffic planning and town planning becoming better geared to each other and besides the adoption of active rather than reactive town planning. The decentralized authority in the various competent bodies that until now set the rules nearly everywhere is not at all conducive to the purpose of land-use planning aimed at reducing traffic. Another disadvantage is the deconcentration of the utilisation of various buildings, which has been practised for a long time. Sophisticated measures to protect the environment provide for a situation where people live much closer to their places of work. This would accomplish a significant reduction in traffic volume.

The German Road Traffic Act with its Road Traffic Ordinance (StVO) and the Federal Immission Protection Act (BImSchG) offer a variety of decisive possibilities for measures in respect of existing as well as new roads. Such measures, however, should preferably only be taken within the scope of regional and large scale planning, as otherwise the risk of problems only being shifted from one place to the other cannot be ruled out.

In the recently amended BImSchG (10) complementary and new regulations for regional measures aimed at fighting air and noise pollution have now been included.

In the area of noise abatement new regulations for noise reduction plans have been included (par. 47a). Here analyses of the situation and plans for reduction will be carried out, when harmful effects of noise on the environment can be expected and coordinated action against noise sources of various types is required. This situation will mostly occur in the main streets in the town centres, where often also a variety of responsible authorities can be found, so that the instrument of noise reduction plans can or must be applied.

Details of the measures that may be taken are mostly in accordance with par. 45 StVO; consequently restrictions and blockades can be imposed for reasons of noise protection and noise protection zones can be declared banning all motor vehicles except so-called low-noise vehicles. The conference of Environment Ministers of the German States strongly advised the municipalities in March this year to use this instrument of incentives for low-noise motor lorries (11).

Both the proposed introduction of noise reduction plans as well as the implementation of areas where incentives schemes apply,

require the municipal situation reports and location analysis, mentioned in the previous chapter, and the resulting plans for measures aimed at prevention and reconstruction.

In the area of the fight against air pollution the same applies. On top of that par. 40 of the BImSchG provides more rigorous regulations which make it possible to take areawide measures restricting traffic in order to avoid excessive air pollution, if certain limiting values for immissions are exceeded and/or as a precaution.

Measures restricting traffic represent a serious intervention in the field of transport. But they are especially inevitable, when certain limiting values set to protect public health are exceeded. Then the authorities no longer have any latitude for discretionary decisions. On the other hand such high pollution levels can already be countered at an early stage with suitable precautionary measures. These include the use of advanced technology (in the vehicles), but also appropriate measures in town planning and traffic planning. Therefore it is inevitable that in future analyses of pollution and environment-oriented objectives become part and parcel of town and traffic planning.

Moreover it should also be in the interest of trade and industry that the danger implied in traffic restrictions is avoided by the earliest possible utilisation of all technical means we have at our disposal to reduce pollution. The representatives of trade and industry should give this more thought at the continuously very difficult negotiations on the determination of internationally coordinated emission limits of motor lorries. Besides, one should also see to it that the permitted emission margins are not increasingly exhausted by traffic while on the other hand locally licensing problems arise from the location of industries. This would lead to considerable structural disadvantages for the regions concerned.

3.3 Reduction by means of technical measures

Technical measures for the reduction in emissions usually require sizeable effort - in as far as they can be realized at all from a technical-economic point of view. Manufacturers are therefore right in demanding timely and internationally coordinated objectives. It must, however, be quite clear - as has already been elucidated above - to all participants involved in the determination of such objectives (authorities as well as the opposing lobby of manufacturers) that any lack of courage to realize the technical possibilities will only necessitate far more deplorable measures in the non-technical area (traffic restrictions).

3.3.1 Reduction of air pollution

The major share of emissions of air pollution in traffic, with the exception of soot, comes from passenger cars. Here considerable reductions can be expected from a consistent pursuance of a sophisticated catalyst technique (electronically controlled catalytic converter). This statement refers especially to the existing NO_x -, CO- and HC-pollution and their reduction. Measures in respect of motor lorries should first get to grips with the pollution with NO_x and sootparticles which is mainly caused by motor lorries. For that reason the relevant EC limits

should finally be introduced (soot) and tightened (NO_x) respectively, making it compulsory for manufacturers take steps in order to comply with these limits. For instance, limiting NO_x emissions to 7 g/kWh and so halving the present NO_x -limit compared with today is justifiable, in considerations regarding the limitation of the overall consumption.

On a national level efforts should be stimulated to implement those techniques for reduced emissions by motor lorries, which have already been tested, for instance the at least partly successful techniques tested at the large scale fleet test conducted by the Federal Environmental Minister for the purpose of introducing soot-filters in motor lorries, but apart therefrom those for low-noise vehicles as well, at the earliest possible date.

The development of lorry engines with low emissions of NO_x and soot is to be given top priority in the public interest. The official promotion of appropriate engineering output must therefore be continued unconditionally.

3.3.2 Reduction of noise levels

During the past ten years the development of technical measures to reduce noise levels of motor lorries already met with considerable success (12). Partly these achievements could be converted into tightened EC limiting values for noise by the end of the eighties. Consequently the motor lorries approved in the nineties should be quieter to a degree that ten of these together produce as much noise as one single motor lorry did in the early eighties [reduction by 10 dB(A)].

Nevertheless the limits of the technical and economical capabilities have not yet been reached. In the course of 1990 there will be over a hundred types of lorries made by seven European manufacturers, which will meet the clearly more demanding definition - in comparison with the EC limits - for low-noise motor lorries stated in the German Road Traffic Licensing Ordinance (Annex XXI StVZO). A comprehensive and regularly updated list of the now available low-noise lorry-types (at present, April 1990, more than 100 types from 2.8 tons to 32 tons and from 51 kW to 282 kW) can be obtained from the German Federal Environmental Agency in Berlin.

At the new negotiations on a further tightening of EC limiting values for noise the German delegation will propose the definition of traffic noise values for low-noise vehicles as given in the German StVZO as the new EC limiting values for motor lorries.

Meanwhile the chances for success on the market for the low-noise motor lorries which are already available, but a little more expensive, should be improved by providing incentives. This is already practised today in as much as they are exempted from road restrictions or receive financial benefits (for instance in Bad Reichenhall, Baden-Württemberg, Berlin). In other countries, too, the purchase of low-noise vehicles is encouraged by incentives, but the criteria laid down still vary. In this area standardisation on a European level is highly desirable. Recently the effectiveness of such incentives has been noticeable in Austria, where there is a ban on night traffic for commercial vehicles

with the exception of low-noise vehicles. This ordinance has led to a sharp increase in the supply and the sales of low-noise vehicles.

When, however, lorries are deployed in town centres, the nuisance is not only caused by the operation of the vehicle itself, but also by the noise produced by work units mounted on the vehicles. As an example the substantial disturbance caused by municipal vehicles especially in residential areas may be mentioned. As has been demonstrated in developments ordered by the German Federal Environment Office (13), this noise can also be reduced by the introduction of sophisticated technical measures. At the recommendation of the UBA the German 'Environment Label Jury' has meanwhile laid down criteria for permissible noise levels. Commercial vehicles meeting these criteria will be distinguished with this Environmental Label (14).

The technical possibilities of reducing pollution by vehicles also include exercising influence on the driving behaviour. It has been shown that driving with low revolutions and a constant speed results in both a reduction in fuel consumption and in noise levels (15). In addition, a constant driving style results in reductions in air pollution as well. Such attitudes among the drivers can be achieved by the training of drivers; this is already done by the Federal German Freight Transport Association (BDF) in order to save on fuel. But also with technical devices, such as automatic gears, revolution and speed limiters and (within town limits) with suitable traffic controls (adaptation of traffic lights to the flow of commercial vehicles) the style of operating vehicles can be changed in such a way that emissions are reduced.

So far little attention has been paid to the nuisance produced during loading and unloading work and ways to combat this. Training of workers can help to eliminate unnecessary nuisance resulting from incorrect behaviour. Examples are that engines should not be kept running during loading and unloading and the avoidance of unnecessary noise during these activities, especially at times when this would obviously annoy the neighbourhood. Besides there is a series of technical solutions, for instance special loading ramps with loading doors that are virtually flush with the body of the vehicle, and low-noise rolling platforms for containers which will help to avoid disturbances during (un)loading activities.

3.4 Reduction by means of traffic control

Due to the continuous increase in traffic it is unlikely that the necessary reduction in pollution caused by traffic can be achieved with technical measures alone. As there are more vehicles on the roads, non-technical measures to control traffic are becoming increasingly important to the protection of the environment, but also to ensure an efficient traffic management.

3.4.1 Controlling traffic volume

Apart from leaving and arriving long-haul traffic freight transport within towns is performed on the streets for close to 100 per cent. Shifts to other carriers less harmful to the environment, are now under discussion, but only for planning in the very long term. For the purpose of reducing pollution it must also be examined whether general traffic reductions, or at least

local changes in traffic volumes, can be realized.

It would be most important for the global reduction of air pollution if the necessity of transport services were queried, as this would possibly bring a general reduction in traffic volumes about. On the one hand this is a matter of reducing the number of trips by improving the weight load factor of the vehicles. With improved logistics (e.g. distribution centres for goods, inter-transporters cooperation, introduction of mobile telecommunication equipment), and by cancelling legal transport restrictions the proportion of empty runs, until now calculated to amount to 30 per cent to 50 per cent (16), should be reduced. This should not lead to contradictions with the endeavours of trade and industry, as they can now purchase the transport services they need at better prices because of the improved loading techniques.

In addition unnecessary and economically not justifiable transport services should be avoided, too, by a concentration of production processes in one location which can be achieved with town planning and internal planning by companies. The proportion of the cost of procurement, sales and storage of the total cost of a product is approximately 25 per cent to 30 per cent. (17). The ever increasing tendency to decentralize manufacturing and to make 'just-in-time' deliveries finds its cause in the fact that motor lorry traffic bears only part of the cost it is responsible for and that for that reason and by cheaper decentralized manufacturing possibilities savings in costs are made. Manufacturers will probably persevere in their decentralized manufacturing for as long as it yields advantageous prices and their deliveries reach their destinations promptly and reliably. Especially the latter is only possible - the streets today being hardly capable of accomodating more traffic - if the forwarders anticipate long waiting times in the city streets as a precaution and, in so doing, contribute considerably to pollution and traffic problems.

If trade and industry do not soon begin to be aware of these self-inflicted problems, there will in the long run hardly be any other possibility but to increase taxes for traffic or for the government to resort to measures (e.g. issuing licenses for transport services or rationing fuel for manufacturers). How serious manufacturers take the argument of punctual deliveries becomes clear when we see that many companies with easy access to the railway system have converted to rail carriage for their 'just-in-time' business again, in spite of the price advantage offered by motor lorries. Until now the railways still have the upper hand over road traffic in respect of punctuality.

For the reduction of noise pollution in built-up areas, but also for the reduction of locally excessive air pollution local regulations controlling traffic volumes are very important. Noise decays quickly near the source. But it can also be easily controlled by means of screens or embankments. Therefore it is possible to free large town areas from noise to a large extent with the use of a directionality concept concentrating traffic on main roads, and to concentrate measures to reduce noisiness by building screens etc. along main thoroughfares (regional traffic noise abatement). In this respect it should be known that right now 80 per cent of transport services is performed on only 20 per cent of the road network in town centres. In paragraph 2.2 it was already mentioned to what extent motor lorries can be found in

the various types of streets and in the various types of areas. Concepts for the local control of motor lorry traffic should ensure that motor lorry traffic, which is particularly noisy, is channeled through priority routes. These priority routes should preferably be constructed through areas where the noise sensitivity is low - even if the roads would need to be longer. In those cases where such sectors are not available, temporarily differentiated solutions (e.g. night ban on lorry traffic), speed limits and incentives regulations (e.g. exemption from traffic restrictions) could be applied to the operators of vehicles that are less harmful to the environment. Short cuts through residential streets should be prohibited regardless.

3.4.2 Influencing traffic management

The above mentioned measures to control local traffic are in part and at the same time measures to control traffic management. By increasing driving resistance leading to reduced travelling speeds of individual vehicles or by the installation of gating traffic lights it will for instance be possible to reduce the pollution by vehicles on certain routes. In residential areas traffic jams should be avoided regardless, because of the local pollution they cause. This can be achieved by appropriate construction of road junctions, phased traffic lights and priority routes.

For (local) freight transport planning of trips and of vehicle utilisation will result in a traffic management less harmful to the environment. Here freight transport transfer centres will be able to play an important role. So it can be ensured that long distance vehicles, that are basically not meant for the road infrastructure in towns, are transferred to distribution vehicles suited to inner-city transport. Moreover the operation of low-emitting vehicles with exemption certificates can be coordinated for trips through noise-sensitive areas or through areas where precautions against severe air pollution are necessary. The installation and maintenance of such transfer centres should be sponsored by the authorities because of their important public function.

3.5 Elucidation and Information

In order to implement many of the above-mentioned measures it is necessary to raise the acceptance by the parties concerned by enhancing their awareness of the overall traffic problems.

What is still lacking is the realization of the interdependence between the three main factors in traffic: the assurance of the transport function, the guarantee of individual freedom of movement and the conservation and maintenance of proper environmental quality standards. It is particularly important to clarify that none of these factors should be allowed to prevail. In any case it should be left to a political weighing up of goods to determine to what extent the individual choice of transport should be limited in order to simultaneously guarantee the necessary traffic and to prevent avoidable environmental nuisance.

Time and again it is evident that the people concerned are full of good will, when it is a matter of a sensible need for behavioural changes. This, however, is conditional upon furnishing the general public with proper information and

transparency of decisions. In an important work written for the Verband der Öffentlichen Verkehrsbetriebe (Association of Public Transport Companies) (18) it was demonstrated that the population points out the decisive role to the traffic problem, before any other municipal problem. On the other hand the investigation shows as well that the political decisionmakers totally underestimate the willingness on the part of the population to changes in behaviour.

One of the most important steps in enhancing public awareness is to make road users realize better how their personal activities in traffic affect the environment. This information should already be imparted in the general education of young people, but at the latest during driving lessons (also see paragraph 3.3.2) and it should be part of the driving test. But it is equally important to show possible alternative ways of conserving the environment.

Information on the existing types of low-noise and low-exhaust-gas cars that are produced in series by the manufacturers should clearly be improved. This applies in particular to advice to customers by salesmen.

4. EMISSION REDUCTION (AIR POLLUTION AND NOISE)

Without concrete case studies it would hardly be possible to quantify the emission reduction of the various measures outlined above. All the same an attempt should be made to describe these measures as to their qualitative significance and the space of time until they will take effect. Nevertheless, it is only fair to express a warning that the effects of the various measures cannot be added up unconditionally on account of their mutual dependence. Since none of these measures is very clearly superior to any of the others, a decisive improvement of the environment can only be achieved by simultaneously applying as many of the measures described as possible.

TABLE 2

Evaluation and designation of measures.

	Reduction effect	Effec- tiveness	Action by	Costs
1. Town- and Traffic Planning (see par. 3.2)				
1.1 Concentration of planning competence in public authority	++	m/l	B	-
1.2 Coordinated town- and traffic planning	++	m/l	B	-
1.3 Land-use planning to reduce traffic	++	l	B	-

- continued -

TABLE 2, continued

2. Planning and traffic regulation measures (see par. 3.2)					
2.1	Plans to reduce air pollution and noise	+++	m/l	B	---
2.2	Traffic restrictions	++	k	B	-
2.4	Tightening of limiting values of emissions	+ / +++	m/l	B	- / --
3. Technical reduction measures (see par. 3.3)					
3.1	Development of low-emission commercial vehicles	++	m/l	P	--
3.2	Promotion of low-emission vehicles	+ / ++	m/l	P/B	-
3.3	Influencing operating method with technical aids	+ / ++	k/m	P/B	-
4. Control of traffic volumes (see par. 3.4.1)					
4.1	Improved loading of vehicles	++	m,l	P,B	--
4.2	Local concentration of manufacturing	++	m,l	P	---
4.3	Road-pricing	+	m,l	B	-
4.4	Mileage or fuel quotas for companies	++	l	B	-
5. Influencing traffic management (see par. 3.4.2)					
5.1	Speed limits	+ / ++	k/l	B	- / ---
5.2	Sustaining traffic flow	+	k	B	- / ---
5.3	Non-polluting vehicles for distribution	++ / +++	k/l	P/B	--
6. Elucidation and information (see par. 3.5)					
6.1	Information on pollution air and noise nuisance charts	++	m/l	B	--
6.2	Information campaigns	+	k	P	--
6.3	Information and education	++	l	P,B	-
6.4	Training of drivers	+	k	P	-
Reduction effect:	+++ high	++ medium	+	low	
Measures come into effect:	k short term	m medium term	l	longterm	
Action by:	B public	P private body (e.g.companies)			
Costs:	--- high	-- medium	-	low	

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