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Urban Goods Transport

COST 321. Short version. Main text and some annexes

Anders Lindkvist, TFK (Ed.)

KFB-Report 1999:15, Main text
(annexes available separately)

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Aktionen COST321 initierades av en tilltagande medvetenhet om miljöfrågornas betydelse i städer, särskilt mot bakgrund av vetskapen om att tunga fordon svarar för en ansenlig del av utsläppen och bullret. Eftersom distributionsfordonen idag kan betraktas som oumbärliga för varuförflyttningar i tätorter var det viktigt att finna åtgärder som kan förbättra situationen och att utvärdera effekterna av dessa.
Tolv Europeiska länder skrev under COST321-aktionen. Avsikten var att identifiera och undersöka innovativa åtgärders utformning och funktion i syfte att åstadkomma förbättringar avseende distributionstrafikens miljöpåverkan. Studien påvisar hur utsläpp, buller och bränsleåtgång förändras vid optimering av distributionstrafiken i cityområden då olika moderna logistiska system eller lämpliga administrativa åtgärder används. Även ekonomiska konsekvenser beaktas.

ABSTRACT (Aim, Method, Results)

The COST 321 Action was prompted by an increasing awareness of the environmental concerns in cities in particular with regard to the fact that delivery trucks account for a substantial part of pollution and noise. Since trucks are indispensable for goods transport in cities, the need to find measures of improving the situation and to assess the effects from these became obvious. Therefore twelve European countries signed the COST 321 Action. Its aim was to study the design and operation of innovative measures to improve the environmental performance of freight transport in urban areas. It examines the reduction of air pollution, noise and energy consumption by optimising the use of trucks in city traffic through the application of modern logistical devices and appropriate administrative measures. Economic effects are also taken into account.

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COST

TFK

This report, aimed for the Swedish market, is a short version of the original COST 321 final report. The national reports, the memorandum of understanding including project task annex and the COST Transport overview with the list of other COST Transport actions have been excluded in this version. They may be obtained from KFB.

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From 1994 to 1998, 12 countries (Denmark, France, Finland, Germany, Greece, Italy, The Netherlands, Slovenia, Spain, Sweden, Switzerland and United Kingdom) have studied the design and operation of innovative measures to improve the environmental performance of freight transport in urban areas.

This report examines the reduction of air pollution, noise and energy consumption by optimising the use of trucks in city traffic through the application of modern logistical devices and appropriate administrative measures. Economic effects have also been taken into consideration.

A great deal of additional information on COST Transport is available on the World Wide Web. It can be accessed through the CORDIS server (http://www.cordis.lu/cost-transport/home.html)

FÖRORD

Det europeiska forskningssamarbetet COST ("COoperation europeene dans le domaine de la recherche Scientifique et Technique") etablerades 1971. Det är ett samverkansprogram för såväl teknisk som samhällsvetenskaplig och medicinsk forskning med syfte att organisera och samordna FoU-projekt vid universitet, institut och industrier i Europa så att de nationella resurserna utnyttjas mer effektivt. 28 stater deltar i samarbetet. Förutom EUs medlemsstater är det Island, Norge, Schweiz, Tjeckien, Slovakien, Ungern, Polen, Turkiet, Malta, Rumänien, Estland, Slovenien och Kroatien.

Samarbetet inom COST kanaliseras via så kallade COST-aktioner. Dessa kan beskrivas som kraftsamlingar inom olika ämnesområden. Beslut om deltagande i nya aktioner fattas av respektive lands regering och arbetet inleds när minst fem stater skrivit under. 1996 fanns 151 olika COST-aktioner, Sverige deltog i 100 av dessa. Aktionerna är tre- till femåriga och består av ett antal delprojekt, samordnade av en styrkommitté. Det finns för närvarande 17 olika huvudområden varav transporter är ett. COST-321 Urban Goods Transport (Stadens varuförsörjning) är en aktion inom området.

COST action 321 Urban Goods Transport syftar till att a) identifiera och analysera åtgärder för att minska varutransporternas negativa effekter och b) värdera och simulera de mest lovande åtgärdernas betydelse. Följande huvudmoment har utgjort stommen i aktionen: 1) inventering av varudistributionens premisser i olika länder, 2) identifiering och analys av åtgärder, 3) införande av åtgärder och försöksverksamhet i deltagande länder och städer, 4) utveckling av simuleringsmodeller och 5) framtagning av rekommendationer

Tolv Europeiska länder (Danmark, Frankrike, Finland, Grekland, Italien, Nederländerna, Slovenien, Spanien, Sverige, Schweiz, Storbritannien och Tyskland) signerade COST 321-aktionen. Aktionen startade 1994 och avslutades med en konferens i Rom i januari 1998.

Svensk deltagare i COST 321 har varit Anders Lindkvist vid TFK – Institutet för Transportforskning. Han har bl a ingått i styrgruppen för framställning av slutrapporten. Anders Lindkvists medverkan i projektet har finansierats av KFB (Kommunikationsforskningsberedningen).

Följande rapport utgör slutrapportens huvudtext. Bilagorna finns tillgängliga hos KFB. Rapporten i sin helhet inklusive bilagor är utgiven av COST. Den finns tillgänglig via COST-sekreteriatet på EU:s DGVII i Bryssel.

Urban Karlström
Generaldirektör KFB

TABLE OF CONTENTS

Additional annexes may be obtained from KFB

1. EXECUTIVE SUMMARY

1.1 Background and general objectives.

The COST 321 Action was originally prompted by the observation that *surveys in recent years have shown that although trucks account for a relatively low share of all transport operations in towns and cities, they are responsible for a much greater percentage of the pollution and noise caused by city traffic.* On the one hand, it is therefore understandable that the public increasingly perceives truck traffic as polluting, but on the other hand, it is clear that trucks are indispensable for goods transport in cities.

In line with the increasing awareness of urban environmental problems, it seemed then necessary to proceed with the identification of measures apt to reduce the negative impacts of goods transport within cities. Long lists of such measures had been drawn up, covering a wide and diversified range of possible interventions. However, the public debate made it clear that widely diverging arguments were being voiced about which specific measures are most effective to enhance the quality of urban life, without impairing that of supply and collection service in the process.

A consensus had to be found urgently, to enable a value-free assessment of the effectiveness of various measures in certain city-types - from the transport, ecological and economic points of view - but also to demonstrate the acceptability of these measures and the approaches to implementation which could best ensure consensus in the concerned population groups.

Therefore twelve European countries (Denmark, France, Finland, Germany, Greece, Italy, The Netherlands, Slovenia, Spain, Sweden, Switzerland, United Kingdom) signed the COST 321 Action. Its aim is to study the design and operation of innovative measures to improve the environmental performance of freight transport in urban areas. It examines the reduction of air pollution, noise and energy consumption by optimising the use of trucks in city traffic through the application of modern logistical devices and appropriate administrative measures. Economic effects are also taken into account.

1.2 The programme of work.

The structure of this Final Report reflects the overall organisation of the COST 321 working programme.

Chapter 2 sets the scene: it underlines the critical role played by urban goods transport in the development of cities, and highlights the most important issues at stake, from both the political and practical viewpoints.

The current state of policy orientation in Europe is then summarised, through the illustration of the most commonly agreed guidelines for the identification of effective solutions for the improvement of the urban goods service performance. On the other hand, the diversity of practical approaches is also underlined and explained, owing in particular to the many differences in physical, economic and political framework in which the various cities operate and develop from one country to the other.

Such differences, and the resulting difficulties in carrying out comparative assessments, are described in ***Chapter 3***, which identifies and documents a wide range of possible local specificities. As a preliminary but fundamental finding, ***Chapter 3*** points at the absolute necessity of: i) promoting increased levels of harmonisation, and concertation between players, and ii) enhancing the availability and circulation of both technical and regulatory information and knowledge. The crucial role of public authorities, especially at the local level, is underlined.

Chapter 4 then proceeds to illustrate the main features of the original work carried out within the Action, and the results obtained thereof.

The programme was structured in two parallel but complementary working groups:

- Group A (WGA) was in charge of reviewing current and potential measures promoted by public authorities and private parties, in the logistical, technical, behavioural, infrastructural and administrative field. This includes all levels of responsibilities (i.e. international, national, regional and local) for what concerns the public authorities involvement, and the full range of private actors (shippers, receivers/retailers and transport operators).
  An extensive survey was conducted, leading to a policy-relevant classification of observed or planned measures. Subsequently, based on organised experts' views, a qualitative assessment of the potential contribution of measures to the overall improvement of the quality of urban goods transport was carried out and the primary findings highlighted. A set of 10 individual measures is finally proposed as the most promising; it includes measures of extremely varied

nature, including: logistic organisation, modal choice, road pricing, infrastructure planning, traffic management and other technical measures.

- Group B (WGB) was in charge of providing a complementary, and more quantitative perspective of the possible impacts of measures. This was carried out primarily through simulations, in turn based on the use of specific modelling tools. A cross-sectoral survey of metropolitan areas was made in order to obtain information about measures already in place or planned, which was then followed by an overall economic and environmental evaluation. After a centralisation and exchange of information of the state-of-the-art in the different COST countries involved in the action, a more detailed review of these measures and their effects in participating countries was conducted, so as to finalise the selection of measures and test sites to be analysed through quantitative methods.

  The modelling activities concentrated on the case studies thus identified. To a large extent, the conclusions reached proved to be highly consistent with the outcome of the qualitative assessment carried out in WGA. A classification in three main groups is finally proposed, differentiating:

  ⇒ highly and consistently promising measures (6)

  ⇒ moderately promising measures (16)

  ⇒ ambivalent measures, which produce a combination of positive and negative impacts (5).

  Finally, ***Chapter 5*** formulates a set of recommendations drawn from the findings of the Action work.

- Differences between cities and the related contexts must be recognised; there is no such thing as an optimal common policy to improve urban goods transport issues, but rather:

  ⇒ a set of common goals, to be consensually established through increased and more formalised concertation initiatives

  ⇒ a global need for additional and more comprehensive information and documentation, with particular regard to regulatory and legal information, but also to the monitoring of measure implementation and the diffusion of conclusions reached, in view of possible generalisation

- Individual measures per se are not able to address the complexity of the urban goods problematic and of the many interactions between sectors, activities and policies. Also in view of improving the existing toolbox for the evaluation of policy and measures, a general accounting framework for urban goods transport should be developed, allowing to incorporate the full range of impacts and social/external costs generated by the movement of goods.

- Innovative intermodal interfaces could play a major role in the overall improvement of the sector, through a rationalisation of demand, and the reduction

of negative impacts; their actual diffusion is however only in its early stages. A proactive policy to promote a faster uptake could be highly beneficial.

- The technical improvement of vehicles and their fuels is also a promising direction of improvement. But vehicle performance also results from a rational use of current fleets, and the optimisation of vehicle choice still leaves much room for progress.

1.3 Lessons learnt.

Although extensive in scope, varied in contents and rich in findings and proposals, the work carried out in the framework of COST 321 Action should be considered as the first step of a longer process. At this stage, its results undoubtedly already lead, among other, to:

- widen our knowledge, internationally, of the effects and acceptability of the measures;
- prepare the way for the introduction of appropriate measures in Europe as a whole;
- increase public awareness of the problems caused by urban goods traffic and the need for international co-operation in this field.

More remains to be carried out to further increase and widen the sectoral base of knowledge in the area of urban goods transport, so as to pave the way for the full recognition of the complexity of the issues at stake. These, in turn, can only be addressed within the comprehensive framework of the urban quality of life. A higher level of awareness of all involved parties, including the public at large, is a fundamental prerequisite to this end, and it is hoped that the dissemination of the COST 321 results may contribute to this challenging process.

2. URBAN GOODS TRANSPORT AND THE OBJECTIVES OF THE COST 321 ACTION[1]

2.1 Introduction

Freight transport in urban areas is now perceived in many European countries, but also in the United States and Japan, as a - so far - poorly understood research topic and a field where action is required. It accounts for a substantial, and often underestimated, share of all freight transport (private and public carriers). Providers of logistical services find an expanding market in the field of urban distribution. Freight traffic also represents a high proportion of total urban road traffic, with significant consequences in terms of road occupancy, parking, the location and development of activities, town planning, congestion, the environment, etc.

Twelve European countries (Denmark, France, Finland, Germany, Greece, Italy, The Netherlands, Slovenia, Spain, Sweden, Switzerland, United Kingdom) have signed together in the COST 321 international co-operation action devoted to urban logistics. Its aim is to study the design and operation of innovative measures to improve the efficiency of urban freight traffic. This is based on the assumption that such measures are known, and that the improvements they induce can be evaluated.

As it turns out, however, this knowledge can by no means be taken for granted. A large number of original experiments, sometimes full-scale projects, and generally connected with scientific research programmes, are currently under way in various countries, at the initiative of local or national authorities.
Although a variety of meaningful examples can be examined and analysed, an exhaustive overview of all the experiments and projects in the field or related to the field of urban freight transport is virtually impossible to produce,.

As a consequence, it is not always possible to distinguish "good ideas to be developed" from practical experiments which have already been effectively implemented on a real site, possibly with systematic monitoring. This distinction is however essential: translating an idea into practical implementation is often problematic (sometimes impossible), as a variety of obstacles may arise at one or more of the basic steps of the process (i.e. the idea itself, its development, the set-up of the necessary co-operation. implementation and evaluation. It is therefore essential to clearly indicate which is the available "state of knowledge" corresponding

1 The comments in this chapter are largely based on the Interim Report of Working Group A: Savy/Stransky; "Urban Freight Transport, State of the art COST 321 of innovative measures planned or experimented in Europe" and reflect the main background considerations and aims of the COST 321 Action, as documented in the Memorandum of Understanding of the COST 321 Action.

to each measure in order to avoid giving a false impression to local authorities that might wish to implement it.

2.2 The importance of urban freight transport

The scientific and other relevant literature on freight transport usually examines the volume of traffic and its breakdown according to the nature of the goods, modal split, location and management of terminal installations, and logistical organisation. It generally ignores a vital distinction: the breakdown into urban and interurban components. Freight transport in urban areas is thus an almost unexplored link of transport.

The importance of adequate urban freight transport is also that inner cities or city centres can maintain their economic function. By underplaying the urban freight transport problem there is always the threat that the city centre will lose its economic importance. The competition of peripheral shopping centres in this respect can be felt already in many countries in Europe.

The significance of the flow of goods in towns is nevertheless enormous, and the importance of short-distance transport – defined as trips within the statistical one-way range of 50 km – is undisputed. As for long-distance flows, they very often have their origin and/or destination in an urban area. The urban part of the trip has a direct impact on the costs and the logistical organisation. For example, terminal operations usually account for two-thirds of the total cost of a delivery trip, while the transport operation proper – the long-distance part – is only responsible for the remaining third. The costs of pick-up and delivery operations (which often take place in urban areas) are added to the manufacturing and distribution costs of all products. The weight of these costs is further increased today by the minimisation of stocks, the smaller size of consignments and the increase in their number. Temporal and spatial delivery constraints are greater in urban areas where construction, population and consumption density is at its highest level. What is more, these operations suffer from congestion – to which they too contribute. Freight transport in fact accounts for a significant proportion of total urban traffic. Its energy consumption and pollution is higher in percentage than the corresponding share of traffic (in vehicle-km). To the direct costs of urban freight transport it is therefore necessary to add the indirect costs of the various external factors: pollution, safety, noise, etc.

This being so, how is it that so little is known about urban freight transport? The fact that a considerable share of this freight is carried by small goods vehicles, which are often ignored in road freight transport surveys, is certainly one part of the

explanation. On the other hand, it cannot be ignored that, until recent years, the majority of local authorities have devoted too little attention to the problem. Indeed, local politicians are interested in people, not in goods: people vote, goods don't.

2.3 Actors and Factors in urban goods distribution

Public authorities are becoming increasingly aware of the importance and multiplicity of the issues connected with urban freight transport. Such increased awareness is however still associated to a generally insufficient knowledge of the basic characteristics and mechanisms of urban freight transport, and therefore often leads to the implementation of measures whose potential is not known, and whose results can at times prove disrupting.

Initially, these measures were limited to traffic management (to avoid interactions between flows of goods and flows of persons as far as possible), but there is now a much broader range of concerns:

- Economic efficiency is a major issue, especially if the local council has to contribute to the efficiency of the economic fabric of the area for which it is responsible and its competitiveness vis-à-vis other areas. Logistical efficiency concerns not only transport operators and logistical service providers but also their clients and principals, i.e. all local activities.
- Another issue connected with urban freight transport is the organisation of land use, whether this is a matter of town planning or, on a larger scale, regional or national development. This organisation of land use is in fact increasingly taking into account the localisation and handling of traffic flows, both to influence the location of enterprises and their services and to make the best use of infrastructural networks.
- Another, relatively recent, concern is environmental protection. Reducing the impact on environment is not necessarily incompatible with the previously mentioned objectives. Circumscribing the harmful effects generated by an activity such as transport, by concentrating it in a suitable zone (as is the case with a logistical platform with good links to the basic infrastructural networks), can at one and the same time contribute to good environmental management, land-use planning and economic efficiency.

It is also important to note that the environmental impacts of urban freight transport address different spatial levels. While a nuisance such as noise is very localised, pollutant emissions have at least a regional scope of action, and, as they also contribute to the greenhouse effect, a global dimension altogether.

2.4 In search of new solutions

The public authorities thus now have to give due regard to a number of implications, and are increasingly joining forces to analyse situations and implement measures. A common factor in these, ever more diversified, actions is that the management of goods transport flows in towns is no longer regarded as being simply a matter of traffic management.

- The regulation of traffic and parking (with the delimitation of restricted access zones) remains the most widespread practice (certainly thanks to its low cost and its effectiveness). This is nevertheless an area where much remains to be done, notably as regards harmonising disparate municipal regulations. Conurbation often include dozens of municipalities, each with its own particular arrangements, simply as a result of the insufficient knowledge of what is being done elsewhere. For example, the authorised delivery hours may be incompatible with those of neighbouring municipalities (as a consequence, the only practical solution available to delivery drivers is to disregard the regulations!).
- The formulation and implementation of coherent regulations concerning the weight and dimensions of vehicles authorised to operate in towns could be a very effective measure. The industrial and economic implications would be considerable, as operators are reluctant to build up heterogeneous and scarcely polyvalent fleets of vehicles because of the widely disparate local authority regulations.
- Reorientation of the planning of commercial activities in order to revitalise town centres, especially in view of the fact that locating big shopping centres in peripheral zones may in some cases result in negative energy and environmental impacts. This is certainly a promising line of action, but the fruits will only be reaped in the longer term.
- For some years now we have seen the creation of peripheral logistical platforms (serving, in particular, the conurbation on which they are based) and, more recently, specific urban distribution centres concentrating supplies in order to limit vehicle movements in town centres. Logistical operations, whether directly intended for a town or forming part of more complex chains, can thus be based on appropriate zones and facilities to be included in the urban area. This can be achieved first of all by keeping to existing sites, being prepared if necessary to modify the technical facilities they use (rail and port facilities in particular), then by creating small platforms as close as possible to the town centre, in order to concentrate supplies and group deliveries, and finally by creating bigger - polyvalent and if possible multimodal - platforms in peripheral areas, with good connections to both bypass and penetration infrastructures.

Experiences in different countries of implementing urban distribution centres show that their impacts depend very much on the local condition in each town, the town size and the way a concept has been translated into practice (e.g. the successful Bremen GVZ Vs. the not so successful UDC-project in Maastricht). Therefore it is necessary to take local conditions into account when evaluating the benefit of the measure.

Such operational measures and lines of thought concerning urban freight are now increasingly widespread in various European countries. This is a recent policy, however, which is still feeling its way through a process of more or less innovative, bold, and even utopian experimentation. What is more, the diversity of the experiments stems from the continuing diversity of the urban, economic and institutional contexts; it will not be possible to find universally applicable standard solutions.

There is thus a very real need for study and research, including the monitoring of experiments already under way. In addition, research projects are being initiated all over Europe in the field of transport and logistics.

2.5 A proliferation of unexploited ideas?

While a survey of the situation in Europe reveals a common trend towards an increased realisation of the importance of urban freight, as well as the existence of generalised weaknesses in the area of private and public sector management, significant disparities can also be observed from one country to the other, and even between different cities in the same country.

- Differences regarding the territorial coverage of the measures envisaged, ranging from delivery traffic in the pedestrian zones of town centres to the inclusion of the entire conurbation in an extended international logistical network.
- Differences in the institutions involved, with local and national (and even European?) authorities intervening in different ways.
- Differences in the approach to measures (often designated by similar titles), which may be more or less voluntarist as compared with the free play of market forces, based on incentive or coercive instruments, with the matter being more or less part of political debate.
- Differences, finally, in the practical application of the different measures envisaged and the amount of "scientific method" in the approach. Thus, operations *in situ* (already well under way in some countries) may be based on a pragmatic approach or on local studies carried out with no or little reference to

well proven scientific methodologies. In other cases preliminary analyses may be conducted to identify the most appropriate methodological choices and fields of study (pilot towns, like Bordeaux, for example), accompanied by systematic efforts to collect data on urban transport. In these cases, the "concrete experiments" clearly take place only at a later stage.

These many differences add to the inaccuracy and incompleteness that currently characterises our knowledge in the urban freight transport field. They also constitute one of the major reasons for developing international co-operation: the exchange of such varied ideas and experiences - often complementary - can only be profitable. Carrying out an overall critical evaluation of the state-of-the-art, will however remain an ambitious challenge, given the problems involved in trying to normalise for comparison situations that are so diverse in so many respects (let alone the difficulty of transposing methods between countries with often very marked institutional differences). In any event, it is clear that in the present situation, characterised by both economic globalisation and the decentralisation of public action, the establishment of links between practice and theory, i.e. between the particularities on the field and the general trend of ideas and methods, is more necessary than ever.

2.6 Objective and course of the COST 321 Action.

The above overview of the current freight transport situation and the wide range of differing approaches found to be adopted by private operators and public authorities makes it clear that there have already been many attempts to optimise economic, technical and environmentally suitable traffic handling in the freight transport sector.

As yet no synoptic analysis of the available study results - especially on the international level - has been produced, nor are there any recommendations concerning the measures that can best be adopted in given circumstances to achieve the most beneficial results with regard to the environmentally compatible and economically efficient management of road freight transport.
In 1994, therefore, the COST 321 Action "Urban goods transport" was launched with the aim of shedding light on these matters.

The following twelve European countries agreed to cooperate:

- Denmark
- Finland
- France
- Germany
- Greece

- Italy
- The Netherlands
- Slovenia
- Spain
- Sweden
- Switzerland
- United Kingdom

The main objective of this action was formulated as follows:

The reduction of air pollution, noise and energy consumption by optimising the use of trucks in city traffic by the application of modern logistical devices and appropriate administrative measures.

The handling of the COST 321 Action was defined in the context of a "Joint declaration of intent concerning the implementation of a European research action in the field of freight transport in towns" (Memorandum of Understanding).
This describes the details of the objectives, the modalities of the administrative procedures, and the work programmes to be carried out (see Annex 1).

The following work programme was formulated for achieving the set objectives:

- Examination of existing administrative measures and logistical methods employed in the operation of truck fleets, to see which of them could best contribute towards reducing environmental impacts.
- Examination of measures and methods for achieving economic efficiency and environmental benefits in demonstration projects, taking into account the direct and indirect effects on traffic flow, the location of commercial activities, but also, more generally, the quality of life and transport efficiency.
- Demonstration of the economic efficiency of the logistical measures of vehicle fleet management, indicating how they can be applied more widely in the private sector.

The action involves the use of pilot studies and simulation tools for scale-demonstration purposes, so that the work programme should be considered as a preliminary approach whose results will serve, in particular, to:

- widen our knowledge, internationally, of the effects and acceptability of the measures and take into account under which circumstances the measures are implemented;
- prepare the way for the introduction of appropriate measures in Europe as a whole;

- increase public awareness of the problems caused by urban goods traffic and the need for international co-operation in this field.

The implementation of the programme was put into the hands of two separate working groups:

- **Group A reviewed the current and potential measures already tried or planned by all public authorities and private parties.**

- **Group B simulated the effectiveness of various measures by appropriate models methods.**

The results of the COST 321 Action will benefit a variety of applications.

Further important parts of the COST 321 Action are the national reports, written by the individual participating countries. These national reports (included in annex 2) give an overall view about the work down in the different countries.

As an overall result of the COST 321 Action, an increase is expected in public awareness of the problems caused by urban goods traffic, and consequently support for international co-operation in this field. As a specific result, the final report will provide guidance to local public authorities on how to select the most suitable measures, and the urban freight models developed within the action will be a valuable aid to detailed planning concerning the implementation of the measures.

In charge of the 4-year COST 321 Action were

Chairman:	Prof.Dr.Ing. Horst Koriath (D)
Vice-Chairmen:	Dr. Willi Dietrich (CH)
	Jean-Guy Dufour (F)
European Commission (Scientific Secretary):	Mr Rémi Mayet (until 31.12.96)
	Ms Maria Alfayate (from 01.01.97)

The action was co-ordinated by a Management Committee[2], which was made up of representatives of the different countries.

2 List of the Management Committee Members see Annex 4.

3. THE COST 321 ACTION – PLANS BETWEEN URBAN AND TRANSPORT POLICIES

3.1 Urban structure in the participating countries

The road freight transport situation varies considerably between the different countries participating in the COST 321 Action. The causes of this are to be found in the wide differences in:

- economic structure,
- transport structure, and
- urban structure

between these countries. Naturally, depending on the quality of the road, rail, inland waterway and pipeline networks, the proportion of freight transport taken up by each individual carrier varies widely from country to country.

The structure of a town has a major influence on the road freight situation. Depending on whether it is a city or a small town, and on its economic profile (strength of the commercial, service and industrial sectors), a very specific pattern of transport can be discerned.

Because the countries participating in the COST 321 Action, and the towns studied in the course of this action, are structured very differently, it is only to be expected that the results of the individual measures taken to influence goods transport by road will differ widely. One of the aims of the COST 321 Action is to identify common factors here. By comparing the effects of the various measures that were studied in the individual countries and towns, it should be possible to discover general modes of action. It must be taken into account that not only the legal and administrative frameworks in the individual countries but also the existing urban structures play a major role in this context.

The illustration below gives a first overall view about the different participating model towns of the COST 321 Action.


Layout map showing the locations of the European model cities included in the COST 321-action
Helsinki
Stockholm
Aalborg
Vejle
Bremen
Haarlem
Amsterdam
Hanover
London
's Hertogenbosch
Bielefeld
Cottbus
Dortmund
Düsseldorf
Trier
Nuremberg
Augsburg
Munich
Basel
Zurich
Luzern
Lausanne
Bern
Geneva
Bordeaux
Milan
Parma
Madrid

To facilitate a better characterisation of the effects of the structures of the individual urban areas on the performance of the studied measures, a check list for characterising and describing the model towns in the individual countries was developed and distributed. The check list includes questions on:

- settlement structure (inhabitants, employees, enterprises);
- traffic infrastructure (number of motor vehicles, type and extent of the road network, special facilities);
- transport/traffic demand structure (volume of goods traffic, fuel consumption, volume of air pollution attributable to motor vehicle emissions).

These questionnaires were completed by a large number of the countries participating in the COST 321 Action, in so far as information was available, and form a meaningful source of information on the structures of the individual towns. This data have been used to assess the identified effects of the measures taken in these towns and possibly to interpret and explain observed differences between them. A generalised assessment of the effects of the measures studied in the context of the COST 321 Action excluding national, regional and urban influences can then be attempted.
For more detailed information about the results of the questionnaires see section 4.5.3.

3.2 Varied approaches

The transport market within Europe differs widely from country to country. Depending on the state of the various transport systems such as the:

- rail network;
- road network;
- inland waterway network;
- short-sea shipping;
- pipelines.

and the territorial and economic structure, different degrees of importance are attached to the different modes of transport in respect of their contribution to mastering the total transport volume. In most countries, however, trucks carry the largest share of the goods traffic.

This was not always so. In the past, shifts have taken place in the importance of different modes of transport. In recent years, for example, the proportion of freight carried by rail has steadily decreased while that carried by trucks has steadily increased. One of the reasons is that the type of freight has changed. Another is that the various means of transport and their operators have adapted to changing circumstances in very different ways. And also that the transport actors must be as much flexible as possible in order to fulfil the different demands.

One major cause of the declining fortunes of rail transport has undoubtedly been the falling volume of transported bulk goods. These were always of overriding importance for the railways. The situation here has significantly changed in recent years. Owing to economic diversification, the proportion of packaged goods transports has consistently increased. Road transport companies, with their undoubtedly greater flexibility, have exploited this situation and gained a major share of the transport market. One of the factors in their favour proved to bethe door-to-door factors, i.e. the possibility of transporting goods directly, i.e. without having to tranship them, from their point of dispatch to their point of destination. Thissaves not only costs but also time. As a result of this situation, goods transport handling became increasing integrated into production and operational schedules. This development reached its peak with the requirement for Just in Time deliveries to buyers. This requirement had to be fulfilled by the transport companies.

Railway operators had the greatest difficulty in keeping up with these requirements and developments. Lately, however, they have made considerable efforts to win back their lost share of the market. This is illustrated by the efforts made in connection with intermodal transport and the establishment of special goods transport lines.

An analysis of the road haulage sector shows that there are a variety of operators and types of operation. The situation differs from country to country in Europe and is also depending on the town-scales, with wide variations in the significance of:

- nationalised operators;
- large transport companies, sometimes operating in concert;
- small independent transport companies;
- companies with their own works transport service.

As a consequence, the handling of road freight transport is characterised by sometimes very different types of operation, and by wide differences in ability to push through demands at the level of national and municipal policy making.

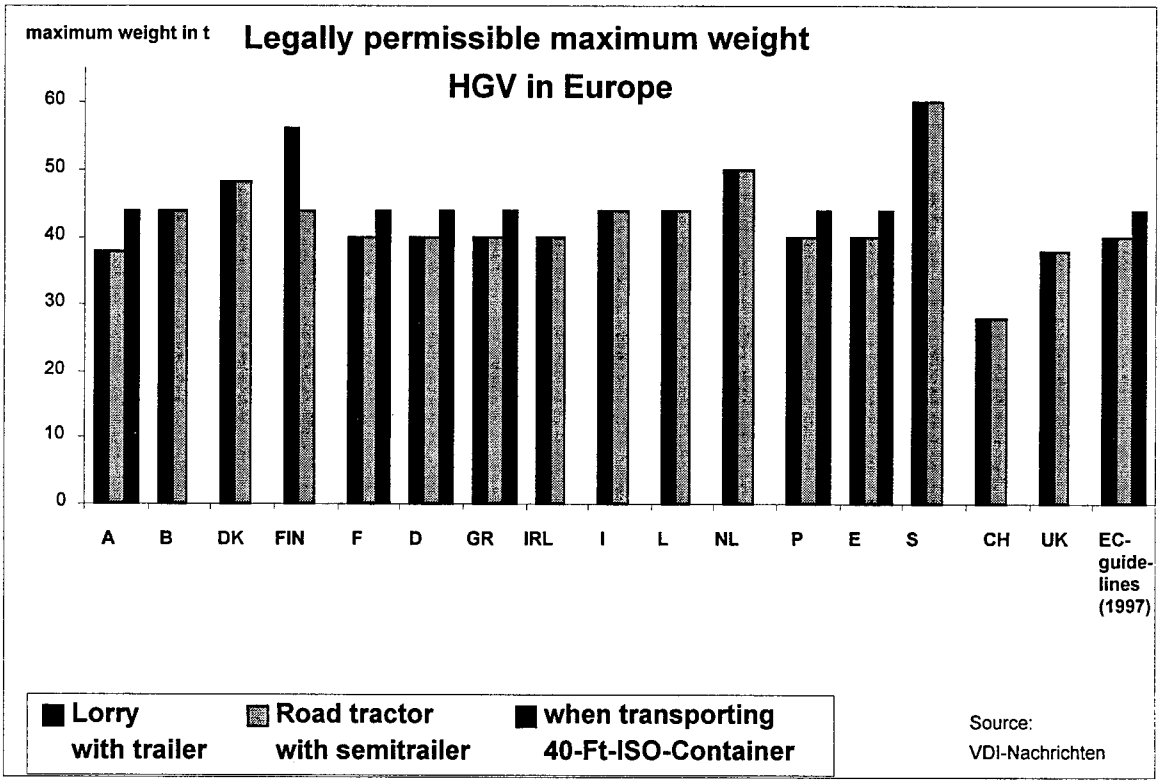
In recent years transport companies and transhippers have sat down together with government, municipal bodies and retailers with the aim of developing integrated goods transport concepts to optimise the road freight transport situation. Examples of such initiatives are the Urban Distribution Platform (UDP) in the Netherlands and the "Güterverkehrsrunden" (goods transport groups) in Germany. Here, as in other European countries, the actors on the transportation market are encouraged to engage in selective co-operation to find the best possible way of harmonising the economic and technical efficiency of goods transport with environmentally compatible and nuisance-free practices.

The attainment of this objective is not simple, mainly due to the one-sided view of most actors involved. On the one hand there are the dispatchers/producers, who are mainly interested in fast and inexpensive handling of goods transport, while on the other are the consignees/customers/wholesalers/retailers, for whom the ordered goods must always be available. In general the urban problems are considered as a problem which has to be solved by all partners involved.

The local population plays a dual role. As customers they expect the goods they want to be available everywhere and at all times, but they do not want trucks to cause disturbances in the local road network or in residential areas.

3.3 National, regional and local policy and instruments

Road freight transport in Europe is characterised by a plethora of different regional (national) and local (municipal) laws and regulations as the following illustration demonstrates.



There are differences in:

- the taxes imposed on trucks;
- fuel prices;
- the permissible dimensions and weights of motor vehicles;
- the regulations governing hours of work and the number of hours a driver can be behind the wheel;
- safety regulations;
- traffic laws (e.g. permissible speeds inside and outside built-up areas);
- land use policies;
- parking space and loading areas regulations;
- legal requirements concerning emissions of pollutants into the environment and noise nuisance (in fact, European directives exist on this particular issue, but they have been ratified by member countries with non-homogeneous interpretations).

Priority must be given, at the national and regional levels, to harmonising laws and regulations and to finding worthwhile ways of intervening to improve the flow of road freight. Measures must be initiated that will help road freight traffic to flow as quickly and smoothly as possible, while at the same time reducing its harmful effects to a minimum. This means that a balance must be found between the interests of work and the economy on the one hand, and residential and leisure interests on the other. In any case the measures taken must be judiciously geared to each other. Interventions that favour one or the other side too strongly must be avoided at all costs.

The first joint agreements have been reached in and between the various European countries for the purpose of achieving progress in this direction. These concern, for example, European standards for limiting the permissible emissions of pollutants from trucks. Moreover extensive research and development programmes have been initiated, which are concerned with:

- collecting basic data on goods transport;
- developing logistical systems for full truckloads ;
- the development of new technologies (such as urban goods vehicles/low-noise goods vehicles, new loading systems) and new forms of co-operation (e.g. intermodal transport);
- the optimisation of the use of existing infrastructure;
- the development of new infrastructure (e.g. rail/road interfaces).

Municipal authorities can and must exercise a considerable influence on the handling of freight transport in towns. It is essential that the developed policy issupported by all parties involved, i.e. the local authority, cities residents, transhippers and transport representatives, business and shopkeepers, police and (neighbouring) cities in the region. Local authorities must intervene to control such transport impartially, taking due account of the needs of all companies involved in freight transport as well as the needs of all urban residents affected by such transport. This means that local transport policy must be designed to expedite goods transport where fast processing is necessary, and to act restrictively when it is necessary to protect the population from its harmful effects. A number of European cities have been working along this line for some time. From the accompanying national reports, it can be seen that in many instances urban distribution platforms and goods transport groups have been set up, in which targeted co-operation between industrial and commercial companies, transport operators and municipal authorities has resulted in the identification of the fastest and smoothest possible ways of expediting goods transport flows and the development of worthwhile solutions.

The activities covered by local transport policies are far ranging. They include joint round-table initiatives, such as discussion platforms or goods transport groups, in which measures for bundling and regrouping goods flows are examined and developed. The transport companies attempt to organise operational and transport procedures more smoothly and cost-efficiently by putting greater emphasis on co-operation and the use of improved logistical systems.

Municipal administrations contribute by initiating measures to improve goods traffic flows on the one hand, and to protect the population on the other. Such improvement measures include:

- upgrading and improving the main road network, suitably adapting the design elements and traffic light systems to the needs of truck traffic;
- establishing protected loading zones in areas where there is considerable delivery traffic;
- establishing and publicising properly signposted truck networks, through which the flows of trucks can pass quickly and smoothly without harming the environment;
- creating alternative options for trucks, e.g. establishing or reactivating rail terminals;
- establishing the conditions from public side freight transport and freight distribution centres to facilitate the bundling of traffic flows, regrouping for other means of transport (e.g. rail, ship) and the use of "town-friendly" trucks.

Besides taking measures to expedite truck traffic, municipal administrations are also forced to introduce restrictions on such traffic. These include:

- the establishment of pedestrian zones in which deliveries can only be carried out at certain times of day or night, and weight restrictions sometimes also apply;
- the establishment of protected zones that have to be kept completely or partly free of trucks (for example a ban on overnight travel, or a ban on truck through-traffic).

From the list of regional and local policies and the instruments for implementing them, it appears that many initiatives are being taken to bring about improvements in goods transport and to make such transport more environmentally compatible. It is important that businesses, transport companies and public authorities cooperate to develop and implement solutions that are for the benefit of all sectors of society.

From the national reports and the many sub-reports generated in the context of the COST 321 Action, it is clear that corresponding initiatives are being taken in many countries.

3.4 The COST 321 Action plans and results

The COST 321 Action is intended to make a contribution to facilitating the handling of truck traffic in an environmentally friendly form at the international level. The countries participating in the COST 321 Action have come together to cooperate in achieving this aim and have declared their readiness to exchange basic information and results and to develop and evaluate suitable measures for handling truck traffic.

During the work on the COST 321 Action it became clear that the situation of road freight transport in the individual European countries differs widely. This is also true for what concerns:

- the available information on freight transport;
- the forms of organisation in road freight transport;
- priorities concerning the handling of freight transport.

Accordingly, the countries in the COST 321 Action also fitted differently in terms of their priorities. As a consequence the results from the various countries could not be forced into a uniform framework but were characterised by their own individual peculiarities.

Basically it can be stated that almost all countries attached considerable importance to collecting special information on goods traffic and in particular on road freight traffic. Extensive surveys were carried out, covering a broad spectrum of widely varied towns (see also chapter 3.1).

In addition, in many countries consideration was given to the enactment of selective measures for handling road freight traffic. Working group A of the COST 321 Action drew up an overview of the measures considered (see also chapter 4.3).

Working Group A also carried out a qualitative assessment of the measures. Working Group B had the task of carrying out a more far-reaching quantitative assessment. As part of this, simulation models were used to examine the effects of some of the measures and to compare them for different towns. The aim of this was to examine the extent to which the different measures affected the freight traffic situation and the environmental situation in urban areas, and to what extent the effects of the

individual measures can be generalised, i.e. can be extrapolated to the individual towns.

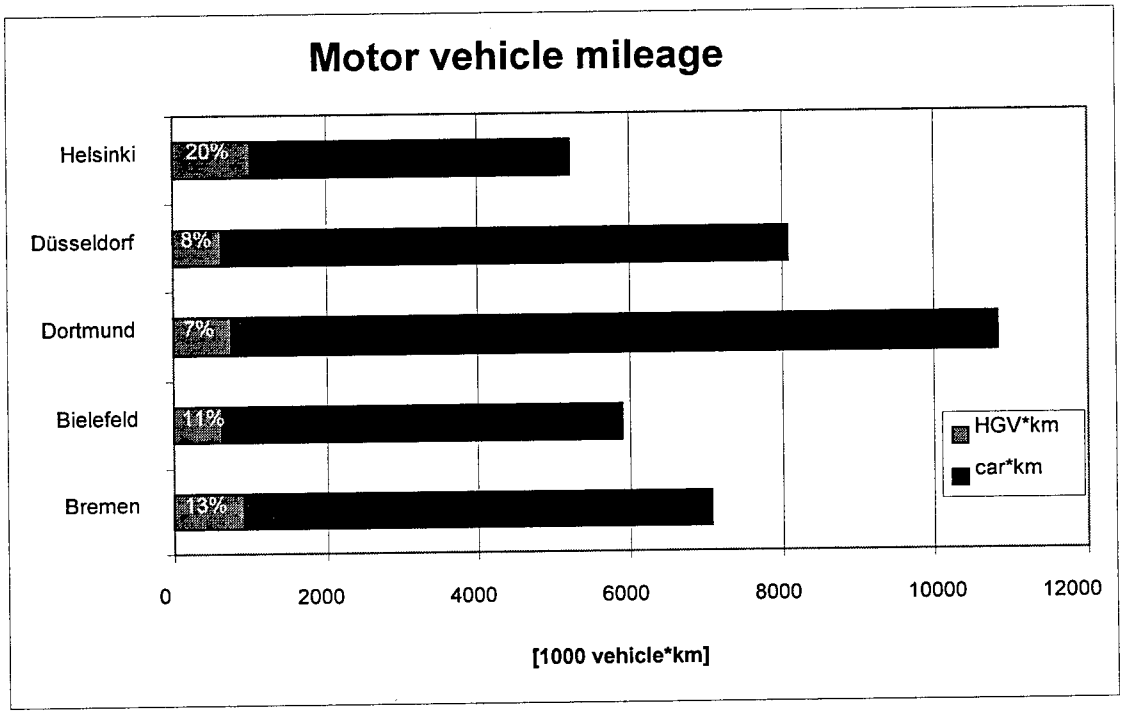
During the course of the COST 321 Action it was found that the objective of formulating results that can be generally applied at an international level can only be achieved in part and with great difficulty. One reason for this is that the number of measures to be studied is very large, and the study and observation methods in the various countries differ widely. Some countries, for example, gave priority to a detailed treatment of a few main themes and the evaluation of field studies, whereas others placed the emphasis on the use of simulation models to test whether measures and their effects are applicable to other towns. Even within the same country towns and cities differ so much that it is hardly possible to draw uniform results.

Summaries of the projects carried out by the various countries and their results are contained in the sections 4.4 and 4.5 and also in the national reports in the annex 2. Other, more detailed information, are contained in the special report listed in annex 3 (Cost 321 documents).

4. TOWARDS OPTIMISED URBAN GOODS TRANSPORT

4.1 Disparate realities – concordant objectives

The settlement structure in the individual European countries differs widely. This is reflected in the overall picture of the goods transport sector in general, as well as in the specific area of goods transport by road in urban areas. Even in towns and cities of comparable size, goods transport by road has different share in the total motor-vehicle-mileage (see illustration above) and affects the overall transport picture in different ways. The reasons for this are not infrequently to be found in different city size and city structure (e.g. with or without historical centre), but also in the range of distances between cities: Germany may conveniently use trains for inter-urban distribution, owing the fairly large distance between origin and destination, while the Netherlands can hardly justify the use of railways, due to the relatively small distances to be covered). Those situation differences create different local, regional and national transport policies, expressed in laws, ordinances and guidelines that have a more or less powerful effect on the operational procedures of the companies involved in the transport sector.



The various European countries and towns therefore face different problems in connection with the management of truck traffic, and it follows that special measures are taken to deal with special problems.

This trend was also visible in the context of the COST 321 Action and the incorporated compilation of measures implemented throughout Europe (see section 4.4). From this it is clear that – depending on the degree of necessity and the opportunities available – widely different measures are being tested and introduced for improving the truck traffic situation. These range from moderately effective individual measures to global measures that affect the whole traffic network. All, however, have the same objective. This objective is to reduce the environmentally harmful effects of truck traffic, while ensuring that the haulage sector can continue to operate economically efficiently. This means that the problems that have to be tackled must be viewed with an eye to both these aspects and that acceptable results can only be achieved if both aspects are taken into consideration.

In the past, the objective and purpose of a future-oriented transport policy was to develop the relevant infrastructure in order to create greater mobility for economic growth and the resulting increase in goods and passenger transport. Traffic growth and economic growth were coupled together. However, since the transport infrastructure can only be developed to a limited extent, in conurbations in particular, owing to the restricted opportunities for expansion, the impacts on ecology and public health as well as growing acceptance problems in respect of major transport projects, a future-oriented transport policy and research policy will have to develop strategies that will permit economic growth in future without a corresponding increase in the volume of transport.

A decoupling of economic growth and increase of transport volume can possibly be obtained by different approaches.

1. Solutions based on the reduction of transport demand (mainly through the use of advanced telematics).
   Measures which reduce the demand for mobility by means of an increasingly transport-oriented structural policy or which allow physical transport and traffic to be replaced, for example, by teleservices, telejobs or traffic-reducing structures. This decoupling approach starts at the origin of traffic and transport and aims at developing structures which can meet mobility requirements with less traffic. The approach is based on the principle that prevention has priority over subsequent damage limitation. Only those solutions can be considered which are not detrimental to economic development and which are not regarded by the population as restricting mobility.

2. Solutions based on the increase of transport-efficiency.
   Measures which increase the ratio between traffic use and traffic volume (e.g. distances covered by vehicles, energy and raw materials consumption, time required and financial outlay. loading factors), thus enhancing traffic efficiency.

3. Solutions based on the reduction of impacts.
   Measures which markedly reduce the undesirable side-effects of traffic and transport over and above the first two approaches. These measures aim directly at improving safety, protecting the environment and conserving natural resources in the field of transport.

4. Solutions based on the reduction of average product size.

Approaches to rule the truck traffic that are based only on environmental needs or on promoting the economically efficient development of goods transport by road usually prove to be senseless and cannot gain the necessary acceptance as a valid objective of transport policy. All those involved in the transport sector – and this includes transport companies, local authorities, trading companies and public transport operators, as well as citizens – must realise that one-sided encouragement or discouragement has harmful consequences and cannot bring about a satisfactory solution.

The reverse also applies. Individuals and companies must be expected to exhibit a degree of tolerance and a readiness to make improvement measures work. This means that companies must be prepared to co-operate closely, to improve logistical systems, to introduce new technologies and also to accept higher costs. Citizens, on the other hand, must be prepared to accept increased burdens in some cases – in the fields of transport and finance – in return for a general improvement in environmental conditions.

4.2 Goal-oriented measures

A variety of measures have been developed and in some cases already implemented in European countries and towns to address the wide range of problems caused by the transport of goods by road. Depending on the particular case, the problems and measures may be geographically limited in scope or they may affect much wider areas.

Depending on the individual case, the spectrum of measures stretches from a local initiative (such as the introduction of a loading zone, a ban on through-traffic, or a

merger between a small number of carriers) to measures that affect a whole network (such as the introduction of preferential truck networks, the reduction of packaging volumes, or the introduction of speed limits).

As the results of the COST 321 Action clearly show, a variety of methods are used to assess the individual measures. These include:

- traffic counts (before-after);
- questionnaires filled in by companies/experts;
- measurements taken from aerial photos, and their evaluation;
- evaluations of drivers' record books/accompanying goods documents;
- measurements of noise levels and pollutants.

The effects of introducing a measure can be monitored after its implementation by the methods described above, or they can be evaluated with the help of simulation models and the use of urban distribution effect tools (The Netherlands). The advantage of the model calculations is that the effects of the measure can be evaluated without having to put the measure into practice (with all the expense and effort involved). The possibility of analysing packages of measures, consisting of several individual measures, is of special importance in this context. In such cases it is almost impossible to reach conclusions about the effects of superimposing several measures on the basis of simple considerations or personal estimates, and the help provided by modern computers and suitable simulation programs has proved helpful and advantageous. This applies the more so in view of the fact that information on the urban and transport structures in the region under consideration can be fed into the model, allowing local circumstances to be taken into account.

In principle, however, the situation in cities is very complex, so it must be assumed that the use of simulation models and the results derived from them should only be an aid to decision making. The final decision should always be left to the experts and those involved. Their task is to assess the effects triggered by the individual measures or packages of measures in the context of the overall picture. This task is often very difficult, because it involves evaluating widely different criteria concerning the ecological, economic and traffic situation.

No generalised system of evaluation is currently available for the assessment of individual measures. Assessments must therefore be carried out on the basis of the specific characteristics of each case, and ultimately a decision can only be taken in the context of a synoptic consideration of the whole picture. Only rarely do pure cost-benefit analyses result in a satisfactory solution.

The above considerations reveal that the measures implemented under the varying circumstances, and their evaluation, cannot be developed and assessed in accordance with any rigid system. This also reflects the real situation in the individual European countries. In almost all countries and towns, specific local measures have been developed and have been assessed in widely varied ways on the basis of the special local circumstances. This situation, of course, makes it very difficult to positively identify those measures that could be meaningfully implemented. Nevertheless an attempt can be made to identify general effects for individual measures under certain specific conditions. The results of this exercise should enable an assessment of whether it is worthwhile to implement specific individual measures to deal with a given problem. The results of COST 321 provide, in this framework, an initial indication of the effects that specific measures are expected to produce, and should therefore contribute to avoiding unsuitable decisions.

4.3 Application fields of the proposed measures – an expert evaluation

4.3.1 Compilation and initial evaluation of measures by Working-Group A (WGA) and TNO

To be able to change the current situation, urban authorities need to have detailed knowledge and understanding of:

- the actual situation and problems within their city with respect to freight transport;
- the underlying logistical structures;
- the often conflicting interests of the parties involved;
- potential measures and policy instruments and their effects.

Although long lists of potential measures can be found in literature, almost no information is available on effects of measures and even less on synergy and counterproductive effects.

The COST 321 initiative aims at filling in "white spots", about measures and their effects, by information exchange, by piloting and by developing simulation tools.

Therefore, a questionnaire has been developed, that has been filled out by the members of the COST 321 Management Committee or by the national experts who are supporting them. The results of this questionnaire together with additional literature research formed the basis for this survey.

4.3.1.1 Introduction to the survey

Categories of measures

It is almost impossible to make a fully distinctive categorisation of measures, since there are many interdependencies. Within the COST 321 initiative Working Group A has chosen for a categorisation into 8 topics, that fall into four major policy areas, being mobility demand, infrastructure supply and vehicle supply.

Area: ***Mobility demand***

Topics:
1. Logistical organisation
2. Modal choice.
3. Price of transport

Area: ***Infrastructure supply and land use***

Topics:
4. Physical planning, infrastructure planning & investment
5. Traffic planning & management

Area: ***Vehicle supply***

Topics:
6. Vehicle technology
   Alternative fuels

Area: ***Behaviour***

Topic:
7. Driving behaviour

Additional:

8. Other measures

Policy instruments

A distinction has been made between "measures" and "policy instruments".

This distinction has been made to be clear about the actor(s) who really will implement the measure and about the role of the (urban) authorities.

Example: the measure "better co-operation between transport operators" has to be executed by the operators themselves. The authorities might use instruments like information provision, support to agreements, economic incentives, etc.

Only measures in the area of city traffic planning and infrastructure supply are (almost) completely under direct control of the authorities. In these cases, we might state that the measure does not need a policy instrument.

The authorities may intervene with respect to the other areas by means of "policy instruments", being: regulation, stimulation by the economic instrument (taxation or subsidies), agreements with the industry, R&D financing and by information/ promotion.

The following policy instruments to put the measures in place have been identified:
- regulation;
- agreements with the industry;
- economic instruments: taxation and subsidisation;
- R&D;
- Information, co-ordination and promotion.

The selection criteria for measures

The most important criteria for including a measure is the suitability for a better urban environment. A lot of measures are in general suitable to diminish the annoyance of road transport. The Working Group A tried to search only for specific urban measures. They selected the following selection criteria for measures:

1. potential for contribution to the objectives;
2. viability/acceptance including costs;
3. synergy effects and side effects;
4. policy instruments to be used;
5. level of intervention;
6. simulation ability.

There are two reasons why certain measures are not addressed in the overview of measures (chapter 4.3.1.2):

- some general measures that are oriented at freight transport as a whole, but not specifically at urban transport;
- measures with an little (estimated) effect on urban environment.

This regards the following specific measures:

General measures:

- Taxes on fuels
- Harmonised taxes on truck ownership
- Encouragement of buying less CO2 producing trucks

- Distance dependent duty truck trips
- Tire pressure advices
- Tightening exhaust gas tests
- Allowing cabotage

Measures with an little (estimated) effect:

- Private railway transport
- Double loading platforms in trucks.

Topics included in the description of the measures

Of all other measures descriptions have been made in the appendix of the WGA/TNO report, according to the following items:

- short description of the measure;
- objectives of the measure;
- site and way of testing if the measure has been implemented somewhere;
- effects of the measure (local pollution, energy use, noise, congestion, safety, local economy, effects to the transport sector);
- indirect effects;
- time horizon;
- level of intervention;
- required policy instruments;
- potential for simulation.

In order to specify the above mentioned items some explanations might be necessary:

Objective

Often it is not clear what the objective(s) of the measure is (are). In case of a mix of objectives and when available, the sequence of priority is indicated, indicating the primary objective with a "1", etc.

Site and way of testing

Site characteristics generally have an influence on the effects achieved. Respondents were asked to indicate any characteristics as large or small city, part of the city, part of transport included, year of testing. The way of testing gives information on the validation of the results.

Effects

Although long list of potential measures can be found in literature, almost no information is available on effects of measures and even less on synergy and counterproductive effects.

Therefore a distinction has been made between quantified effects (e.g. by before and after studies or by simulation) and expert judgements. The respondents were asked to give their judgements in case no quantified effects were available.

The (potential) effects are determined by two dimensions:

- the effect of the measure on itself (e.g. the effect of using an electric vehicle in stead of a diesel powered one);
- the magnitude of the application field (e.g. application only suited for delivery vehicles of small parcels in the inner urban area).

Indirect effects

Respondents were asked to indicate if there would be any interaction with other measures in supportive or in counterproductive sense. Also the measures might have negative side effects in themselves.

Viability/acceptance

Under this heading two dimensions are included: the costs of the measure and the acceptance (resistance, enthusiasm) by the affected actors.

4.3.1.2 Overview of measures

For most measures aspects as short description of the measures, the objectives, the time horizon and the required policy instruments are included. Some attempts are made to estimate the (indirect) effects. However it must be taken into consideration that not all the effects are recognised and described. Especially when it concerns the impact on other traffic or when it concerns second order effects.

In the introduction of the survey is stated that the measures are divided into 8 categories. The next sections give a short overview of the measures which are included in each category.

Logistical measures

An extensive number of measures addressing logistics organisation is included in the survey (EUCO-COST/321/8/94). These are:

1.1 Service differentiation / reduction of service level requirements
1.2 Shared use of storage space by retailers
1.3 Promotion of storage facilities in inner urban areas
1.4 Outsourcing of freight transport
1.5 Transport co-ordination and co-operation of retailers *
1.6 Reduction of packing volume *
1.7 Common use of vehicle fleet *
1.8 Information systems and telematics applications *
1.9 Goods distribution centres *
1.10 Consolidation by means of "urban" containers *
1.11 Replacing large trucks by smaller trucks or vans *
1.12 Development and use of light goods handling equipment
1.13 Development of lock chambers common to a group of receivers

Most promising at the urban level seem the measures 1.5 to 1.11 (indicated with *).

Modal Choice

Measures influencing the modal choice have some relation with measures of logistic or transport organisation, in particular, since terminals would be included.
Not only in the urban context, modal shift to rail or waterway would certainly have an important effect, since the long distance transport would be optimised from environmental point of view.

Measures included in the survey are:

2.1 Use of bicycle transport for the small or short range transport of retail shops **
2.2 Use of pipelines for transport of fuels and certain types of waste
2.3 Underground freight manipulation
2.4 Use of cheaper handling equipment
2.5 Co-ordination of intermodal transport *
2.6 Regional rail network in combination with urban DC *

Most promising at the urban level seem the measures 2.5 and 2.6 (both in co-ordination with the various functions of DC's and Freight Platforms). In a later stage number 2.1. was added. As results from the Netherlands show also measure 2.3 seems to be one of the most promising measures.

Price of transport

Under this category only the price measures are included that have a direct relation with the urban area and so a direct effect on urban freight transport.

The effects of price measures would have to be studied in the broader scope of the logistic chain, since transport costs constitute only a limited share in the total logistical costs in the physical distribution. Also cost increases could partly be charged to the ultimate consumer, hardly changing the transport market (in cities). So one might argue that a cost raising might have only a very limited effect. And the share of city distribution in the total transport costs is limited.
On the other hand an increase of costs will have an effect on transport companies, who will thus be stimulated towards the identification of more efficient transport solutions.

Measures that are included in the survey are:

3.1 Truck ownership licenses for urban distribution *
3.2 Road pricing in cities *
3.3 Parking duty for delivery trucks modulated according time of day, parking time and site
3.4 Public subsidisation of railway transport in cities

Most promising at the urban level seem the measure 3.1 (in conjunction with DC's) and the measure 3.2.

Infrastructure and physical planning
New infrastructure can be built with a certain emphasis on urban goods transport (facilities). But new infrastructure might result in more transport. An effective infrastructure policy must therefore promote non-road transport modes, and more generally encourage new patterns of infrastructure use that will result in a decrease of congestion and of the other negative effects of urban goods transport. On the other hand, perverse effects (increasing transport) should be avoided. This might be achieved by traffic regulation and/or the price instrument.
Infrastructure and physical planning should be integrated and equilibrated, taking optimising the use of the total capacity of transport modes in cities.

Measures that are included in the survey are:

4.1 Optimisation of distribution systems including transport centres *
4.2 Promoting less transport intensive economic activities
4.3 (eliminated)
4.4 Geographical bundling or separation of functions *
4.5 Extension of transhipment facilities
4.6 Assignment of industrial/commercial estates to existing/future transport infrastructure
4.7 Solve infrastructural problems

4.8 Removal of freight transport depots from residential areas
4.9 Wide lanes to accommodate freight transport
4.10 Energy conscious road design
4.11 Strong expansion of the rail network *
4.12 To revive railway or fluvial central urban sites as urban distribution centres
4.13 Accelerate procedure concerning infrastructural measures
4.14 Establish quick and direct routes between distribution centres and the inner city

Most promising at the urban level seem the measures 4.1, 4.4 and 4.11.

Traffic management

Traffic management is primarily the task of authorities is aimed at making a better use of the urban infrastructure. Suppliers of (information) system providers can give support with specific products or solutions.

Measures that are included in the survey are:

5.1 Regulation of freight traffic *
5.2 Guidance and information systems for traffic management *
5.3 Specific use of infrastructure for goods transport
5.4 "HGV" or truck routes in cities
5.5 Reservation on streets of special sites for truck stops
5.6 Speed limits and external speed control
5.7 Hierarchy in infrastructure for freight transport

Most promising at the urban level seem the measures 5.1, and 5.2.

Technical measures concerning the vehicle

Technical measures on the vehicle will not influence the total transport flows.
The objective of these measures is diminishing the nuisance (noise, pollution, danger etc).
The are very good combination opportunities with distribution centres: transhipment to smaller and electric powered vehicles.

Measures that are included in the survey are:

6.1 Stopping of engine during goods handling
6.2 Speed limiters
6.3 Technical measures concerning the vehicle
6.4 Electronic devices for fuel use and gear shifting recommendations
6.5 Regeneration of brake energy
6.6 Use of alternative fuels *

6.7 Harmonisation of load characteristics and units *

6.8 Development of silent vehicles and handling engines: delivery and pick-up during the night *

Most promising at the urban level seem the measures 6.6 to 6.8.

Measures concerning the way of driving

Measures that are included in the survey are:

7.1 influencing driving behaviour

Other measures

Measures that are included in the report are:

8.1 Harmonisation of national regulation

8.2 Search for an optimum sized Urban Delivery Vehicle

8.3 To remove obstacles to electronic proof of delivery

Most promising at the urban level seems the 8.2, although on the long term.

4.3.1.3 First assessment of the selected measures by the WGA/TNO Report

After selection of the most promising measures by the Working Group A of COST 321, the TNO team carried out an assessment based on the available descriptions and on their own expert judgements. The assessment was achieved and its results represented at three different but inter-related levels:

- a global evaluation of the overall potential effect of each measure, also taking into account the scale and scope of potential application;
- the expected level of viability/acceptance of the measure;
- the typology of policy tools to be preferred for measure implementation.

Graphs were produced to provide an effective illustration of this three-level assessment, and visualise the main correlation aspects. Preliminary conclusions can then be drawn.

4.3.1.4 Conclusions

The assessment of measures carried out as described above has allowed first of all to establish a ranking of measures in terms of their relative potential. With one only exception, such ranking confirmed the qualitative opinions gathered in the first, thus indirectly validating the assessment methodology.

A second conclusion is that measures that would be most effective, seem to have the lowest level of acceptance.

As a consequence, measures that would have an average effect and average-to-high acceptance have a higher chance of successful implementation.

In summary, top-ranked measures are as follows:

Logistic organisation:

1.8 Information systems

1.9 Goods distribution centres

Modal choice:

2.6 Regional rail network with urban DC

Price of transport:

3.2 Road-pricing (although to a lesser extent)

Infrastructure and physical planning:

4.1 Distribution systems with various transport centres

4.2 Geographical reorganisation (long term)

Traffic management:

5.2 Guidance systems

5.1 Regulation of freight traffic (but: problems with acceptance!)

Technical measures:

6.6 alternative fuels

6.7 harmonisation of load characteristics.

The complete report with the description of the measures and a first assessment of selected measures can be found in the document "State of the Art, Description of measures and first assessment of selected measures" CEC/DGVII, November 1995 (EUCO-COST/321/3/95).

4.3.2 Assessment of the compiled measures and their evaluation

In order to ascertain the extent to which the results obtained by Working-Group A could be accepted in professional circles, a survey was carried out among a number of experts[3].

The Expert opinions on the WGA/TNO Report were obtained by means of a further questionnaire to members of the COST 321 Action, and though them to national specialists.

This questionnaire reads as follows:

[3] The comments in this chapter are largely based on the Interim Report of Working Group A: Savy/Stransky; "Urban Freight Transport, State of the art COST 321 of innovative measures planned or experimented in Europe".

QUESTIONNAIRE

This questionnaire is a call for expert judgement on the WGA/TNO Report.
It should be addressed to three to five "experts practitioners" per model city: one or two carriers, one own-account supplier, one or two persons in charge within the municipal technical services.

1. Do you think that any interesting measure has been forgotten in the WGA/TNO Report?
2. Do you agree with the preselection of "most promising measures", indicated with * (from page 6 of the report)?
3. As far as you are concerned, how would you modify or correct the different assessment graphs in the report?
4. Which measures do you consider as most important within your city?
5. In fact, a measure is rarely brought into play on its own, but rather as a part of a coherent whole of measures of different natures, aiming at certain objectives.
   Do you know about (and/or do you have ideas to bring into play) such wholes?If it is the case, please describe them and indicate where you would place them on the assessment graphs.
6. Which other remarks or comments would you like to make?

The number of responses was very low (5 in total), and the quantitative meaningfulness of its results is therefore limited. Nevertheless, some clear messages emerge (the following comments, largely written by Jean Francois Fritsche[4], are intended to provide a short overview of the strong and attention points of the WGA/TNO Report):

"the report's conclusions represent a first important attempt to identify the interconnecting relationships in the field of goods transport by road, although greater efforts will be needed before the effects of measures aimed at positively influencing the transport of goods by road can be recognised."

4 Of the CERTU (Centre d'Etudes sur les Réseaux, les Transports, l'Urbanisme et les constructions publiques) à Lyon.

Strong points

1. The WGA report provides, for the first time, a fairly exhaustive collation of ideas and measures for improving and rationalising urban commercial traffic. The introduction outlines the context of the report very well, stressing the importance of the often conflicting economic, political and social logic of the different actors, public and private.

2. While the report is somewhat of the nature of a "catalogue of measures", it nevertheless represents a considerable compilation effort and, above all, it has the great merit of existing, of drawing up a first list of measures (explained and described), thus opening the way for progress in the subject of freight transport in towns.

3. On the basis of this compilation, it is now possible, in a first stage, to formulate policies through combining several measures together in order to achieve certain objectives. In a second stage it will be necessary to monitor the actual effects of these measures, rather than simply carrying out a simulation exercise.

Attention points

1. The prevailing attention is on the commercial vehicle traffic.
   In practice it is clear that any given measure must of course be looked at from both the goods transport and the private car point of view.

2. Reverse effects and counter-productive measures deserve additional attention. In fact, only measures that have an overall positive effect are included in the WGA/TNO report. That is, measures that would have an obvious counter productive effect were not considered. The possibility of partially counter-productive effects of some measures was taken into account in the description of the measures themselves, including the conditions under which the overall effect should not be negative. Therefore the assessment graphs only have positive scales (from 0 to ++), and no negative scale. For example, a measure to limit the tonnage (or dimensions) of commercial vehicles may very well lead to greater congestion and pollution, through an increase of the number of vehicles or trips necessary. However, most trucks are only partially loaded; in those cases, the number of truck trips would not increase, only the truck size would drop and consequently pollution and even congestion levels.

Such measure should therefore be applied with the necessary caution so as to ensure that an overall positive effect is achieved (although at a lower performance level than could have been expected without counter productive side effects). Incidentally, such considerations are perfectly in line with the simulation results for this particular measure (see below in paragraph 4.5.4.2.)

3. Interactions between measures are by far the most complex and ambitious topic of analysis. As far as possible, these interactions have been taken into account, but more efforts are needed to analyse such combined effects, as for example between the measures 1.10 "containers", and 1.6 "reduction of packing volume".
   Further exploration on this topic has also been carried out at the initiative of the Dutch Ministry of Transport.

4. The classification of the measures is made based on experts opinions in order to carry out a first selection of meaningful measures, to be further subjected to simulation and quantitative assessment.

Conclusions

The measures described in the WGA/TNO Report and the evaluations carried out by the various experts show that this work represents an important step forward in the context of city-friendly management of truck traffic. At this point it should be emphasised that the most promising measures with the most far-reaching consequences in terms of their potential effects and the magnitude of their fields of application are to be found in the realm of logistics.

It is also clear, however, that the consequences of the described measures for improving the traffic situation cannot be clearly demonstrated in many cases. One example is the range of measures falling under the heading "modal choice", for which no clear preferences could be identified by the experts. It must therefore be concluded that extensive experience will have to be gained before measures can be implemented selectively and effectively.

As described in the following section 4.4, in recent times many countries and towns in Europe have initiated measures aimed at improving both the ecological and the economic impacts of truck traffic in urban areas. Although the ecological and economic viewpoints are not always ideally balanced, and economic viewpoints frequently take precedence over ecological ones, it is possible to identify individual measures that fulfil the specified objectives. One example of such a measure is city logistic/transport co-operation.

Because in most cases the implementation of individual measures stretches over a long period, and the effects only become noticeable step by step, it is inevitable that some time will pass before reliable quantitative data on the action mechanisms of individual measures or packages of measures can be obtained.

4.4 Implementing measures: an overview of current experiences

In the context of the COST 321 Action a compilation[5], was made of projects carried out throughout Europe for the purpose of improving the situation with regard to the transport of goods by road. The compilation of the measures implemented in the individual countries and towns includes conclusions about:

- the geographical/operational situation, in which the measure was located ;
- the type and scope of the implemented measure;
- the effects triggered by the measures.

The compilation clearly shows that experience of the effects of measures is only available in isolated cases. Most measures are currently in the trial stage, so that reliable results can only be expected at some future time, probably in 2 or 3 years.

However, in order to obtain an overview of already implemented or planned measures, a number of selected measures are shown in the table below. A more detailed description has not been included here on grounds of time and cost. More information can be found in the above-mentioned report) and in the research reports and national reports prepared in the context of the COST 321 Action.

In addition to the more locally focussed measures shown in the following table, a number of major measures have been introduced in the various European countries by means of legislation at national level. These include traffic restriction at certain hours of the day and on certain roads, regulations governing exhaust gas and noise levels, regulations governing hours of work (e.g. rules for resting periods) and taxes/fiscal levies.

5 See also the Interim Report of Working Group A: Savy/Stransky; „Urban Freight Transport, State of the art COST 321 of innovative measures planned or experimented in Europe".

Overview of measures to influence truck traffic intended/realised in European cities

Country	Town/area	measure(s)
Denmark	Vejle	City logistics
	Aalborg	City logistics
	Copenhagen	City logistics
	Odense	City logistics
Finland	Helsinki	Build up databases
France	Carpentras/Mazan	Electric vehicle (trucks)
	Avignon	Electric vehicle (trucks)
	Toulouse	– Regulation of deliveries – Regulation of abnormal loads – Regulation of the transport of hazardous goods – Evolution of the urban milieu and new measures
	Paris	Management of freight transport in a pedestrian zone
	Arras-Dounai-Lille	Organisation of the deliveries in town centres
	Bordeaux	Build up databases
Germany	Cologne	- Distribution centre, logistic organisation associating a carrier (Nedlloyd) - Eifeltor logistic park / logistic platform - Rhine part of Niehl / combination of railway
	Bremen	- Lorry traffic network - Goods traffic centre - City logistic
	Hanover	- City logistic - Goods traffic centre, - Logistic co-operation for hospitals supply - "Güterverkehrsrunde" (goods transport groups)
	Cottbus	- Lorry traffic network, - "Lärmminderungsplan" (noise abatement strategy)
	Augsburg	- City logistic - Goods traffic centre - Goods distribution centre
	Düsseldorf	- City logistic - "Güterverkehrsrunde" (goods transport groups); - Lorry traffic network
	Munich	- City logistic - goods distribution centre - goods traffic centre - logistic conception for garbage collection
	Dortmund	- City logistic - goods traffic centre - lorry traffic network

Country	Town/area	measure(s)
Germany	Trier	- Electronic navigation system for truck traffic "city master" - goods traffic centre
	Nuremberg	- City logistic - goods traffic centre
	Bielefeld	City logistic
The Netherlands	National level	Urban Distribution Platform (UDP)
	Maastricht	Urban Distribution Centre (UDC)
	Amsterdam	– Inner-city (except freight routes) closed to vehicles heavier then 7,5 tons – With the start in October 1, 1996, 9 private DC's where ready to collect and distribute goods – As of October 1999, an extension of the above with come into action, with the enforcement of Euro-2 norms for trucks and buses, and an additional restriction on vehicle length (>9m)
	's-Hertogenbosch	Selective access system by mobile pyramids for the inner-city
	Shopping street distribution 2000	- Transport goods at night from DC's to transport transhipment centres that cover the country, where goods are sorted in order of destination - Goods delivered between 6:00 and 11:00 am - Packaging pool
Spain	Barcelona (Example)	- Delivery time and parking places restricted to vans and trucks for the load and unload operations - distribution parks for urban deliveries
Sweden	Gothenburg (Linné)	- Co-ordinated city distribution - Introduction of an Environmental zone in the city centre area (special restrictions regarding emissions from diesel-powered busses and trucks)
	Stockholm	Introduction of an Environmental zone in the city centre area
	Malmö	Introduction of an Environmental zone in the city centre area

Country	Town/area	measure(s)
Switzerland	Basel	- European traffic hub - City logistic project (DIANE 6 – Energy-saving and ecological beneficial goods transport)
	Zurich	- City logistic project (DIANE 6) - The town's policy: creation of a multimodal (Rail-road) transhipment platform, concerted actions
	Zurich / Oerlikon	Urban distribution pilot project
	Bern	City logistic project (DIANE 6)
	Canton Tessin	Co-ordinated regional supply and distribution
	Swiss Mittelland	Combined goods transport
	Canton Graubünden	Combined goods transport
	Canton Zurich	Clean air programme – integration of freight in the regional planning – actions in favour of rail and combined transport – incentives for the optimisation of road transport – incentives for switching the transport of fuels from road to rail Railway development programme for the canton

4.5 Estimated effects of measures

4.5.1 Fields of work of Working Group B

Consistently with the overall organisation of tasks within the Action, Working Group B carried out special studies aiming at the assessment of the consequences of the measures for influencing goods transport by road - as collated by Working Group A - to the extent to which such consequences can be quantitatively evaluated by using simulation models. One of Working Group B's objectives was to set up comparable databases for different European cities and to use these to demonstrate the effects of various measures. It was, however, clear from the very beginning that the transferability of the results would be critically influenced not only by special national circumstances (such as laws and ordinances) but also by basic differences in urban structures (such as types of settlement and transport links).

Against the background of these objectives, Working Group B compiled extensive databases. These were as follows:

- the simulation models developed and applied in the individual countries,
- the basic data for describing the studied model cities;
- the measures aimed at influencing the transport of goods by road that were studied in the various cities, and their effects.

A special checklist was distributed with a view to obtaining an overview of the progress made and of the available documentation and results. All of the countries participating in the COST 321 Action were asked to supply information about the existing simulation models, the studied model cities and towns and the simulation results. Responses were received from 10 of the 12 countries approached. It should be noted here, however, that some of the distributed checklists could not be fully completed because the necessary data was not available, and it was therefore not possible to compile any completely homogeneous databases. Nevertheless it has been found that, in principle, the responses provide a very good overview of the current situation for what concerns the model-based treatment of goods transport by road, and the measures that can be derived therefrom.

4.5.2 The simulation models used

The investigations of Working Group B show that simulation programs have been developed and applied in a series of countries. However, the structures of the simulation models and the tasks for which they have been used (and the measures that have been studied with them) vary widely.

The following survey gives an overview of the simulation programs that have been developed in the individual countries. An attempt has been made to give a brief outline of the individual simulation models. More detailed information (with regard to their input, their mode of operation and their output) is contained in the national reports included in the Annex.

Denmark

The model calculates total energy consumption, emissions, transport costs, and traffic accidents as a function of truck and van traffic at the various road categories of the town.

The Model was developed in the model software GAMS (General Algebraic Modelling System).

For each road category the road length and travel speed is entered, together with the present goods transport distributed by vehicle type and size, type of fuel used, type goods carried, goods volume per vehicle type etc. In addition the specific energy consumption an emissions for each vehicle type is defined in the model as well as specific unit vehicle operating costs.

France

First inputs of the global model (FRETURB) concern the location of the different activities. Several factors can explain them, proximity of transportation infrastructures, land planning and land use, environmental disturbance, urban congestion, spatial division of labour, etc. Second input takes into account undertaking logistic transformation: vehicles fleet, number of movements, covered kilometres, rosters organisation, number of transfer centres...

The two output components are:

- estimation of urban congestion by knowledge of road network loading conditions in each zone
- appraisal of energy consumption by knowledge of vehicle-km

Germany

To simulate the effects of individual measures, the space-and-time-related desegregate traffic model VENUS was adopted which reflects the behaviour of the individual actors involved. This is a modelling approach which determines traffic volumes in a given area (divided into traffic zones) on the basis of the structures present in each zone (e.g., number of inhabitants, number of employees, number of companies, etc.). The originating traffic and the terminating traffic volumes are then processed into source/destination relationships, before being applied to the network models in a further modelling step so as to arrive at a description of the

load situation. The calculation of effects for a given traffic situation is then performed on the basis of these traffic loads.

Italy

The work is based on the use of HAPPYTRAILS, a suite of programmes dealing with traffic management. It integrates most of the typical functions of transport and traffic management, including the search of minimum length paths and of minimum cost paths.

The use of the simulation tools was directed to provide answers to the following ambitious questions:

- What is the expected impact of interventions?
- What is the cost of interventions?
- Production of global quality indicators.
- How to establish alternative intervention scenarios.

The Netherlands

In order to get a more accurate picture of freight traffic, a handy flow chart has been chosen (CROW–107). Hereby, the consequences of town planning changes on the volume of freight traffic can be calculated both globally and in a more detailed manner. This requires only a limited amount of calculation, as it is a hand drawn model, not a complex computer model. For specific applications in complex situations additional methods must be used.

Also in the Netherlands computer models are used as i.e. GENMOD which is a desegregated multimodal (car, bike, public transport) traffic model that generates traffic and impacts of traffic (safety, pollution) on the basis of inhabitants, employees, city structure, costs, etc).

Sweden

The work on the Swedish model started in late 1996 and is in the phase of conception. The proposed model system and its construction can be subdivided into four basic components:

- Construction of sub models and data collection.
- Calibration of the sum of the sub models.
- Establishing an database together with methods for the calculation of data to get a complete data set at the transport system level.
- A model system for the analyses, that will be usable for analyses of the present transport system, consequence analyses and forecasting.

Switzerland

In Switzerland a model to simulate potentials for an urban vehicle fleet transformation was selected. It deals with statistical data and specific surveys. It is called a simple effectiveness analysis model (EWM) and is divided into two parts. First, the intrinsic characteristics (i.e. load factor) of the city truck are researched. This allows as a consequence the impact to be assessed in a linear relationship of city trucks in the total vehicle fleet.

Secondly, various determinant factors relating to the feasibility of the proposal have been incorporated in the model. The essence and the innovative aspect of the EWM are constituted by the analysis of the feasibility of introduction of the city truck. In this heuristic part of the EWM, 2-3 companies will be studied in depth. These permits to determine the realistic potential for effective substitution. With the load factor values established in the first part, the impact will be quantified.

As can be seen from the short descriptions, the models used in the various countries are structured very differently. They range from macroscopic approaches, involving the summary determination of the traffic situation for a total area, to microscopic approaches, in which the traffic situation is determined and evaluated for each individual road section.

4.5.3 The studied model cities

The studies carried out in the individual countries into the effects of alternative measures aimed at influencing HGV traffic were focussed on a range of selected cities (model cities). Specific models were tested in these cities (largely using the simulation models described above) and the results were published in special reports. (See also the collated reports drawn up in the context of the COST 321 Action.)

To be able to understand and interpret the results obtained for the individual countries, it was found useful to create a relationship between the structure of the studied cities and the traffic situation. In addition to the checklist on the applied models, the countries who participated in the COST 321 Action were therefore asked to complete further checklists describing the studied model cities and the results obtained with regard to measures to influence HGV traffic.

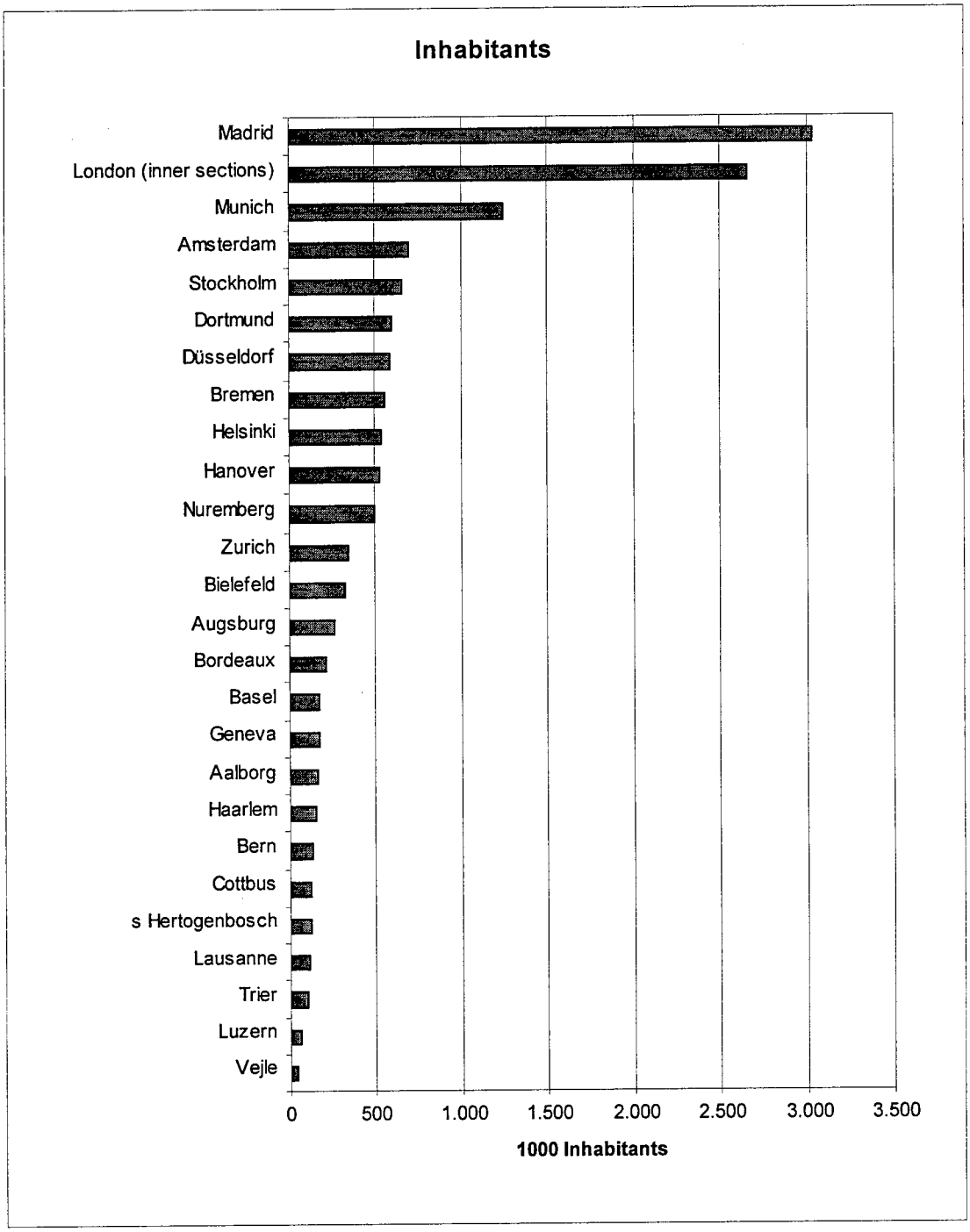
The data obtained in this way served to create a relationship between the specific city structure and the corresponding results concerning the traffic situation.

Experience has shown that the traffic situation in a city is largely shaped by the existing settlement structure and economic structure (population, number of people employed in the various sectors of the economy), as well as the traffic structure (road

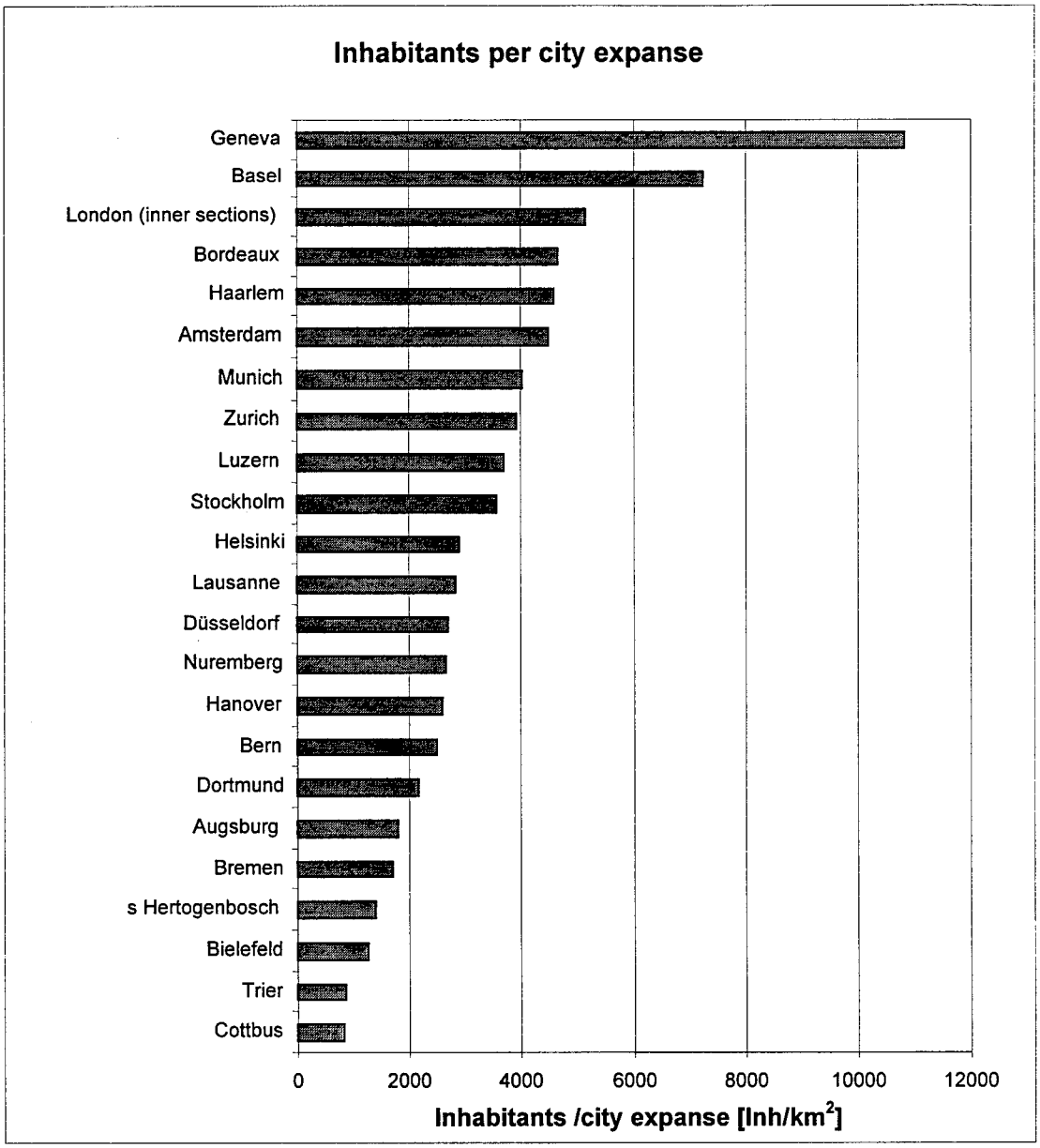
network, rail network, harbour, airport). These characteristics have a considerable influence on the traffic situation and on the effects of measures aimed at influencing HGV traffic.

In the context of the work carried out by Working Group B, details of almost 30 model cities were collected. Here too, it was not possible to answer all the questions in the checklists, so that the relationships between city structure and the associated traffic situation could only be established in a limited form. The following remarks are intended to give some insight into the information obtained. An attempt is made to identify relationships between the settlement structure, economic structure, transport structure and the traffic situation, and also to give an impression of the individual anomalies that are encountered in some model cities. This information serves as an initial indication of how difficult it is to look at the effects of individual measures in one city and use them to draw conclusions about another city. Each city is ultimately unique and reacts in its own unique way to individual measures. The sets of values shown below should serve as an indicator of this fact. The degree of fluctuation observed here is inevitably reflected (sometimes to an exaggerated degree) in the results described in the following section 4.5.4.

The evaluation of the checklists for the model cities indicates that cities of all sizes were studied. The spectrum stretches from cities with a population of millions, such as London, Milan, Madrid and Munich, to more modestly sized cities such as Vejle, Aalborg, Cottbus, Bern and Trier. Most of the studied cities have populations of between 200,000 and 600,000 people, so that medium-sized cities are very strongly represented. This is advantageous for the proposed studies. On the one hand these cities experience considerable problems as a consequence of the transport of goods by road, but on the other hand comprehensive measures (e.g. goods traffic centres, HGV routes) can be implemented more effectively in cities of this size than in smaller cities.



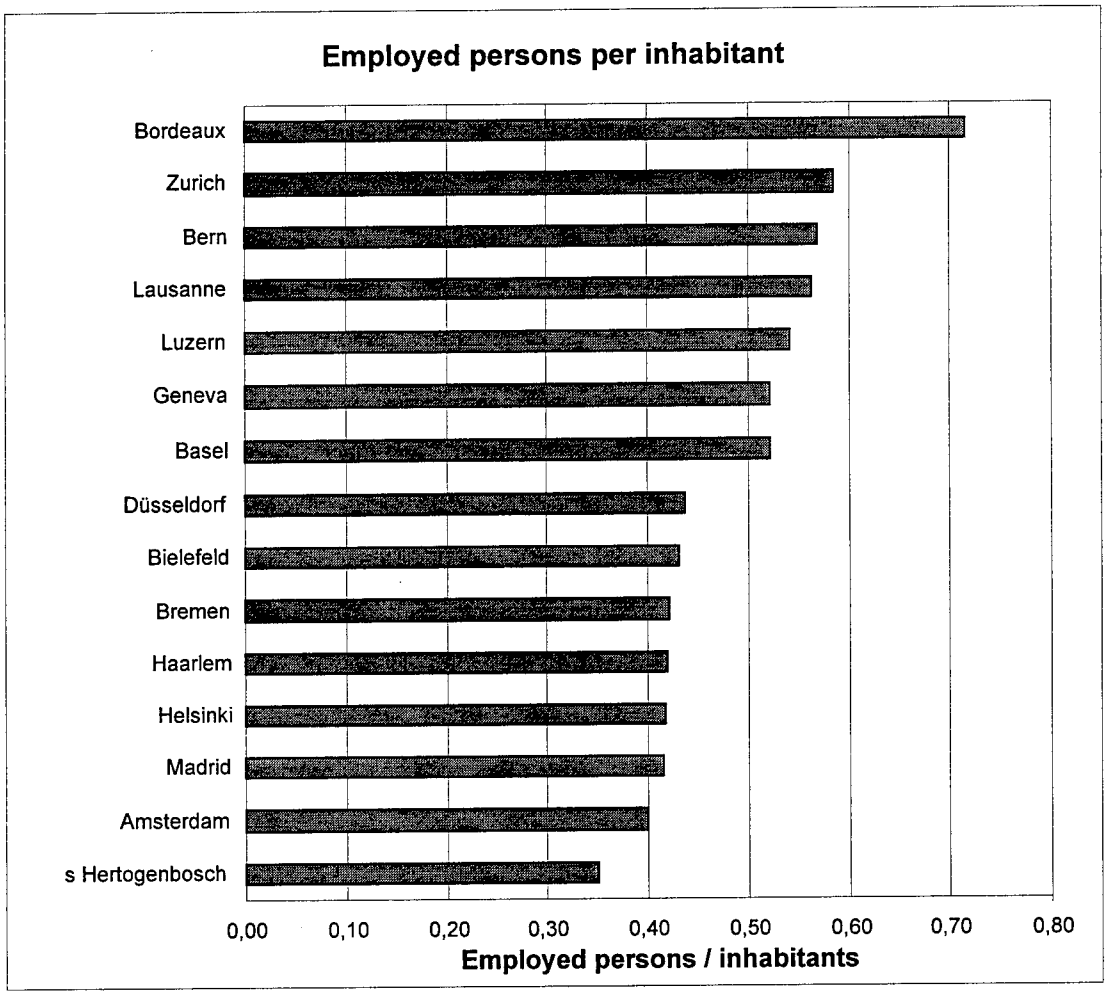
The settlement density of an area plays a crucial role with regard to the traffic situation in general, and the transport of goods by road in particular. The figures collected for the various model cities indicate that settlement density varies considerably in the individual areas. It ranges from almost 1,000 inhabitants/km^2 (e.g. Cottbus, Trier) to values of 5,000 and even as high as 10,000 inhabitants/km^2 (e.g. London, Basle, Geneva).



Besides the number of inhabitants and the centrality in terms of services, shopping and consultants the settlement density and the size of the gainfully employed population is also a significant parameter for describing an area. The gainfully employed population refers to all those who are actually in work, i.e. it does not include the unemployed.

The analysis of the collected data for the various model cities indicates that the proportion of employed persons in the total population (labour force participation rate) is similar but certainly not the same. For example, the labour force participation rate in German cities and in Madrid and Helsinki is about 42 to 45%, which is much lower than in the Swiss cities, where the equivalent figure is 52% to 58%. The difference is probably attributable to the different job market structures and the

different levels of unemployment in the individual countries. For urban goods transport also centrality and attraction are determinant dimensions.



Considerable importance attaches not only to the number of inhabitants but also to the number of employed persons in an area, especially in respect of the description of the traffic situation in the field of urban goods transport.

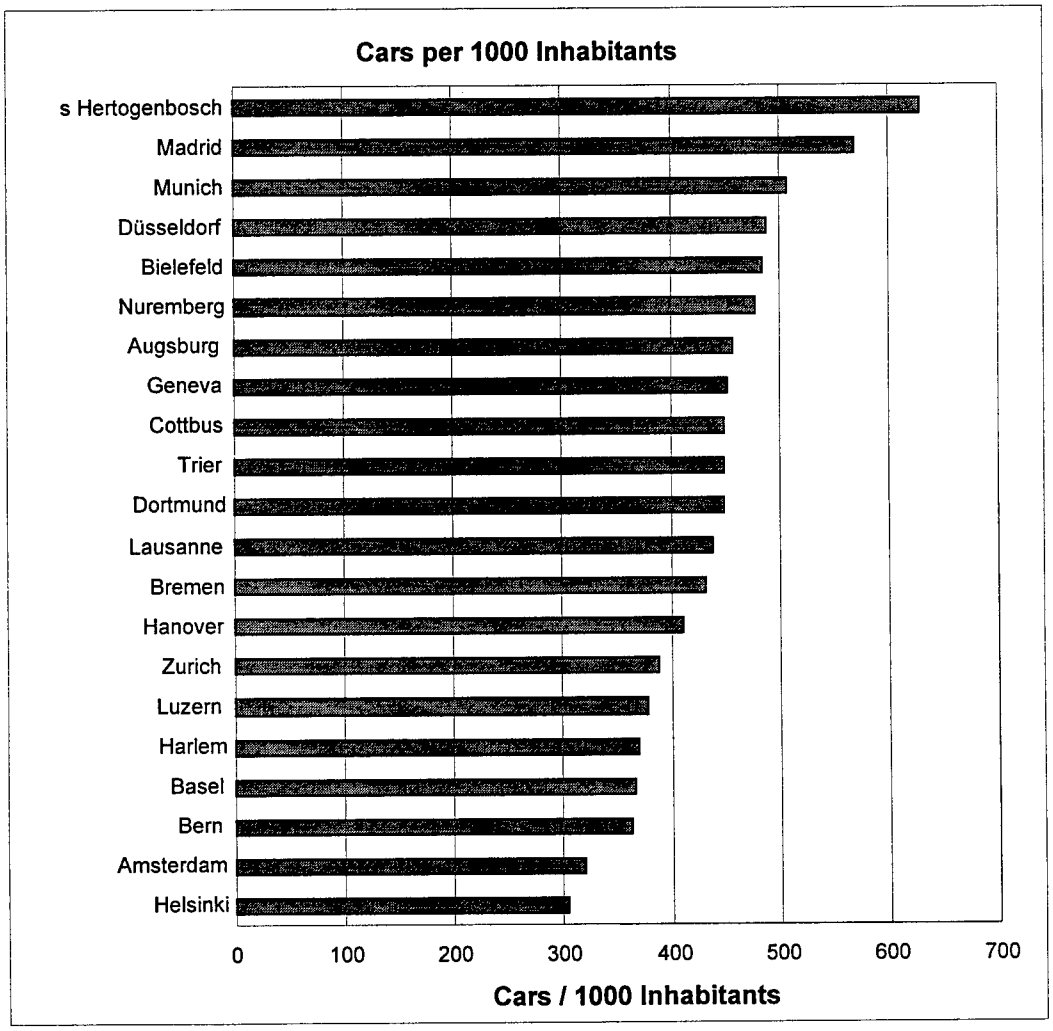
The different degrees of attractiveness of the individual cities give rise to clear differences between incoming and outgoing traffic. This situation is especially obvious in the case of work commuters, but also applies to the traffic flows caused by shoppers and urban goods transport.

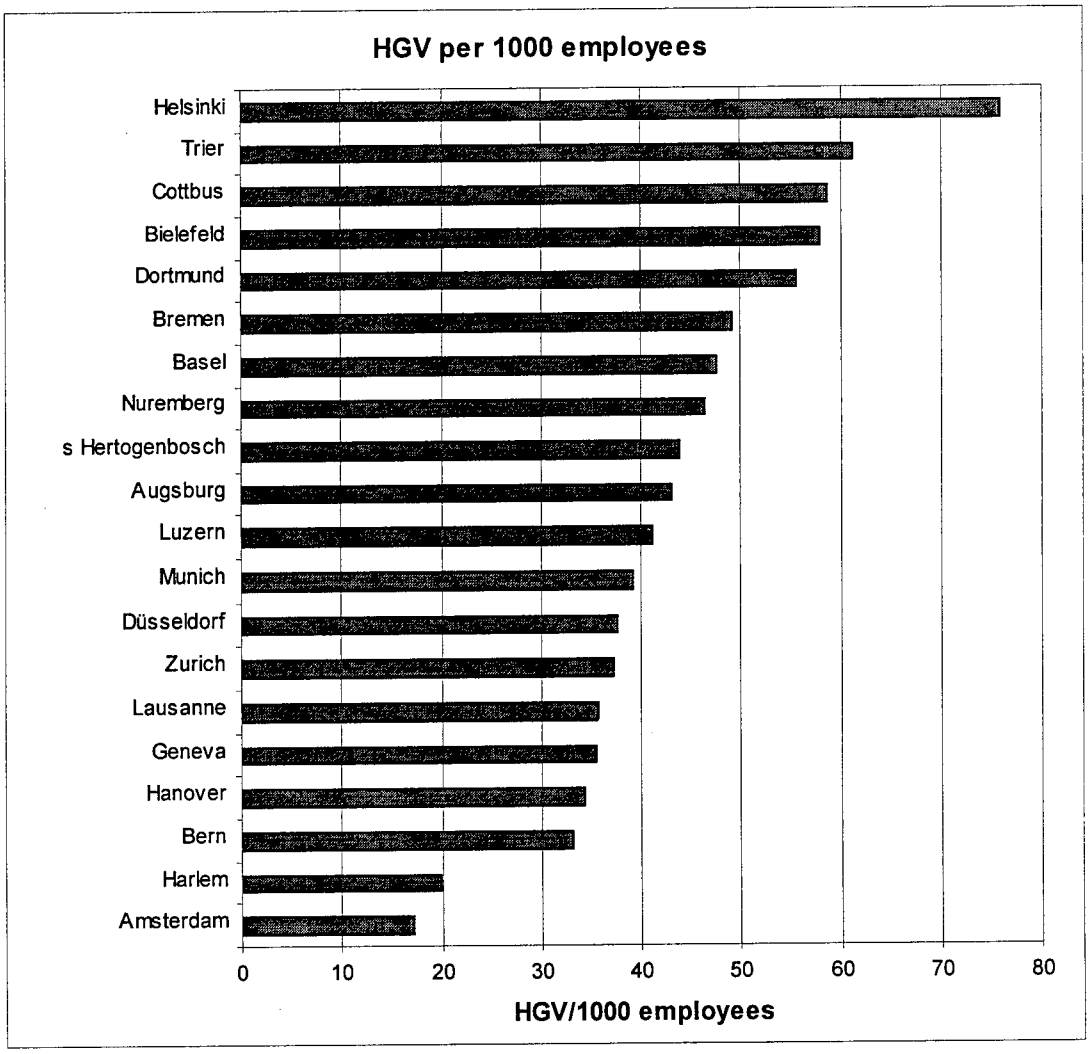
Basically it was found that, in cities where the ratio of gainfully employed persons to inhabitants is similar to the ratio of employees to inhabitants, the relationship between incoming and outgoing traffic is more balanced than in cities where there are large differences between these ratios. The figures gathered for various model cities indicate clearly that, in the large cities in particular, there is a large in-commuter surplus, which also has to be viewed in connection with the high settlement density in these cities.

The rough outline given here of the similarities and differences in the settlement structures of the various model cities is intended to give an indication of the influence that the settlement structure can exercise on the traffic situation in an area.

The relevant parameters for describing the overall transport and especially the goods transport situations include information on the number of available cars and HGVs and on the available transport network, especially the road network.

As the analyses reveal, different levels of motorization prevail in the various model cities (cars/1,000 inhabitants). This varies from about 300 cars/1,000 inhabitants to about 570 cars/1,000 inhabitants. The average value is about 450 cars/1,000 inhabitants. The differences in levels of motorization are related to the economic situation in the individual cities/countries and in particular to the local settlement and transport structures. The level of motorization is usually lower in large cities with a high settlement density and a good range of public transport services (e.g. underground railway network) than in less densely settled areas or areas of rural settlement.

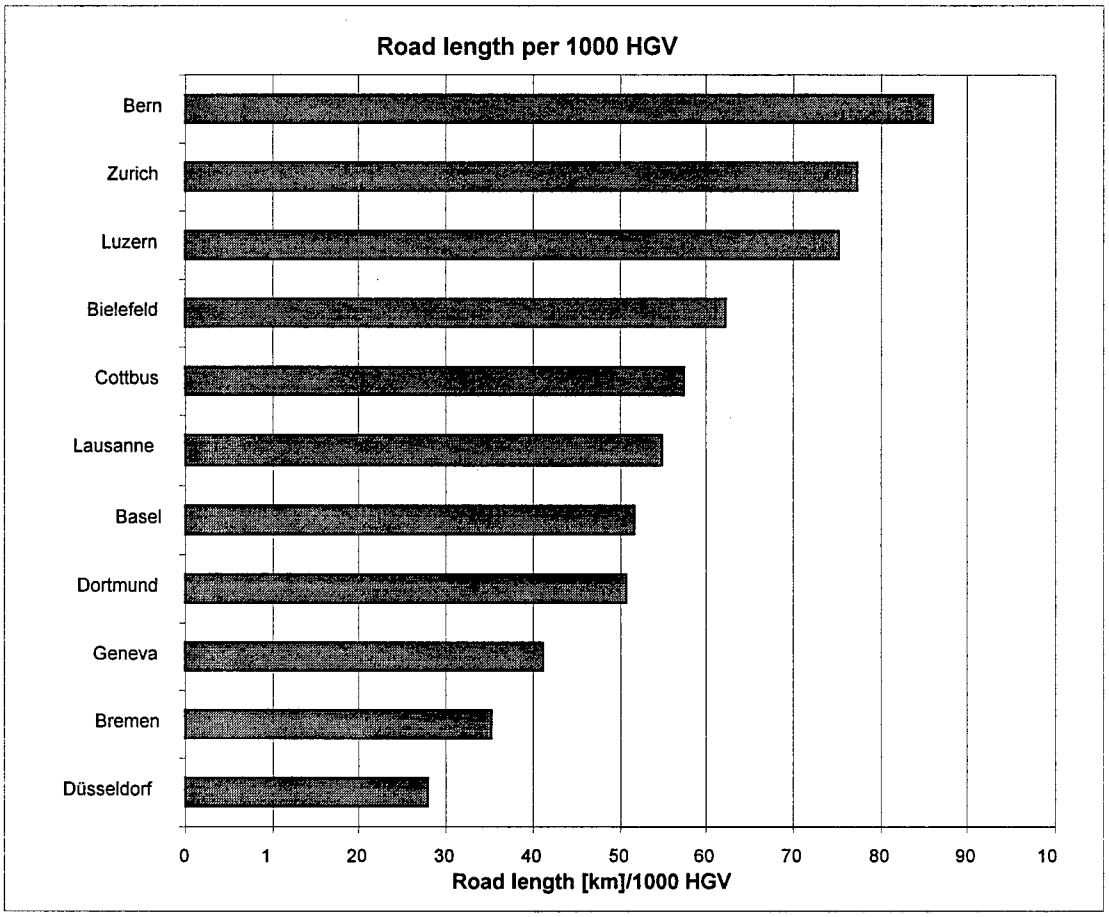




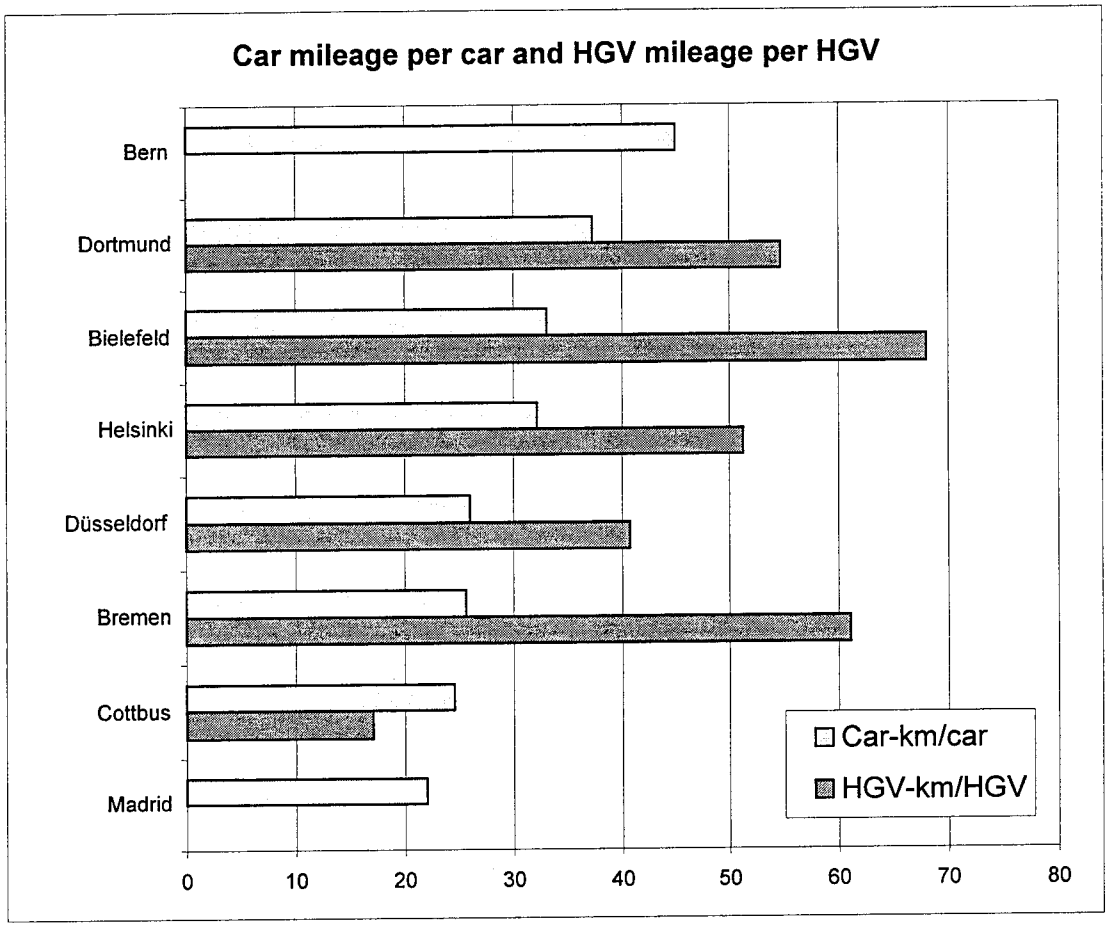
The number of HGVs and the HGV density (HGVs/1,000 employed persons) are of special significance for the handling of urban goods transport. The analysis of the model city data obtained through the checklists indicates that some 35 to 60 HGVs (with a total weight of more than 2.8 or 3.5 tons) are registered per 1,000 employed persons. The differences observed here are also largely attributable to the local structure. More HGVs are registered in cities with a large proportion of industrial workers than in cities with a high proportion of service sector workers. This conclusion is clearly confirmed by a comparison between the Swiss and German cities. The HGV rates (HGVs/1,000 employed persons) of the German cities are appreciably higher than those of the Swiss cities, only one of which - Basle - has an unusually high value in relation to the others. Basle has a high concentration of industry, and this is why its HGV rate is higher than those of the other Swiss cities and is closer to the values obtained for the German cities.

The quality of the existing road network is a major factor in respect of the management of HGV traffic. Depending on the nature of this network, there are more or less favourable conditions for carrying out the number of trips that fall due. The network density available to HGVs - quantified as the road kilometres/1,000 HGVs - is used as an influencing variable.

Analysis of the collected information shows that the number of available road kilometres in the various cities ranges from 40 to 80 km/1,000 HGVs.



The traffic situation resulting from the settlement structure, the economic structure and the traffic structure has an impact on the road network in the form of car and HGV flows. The miles travelled by cars and HGVs can serve as a meaningful measure of these flows. Analysis of the information collected about the model cities indicates that each car is driven from about 25 to 35 – in exceptional cases 45 – kilometres each day.



This value is much higher for HGVs. The number of kilometres travelled by a HGV is 20 to 70 km/day. This means that the daily mileage per HGV sometimes is double the mileage per car.

The information collected about the model cities, and the relationships identified on the basis of the analysis of this information, formed the basis for the mathematical simulation of the HGV traffic situation and for determining the effects of measures aimed at bringing about a sustainable city.

The relationships described here make up only a small part of the whole spectrum of multifarious relationships. Depending on the model approach used, it was possible to derive more or less comprehensive information for the individual cities.

The figures shown here and the ranges of fluctuation associated with various relationships clearly indicate that the values obtained from simulations must always be viewed in relation to the existing settlement structures, economic structures and traffic structures, and moreover that national and possibly local rules and regulations must to be taken into account. Despite the resulting inevitable differences in the

premises, the available results nevertheless demonstrate that the traffic situation in the different cities and countries is subject to similar laws and that certain general conclusions can therefore be drawn.

4.5.4 Simulating the impacts of measures

4.5.4.1 Qualitative overview of the results

As is clear from the above and from the national reports included in the Annex, the countries participating in the COST 321 Action chose different methods of studying HGV traffic. This applies equally to the choice of different measures to influence urban goods transport and to the determination of the effects of the chosen measures. The spectrum of methods used to assess the individual measures ranged from practical experience (from model experiments) through qualitative estimates to quantitative effect analyses using complex calculation procedures. The study methods/simulation models developed in the individual countries are outlined in section 4.5.2 and are described in more detail in the national reports included in Annex 2.

The countries participating in the COST 321 Action studied the effects of different measures. The measures studied depended on the significance attached to the individual measures in the various countries and the range of tools for quantifying their impacts. It proved possible to derive results for a total of 27 measures, although the quality of the results as a basis for drawing further conclusions about the studied cities and the studied measures sometimes varied widely. Despite the inevitable gaps in the information, it proved possible to derive a series of results for the European cities concerning the effects of measures aimed at influencing HGV traffic in terms of its environmentally compatible and economic management. The analysis of the studied measures and their effects yielded the following general results:

- The effects of the individual measures in the different countries and cities tend to be along the same lines.
- The effects of the individual measures depend considerably on the structure of the city and region and, on the traffic structure. For example, it makes a difference whether a measure is introduced in a large or a small city. The nature of the transport system (road, rail, water) in the area studied also plays a role.
- The effects of the individual measures depend on the organisational structure of the enterprises participating in the transport sector. For example, there are consequences associated with the extent to which public sector companies, large companies (works traffic) or small transport companies are involved in the management of goods transport by road.

The effects of the individually studied measures are not intrinsically positive, negative or neutral. The study results indicate that the individual measures have different effects on the

- traffic/economic/operational criteria (traffic flows, vehicle mileage in the road network, dwell time in the road network)

or the

- environmental/ecological criteria (air pollution/noise emissions).

The effects may be aligned in parallel with regard to all of the criteria, but they may sometimes be aligned in opposing directions. In these latter cases, problems will undoubtedly arise in connection with the evaluation of the measures, and as a consequence it will only be possible to make decisions on the introduction of a measure after going through intensive evaluation procedures.

In order to be able to draw initial, general conclusions about the anticipated effects of individual measures, the results obtained in the individual countries were analysed in qualitative form and collected in a table. As far as possible, the analyses were undertaken is such a way as to yield differentiated evaluations in terms of ecological effects and economic/operational effects.
Effects on pollutant emissions and noise nuisance were included under the ecological effects. Effects on journey times and distances (vehicle hours, vehicle kilometres) were included under the economic/operational effects.

The evaluations were made in terms of a 5-level scale and indicate whether the effects of a measure are :

- very favourable (++)
- favourable (+)
- neutral (0)
- unfavourable (-)
- very unfavourable (--).

Measure		Effects				
		ecology		traffic	economy	Safety
		air pollution	noise	HGV mileage in road network	HGV dwell-time in road network	
1.5	Transport co-ordination and co-operation of retailers	0	0	0	0	0
1.6	Reduction of package volume	+	+	++	++	0
1.9	Goods distribution centre	0	0	--	0	0
1.10	Consolidation by means of "urban" containers	0	0	0	0	0
1.11	Replacing large trucks by smaller trucks or vans	0	0	0	+	0
1.12	Development and use of light goods handling equipment	+				0
1.14	Tour planning	0	0	0	0	0
1.16	Goods distribution centres with co-operation of carriers	0	0	0	0	0
1.17	Packing and Stuffing	+		+		0
1.18	City logistic	++	0	++		0
2.1 + 2.2 combined	2.1: Use of bicycle transport & 2.2: Use of pipelines for transport	0				0
2.5	Co-ordination of intermodal transport	0	0	0	0	0
3.2	Road pricing in cities	+	0			0
4.1	Optimisation of distribution systems	+	0			0
4.8	Removal of freight transport depots from residential areas	0	0	0	0	0
4.11	Strong expansion of rail network	+	+	0	+	+
5.1	Regulation of freight traffic	0	0	0	+	+
5.2	Guidance and information systems for goods transport	+	0	0	0	-
5.4	Truck routes / truck network in cities	-	++	-	-	0
5.5	Reservation on streets of special sites for truck delivery stops	0	0	0	0	0
5.6	Speed limits and external speed control	-	++	0	--	+
5.7	Hierarchy in infrastructure for freight transport	0	0			
5.8	Banning HGV through-traffic from city centres	0	0	0	0	0
6.1	Stopping of engine during goods handling / start/stop system	+				
6.8	Development of silent vehicles and handling equipment allowing delivery and picking during the night	0	+	0	0	0
6.9	Exploitation of alternative drive concepts for trucks (electrically powered vehicles)	++	++	0	0	0
7.1	Influence driving behaviour	++				
Legend	-- ⇒ < -5 %	- ⇒ -2 % to -5 %	0 ⇒ -2 % to +2 %	+ ⇒ +2 % to +5 %	++ ⇒ > 5 %	

This simplified overview is intended to provide the first indications of how the individual measures are to be rated in terms of their significance.

4.5.4.2 Quantitative overview of the results

Although the initial general results for the studied European model cities yield useful information on the effects of measures aimed at influencing HGV traffic, they cannot be regarded as being totally satisfactory. For this reason further efforts were made to derive quantitative results from these qualitative evaluations. One considerable difficulty here was that directly analysable quantitative data on HGV traffic and the effects of measures was only available for a limited number of cities.

An aggregation of the results in quantitative form could therefore only be undertaken for a limited number of cities. These were, primarily, Bielefeld, Bremen, Cottbus, Dortmund, Düsseldorf and Vejle. In some isolated cases it was also possible to derive information from the other European model cities.

The magnitude of the expected effects can vary significantly from one measure tothe other. The magnitude of the changes in terms of e.g. ecological and environmental criteria for HGV traffic can be as low as 1 to 2%, with a possible increase of these values only attainable in combination with other individual measures. But more effective measures have also bee found, which appear to yield higher potential effects on the HGV traffic situation. However, the effects of these measuresin the various relevant areas are not always consistent: while some measures, for example, have both ecological and economic favourable effects, others proved to havepositive impacts in one sector and negative in the other (ambivalent measures).

As a result, the 27 studied measures can be subdivided into 3 main groups, corresponding respectively to:

- the measures from which only moderate effects are expected;
- the measures whose implementation is deemed to provide a substantial, unambiguous contribution to the improvement of the urban goods transport picture;
- intermediate (or ambivalent) measures, whose effects are somewhat contrasting, in that both positive and negative impacts are expected.

In order to make the results obtained from these quantitative analyses as transparent as possible, they were categorised in terms of the above mentioned three groups. The derived results are described below.

4.5.4.3 First group: Measures with a moderate effect

The measures with only a weak effect on goods transport by road include the following :

- 1.5 Transport co-ordination and co-operation of retailers
- 1.9 Goods distribution centre
- 1.10 Consolidation by means of urban containers
- 1.14 Tour planning
- 1.16 Goods distribution centres with co-operation of carriers
- 1.17 Packing and stuffing
- 2.1 Use of bicycle transport + 2.2 Use of pipelines for transport
- 2.5 Co-ordination of intermodal transport
- 3.2 Road pricing in cities
- 4.1 Optimisation of distribution systems

- 4.8 Removal of freight transport depots from residential areas
- 4.11 Strong expansion of rail network
- 5.5 Reservation on streets or special sites for truck stops
- 5.7 Hierarchy in infrastructure for freight transport
- 5.8 Banning HGV through-traffic from city centres
- 6.1 Switching off the engine during goods handling

The identified effects of these measures have only a very slight influence on the traffic situation in respect of HGV traffic. They result in change rates of no more than 1 or 2% in terms of their ecological and economic effects, and in some cases these effects are unfavourable rather than favourable.

The causes of these limited effects vary from measure to measure. One of the main causes is frequently the fact that the measures only cover parts of the entire traffic situation. For example, the effects may be

- local (e.g. restricted to a city centre)
- limited to a certain time (e.g. the night)
- limited to certain forms of transport (e.g. streetcars)

Inevitably only a very small field is affected in relation to the total urban area. However, the situation looks different if the effects are considered only in relation to their restricted part of the total situation. The effects can then seem to be a lot more significant. These measures should not therefore be categorised as generally unworthy of implementation. Their classification as slightly effective simply indicates that they are of subordinate importance in relation to the city as a whole.

4.5.4.4 Second group: measures with consistently favourable effects.

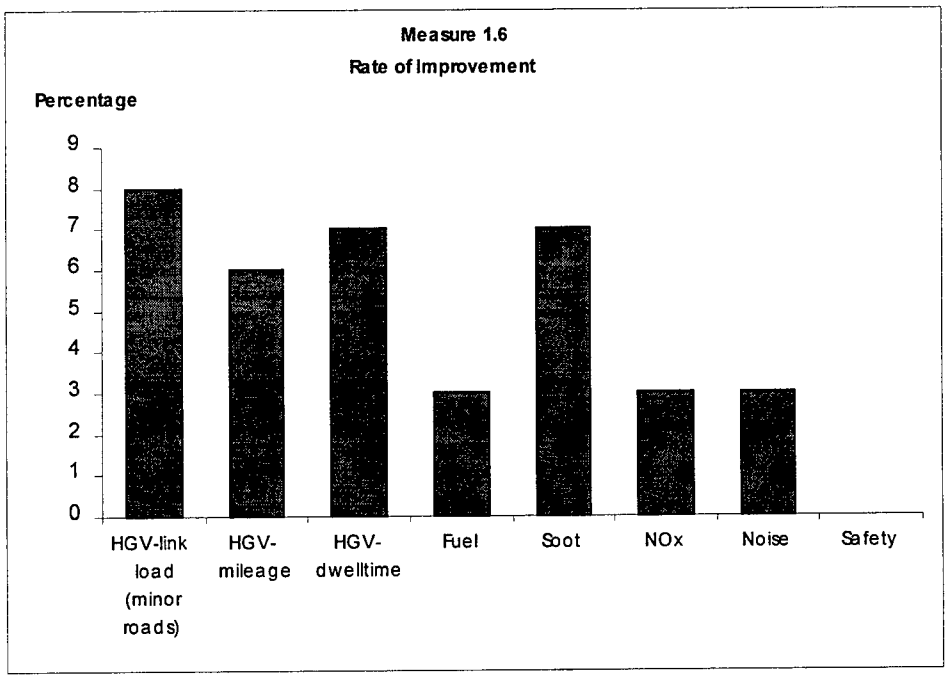
The more strongly effective measures with uniformly favourable consequences include:

- 1.6 Reduction of package volume
- 1.12 Development and use of light goods handling equipment
- 1.18 City logistics
- 6.8 Development of silent vehicles and handling equipment: delivery and pick-up during the night
- 6.9 Exploitation of alternative drive concepts for trucks (electrically powered vehicles)
- 7.1 Influence driving behaviour

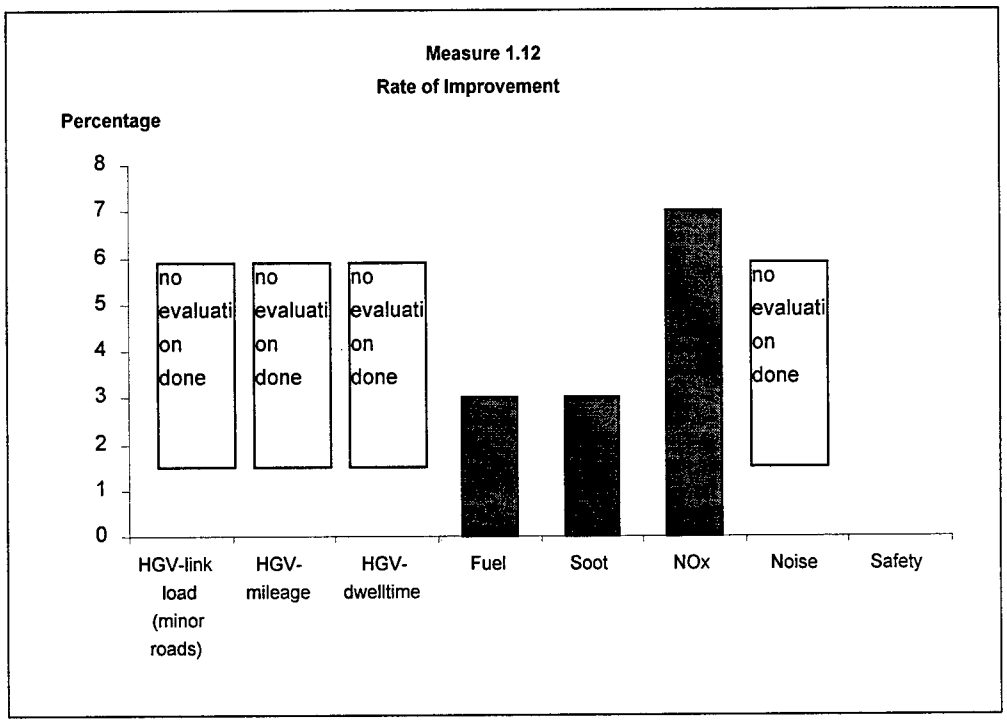
The identified effects of these measures are represented in special diagrams. Again a distinction is made between ecological and economic criteria. Information is provided about the effects on:

- HGV-link-load on minor roads
- HGV mileage
- HGV dwell time
- Fuel consumption
- Nitrogen oxides (NOx)
- Soot
- Noise

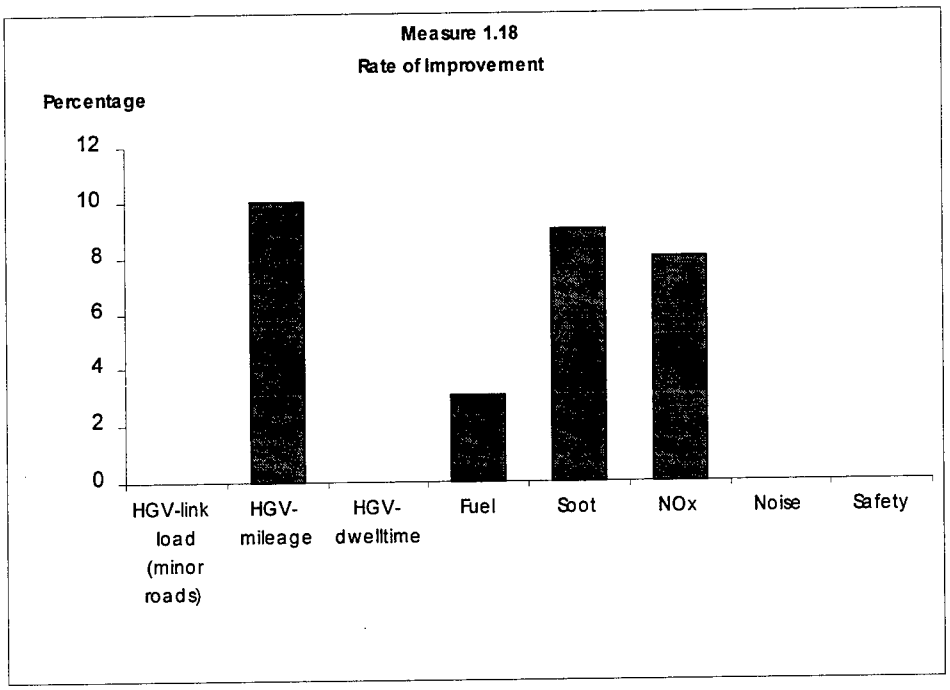
The values shown represent the average effects that could be derived from the values obtained for the individual cities. It was decided to dispense with a strict derivation of the average value such as, for example, the algebraic mean. The reliability of the assessment from an engineering point of view was increased by taking no account of extreme outliers when it was clear that they were attributable to specific, exceptional circumstances. In this context it should be mentioned that the average values given here should only be viewed as general classifications. Analysis of the values obtained from the individual model cities clearly indicates that there are considerable differences between some of the individual cities, which are mainly attributable to the special urban structure and the intensity of application of the individual measures. In isolated instances there were differences of 50 or even 100% between the specified average values and the extreme values.



Implementation of measure **1.6 Reduction of package volume** enables favourable effects to be achieved in respect of almost all criteria. A significant reduction is therefore to be expected in air pollutants (by about 3%) and particulate emissions (by about 7%), and the number of residents in roads with a noise emission level of 64 dB(A) and more would decrease (by about 3%). The average effects on HGV mileage and the flow of HGVs in the secondary road network are even more favourable, with decreases of 6 to 8%.

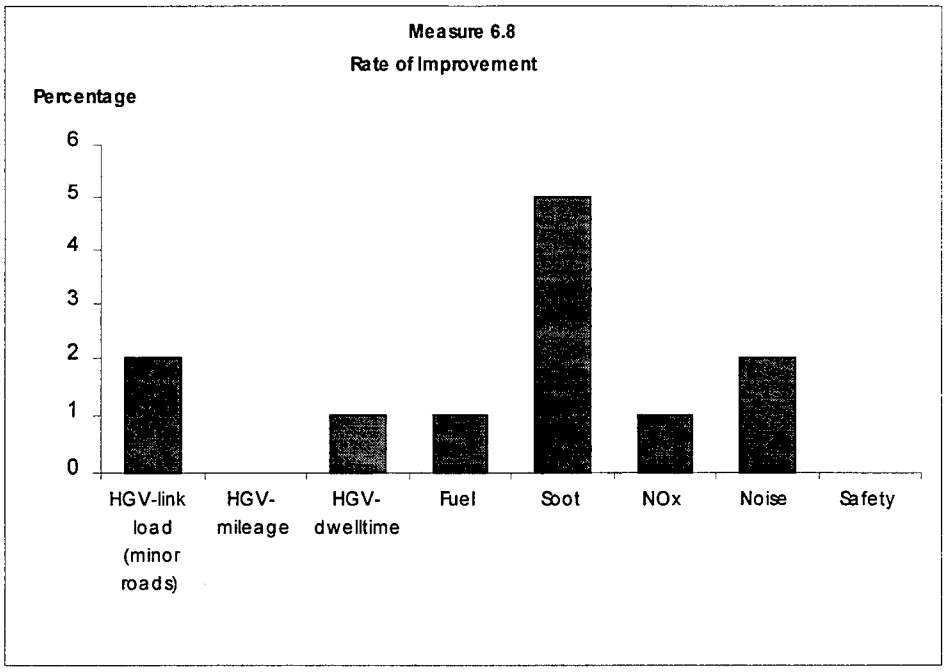


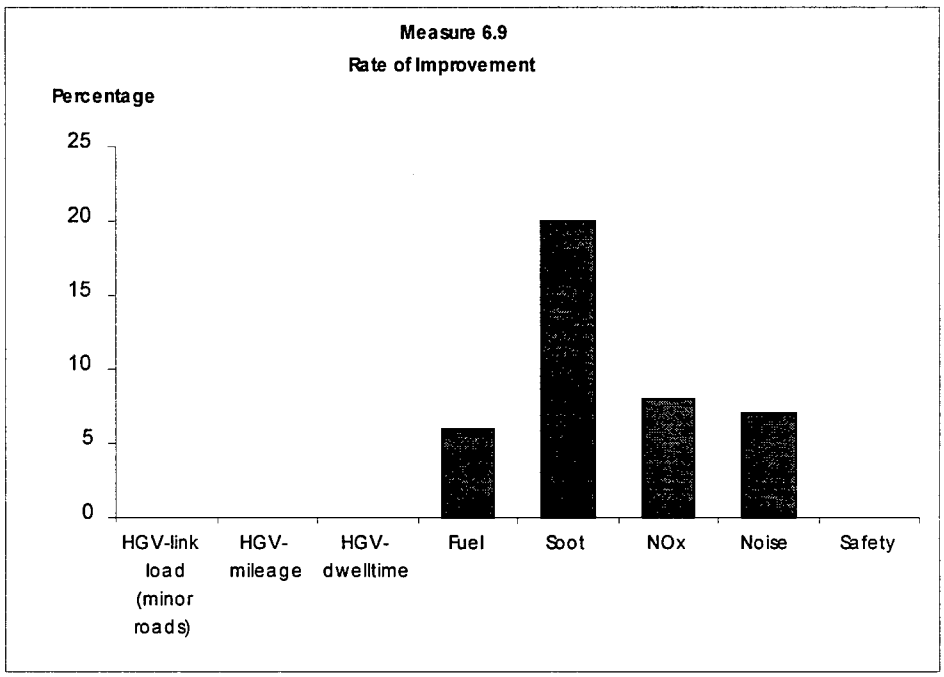
Measure **1.12 Development and use of light and flexible goods handling equipment** shows similar effects to the above measure in respect of fuel consumption and pollutant emissions. Unfortunately no suitable results are available for the other criteria, so no quantitative conclusions can be drawn about them.



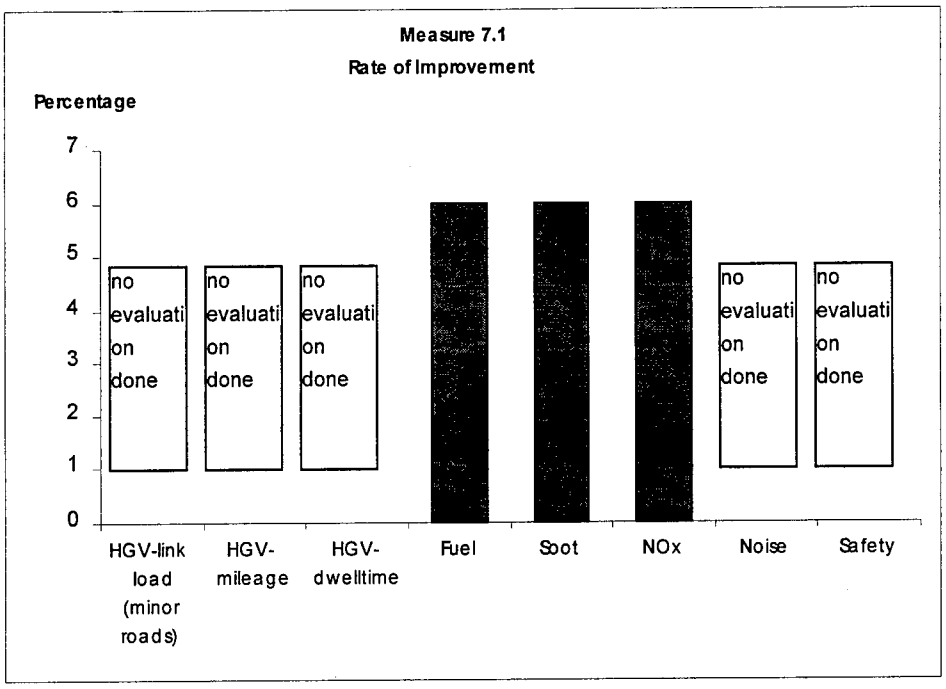
Measure **1.18 City logistics** can be expected to bring about considerable improvements in city-compatible HGV traffic management. The results indicate that cuts of about 10% could be achieved in vehicle mileage, leading to similar cuts in fuel consumption and reductions in pollutant emissions (Soot, NOX).

Measure **6.8 Development of silent vehicles and handling equipment: delivery and pick-up during the night** can be expected to bring about only moderate improvements in city-compatible HGV traffic management. The associated extension of delivery opportunities into the less traffic-intensive hours of night would result in certain shifts in the traffic flow situation and in the necessary HGV journey time. Spreading transports over a longer period of time would reduce peak traffic loads, which would bring about a decrease in noise nuisance and pollutant emissions, especially Soot.





Measure **6.9 Exploitation of alternative drive concepts for trucks (electrically powered vehicles)**, if consistently implemented, leads to significant effects in respect of pollutant emissions and the noise situation. If most HGVs with a permissible total weight of up to 7.5 tons were fitted with an electro-motor, there would be a reduction of some 6 to 8% in pollutant emissions (fuel consumption, NOx). A decrease in particulate emissions of as much as 20% could even be expected. Noise nuisance (i.e. the number of residents in roads where noise levels are 64 dB(A) and more) would decrease by about 7%.



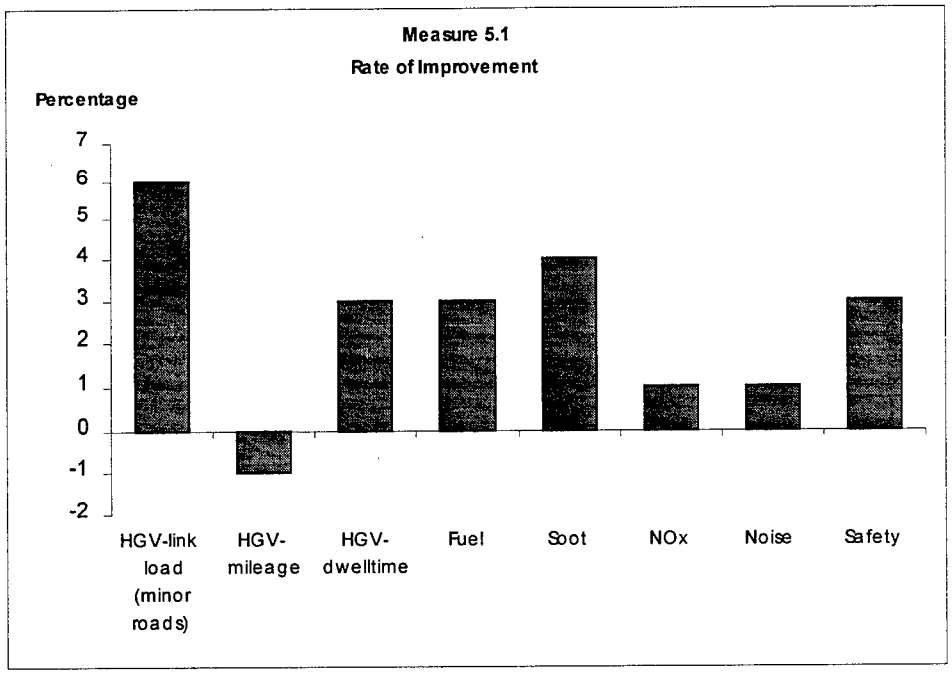
Measure **7.1 Influence driving behaviour** would have an impact on fuel consumption and pollutant emissions. Analysis of the available data indicates that decreases of about 6% could be expected in these two parameters. No suitable results on other effects are available. However, it is probable that a change in driving behaviour would also at least lead to a decrease in noise nuisance.

It should be pointed out that the effects of measure 7.1 will only be felt for a limited period of time. Experience indicates that the effects of this measure gradually disappear and drivers' behaviour, and therefore the traffic situation, revert to their original state. This means that a permanent effect could only be achieved if HGV drivers took regular refresher courses on driving behaviour.

4.5.4.5 Third group: measures with contrasted effects.

The following measures belong to this group

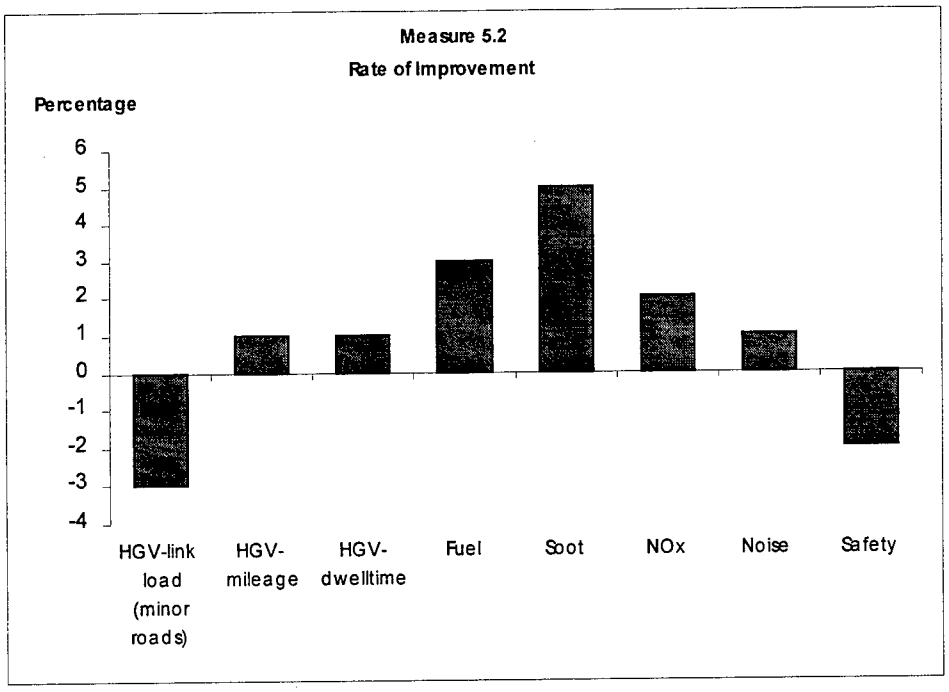
- 5.1 Regulation of freight traffic
- 5.2 Guidance and information systems for goods transport
- 5.4 Truck routes in cities / Lorry traffic network
- 5.6 Speed limits and external speed control
- 1.11 Replacing large trucks with smaller trucks.



Measure **5.1 Regulation of freight traffic** would speed up the flow of traffic on the main roads. This would lead to decreases of about 3% in journey times (HGV hours) and fuel consumption. In addition there would be a decrease in the traffic flow in the secondary road network (approx. 6 %) and in the number of residents in streets with a noise emission level of 64 dB(A) and more (approx. 1%).

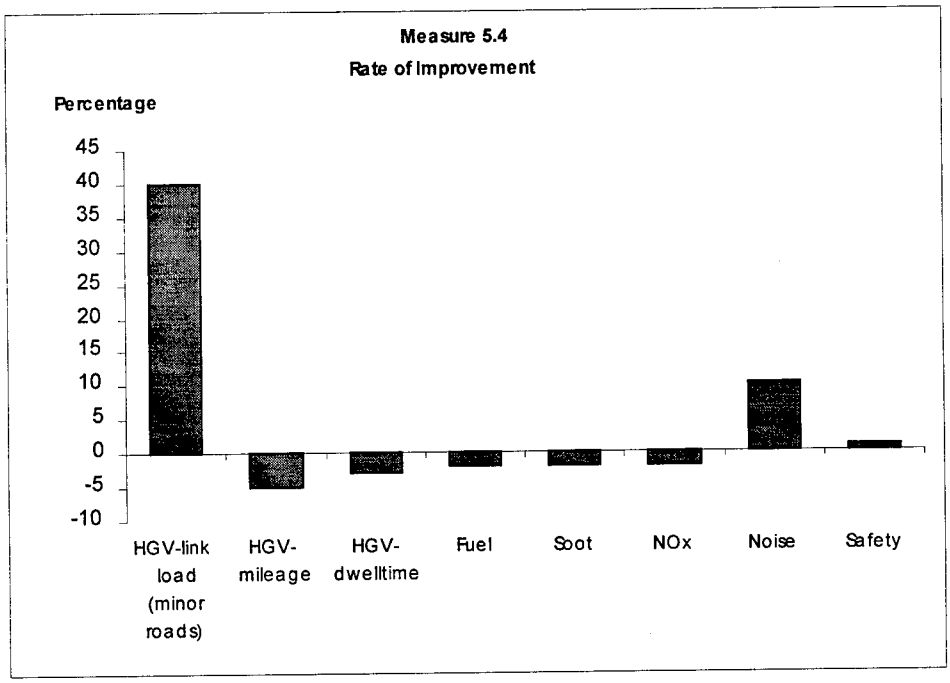
Speeding up the flow of traffic on the main road network would encourage many HGV drivers to stop using the secondary road network, where routes are usually shorter but journey times are longer. This shift from secondary to main roads results in a slight increase in journey distances. However, these are (at about 1%) of subordinate importance, so that the favourable consequences of this measure outweigh the unfavourable aspects.

Measure **5.2 Guidance and information systems for goods transport** has exactly the opposite effect to measure 5.1 in some respects. The provision of more information causes HGVs to take other routes to avoid critical incidents and sites (accidents, roadwork), i.e. to leave the main road network and take to the secondary road network, where the traffic flow therefore increases (by about 3%). Avoiding possible bottlenecks reduces traffic jams on the main road network, resulting in reduced fuel consumption (approx. 3%) and fewer pollutant emissions (Soot 5%, NOx 2%).



The displacement of some HGV traffic to the secondary road network also results in slight improvements (relative to the critical incident) in HGV mileage (HGV km) and HGV journey times (HGV hours).

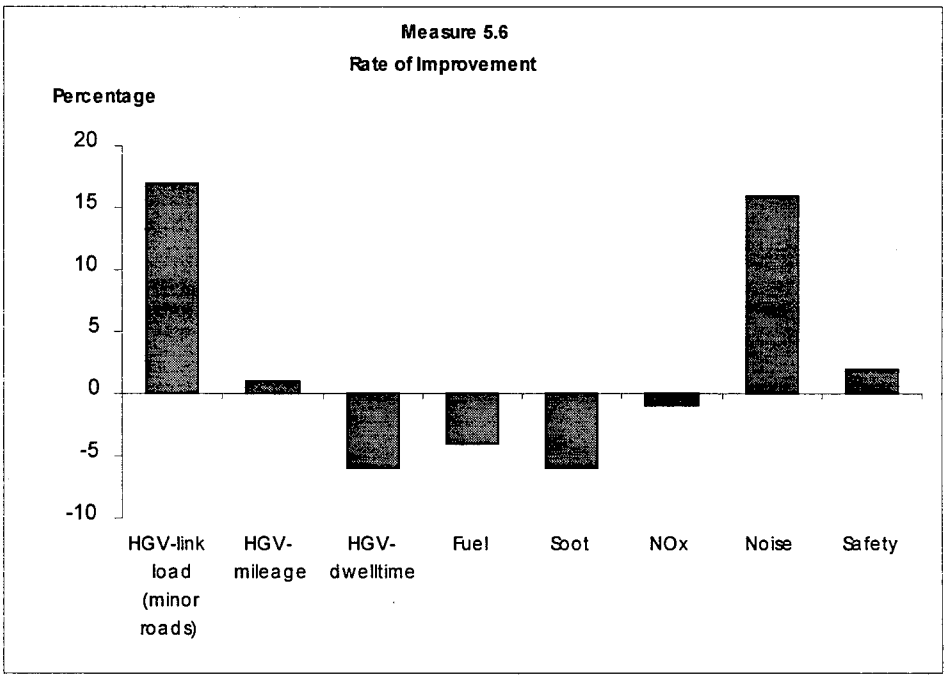
Although the use of guidance and information systems can result in the displacement of some traffic from the main to the secondary road network, the positive effects of this measure must be rated as outweighing the negative ones.



Measure 5.4 **Truck routes in cities / Lorry traffic network** results in HGV traffic being channelled onto a series of main roads that have been specially designated for this purpose. This results in a very effective reduction of the HGV traffic flow in the secondary road network (40%), and in parallel to this a significant reduction in the number of residents in roads with a noise emission level of 64 dB(A) and more (10%).

In most cases the displacement of HGV traffic to selected HGV routes results in increases in HGV mileage (HGV km, approx. 5%) and HGV dwell time (3%). At the same time there is a slight increase in fuel consumption and pollutant emissions (2%).

As the described results indicate, the advantages of the measure "Truck routes in cities/Truck traffic network" are clearly on the side of ecological improvements. These are however of considerable importance, and therefore outweigh the unfavourable effects such as increased journey times, increased dwell times in the road network and increased pollutant emissions (due to the longer dwell time and journey distances). It follows that the introduction of truck routes or a lorry traffic network must be categorised as favourable in respect to city-compatible management of HGV traffic.



Measure 5.6 **Speed limits and external speed control** results in an area-wide reduction of the speed level in the road network. This in turn results in increased HGV dwell time in the road network (approx. 6%). The reduction of the speed level

causes some HGVs to look for better routes and therefore results in a decreased flow of HGVs on the secondary road network (17%). As a consequence the residential population benefits from a decrease in noise nuisance (16%). The general reduction in the speed level on the various roads necessitates new journey cycles for the HGVs and as a consequence they consume more fuel (4%) and emit more pollutants (Soot 6%, NOX 1%).

4.5.5 Final assessment

As the COST 321 Action has shown, a quantitative estimate and assessment of a range of measures aimed at influencing goods transport by road can be undertaken with the help of simulation models.

It became clear that in recent years most European countries have invested more effort into developing and using improved evaluation methods and simulation models. Different model approaches have been developed and put into practice in different countries. These approaches range from the simple to the complicated, from the macroscopic to the microscopic. Their development and use are frequently dependent on the problems that have to be solved and the databases that are available. The use of complex simulation models is inevitably dependent on the availability of detailed network and traffic demand data. Such databases cannot be set up without an exact knowledge of the local and regional settlement and economic structures (with population, job market and company data).

The studies carried out by the countries participating in the COST 321 Action showed that, with only a few exceptions, the effects of individual measures are usually only slight. To achieve appreciable improvements in respect of the environmentally friendly management of goods transport by road, it is advisable to implement combinations of measures in the individual cities. These combinations of measures would have to be developed specially for each city, depending on the local situation. Because it is not possible to determine the best combination of measures by means of field studies, the use of simulation models recommends itself. In this way any number of combinations of measures (case studies in the context of an iterative procedure) can be used to arrive at the best solution for each city. The best solution will certainly differ from city to city, because the settlement structure, economic structure and traffic structure of every city has its own special characteristics, and the people and businesses in each city also have their own special ways and methods of doing things. Although this means that the individual measures will inevitably have different consequences in each one of the studied cities, the general relationships identified during the COST 321 Action could be used as initial pointers for developing and implementing measures to influence the transport of goods by road.

5. RECOMMENDATIONS FOR A EUROPE-WIDE PERSPECTIVE

The COST 321 Action ran from 1992 to 1997 with the goal of defining a European-wide vision and framework for solving problems related to urban goods transport. During this period, numerous studies were conducted throughout the participating countries, many of which had not been completed at the time of publication of this report. The variety of issues investigated and the great number of countries involved, demonstrate the keen interest shown by European towns in achieving a sustainable future for goods transport.

5.1 An urban view of goods transport is essential

It is essential to view goods transport from an urban perspective, since goods transport places a particularly heavy, and disproportionately high, burden on urban Europe, with its large cities and many small regional centres. Urban development professionals and politicians are increasingly clamouring for corrective action to be taken and measures to be instituted. The reasons for the above mentioned situation are many and various:

Globalisation of markets with many as yet unknown factors; world-wide, product-oriented and transport-intensive business practices; changes in transport service demand from clients due to less storage space; the widely supported view that ecological (re)forms of business are necessary; management of resources as a competitive factor; increasing marketability of recycling technologies; information technology creating the potential for new transport concepts; the rising number of providers of global transport services; progress in, and resistance to, the standardisation of transport containers, and; last, but not least; tentative market launches of innovative vehicle and alternative transport concepts.

All these elements are a risk, as well as an opportunity, for goods transport optimisation. From the point of view of system optimisation, urban goods transport could become a prime factor in deciding where to locate a business.

The optimisation of goods transport, as desired by the towns is governed by a few clearly definable parameters. The main are as follows:

- transhipment technology
- land use management
- conditional access for delivery service providers
- transport fleet composition

- infrastructure capacity
- locally convened development forums and programs
- political drive and money available

These areas are subject to widely differing legislation throughout Europe, which thus sets the framework conditions for the main players. The conditions and, more generally, the wide range of predominant practices have often led to a detrimental effect on environmental costs within the public budgets. This applies especially to the urban districts with high goods transport frequencies. It is vital to recommend that highly urbanised municipalities should have a legal right to combat any foreseeable negative effects from the very start, with proven measures, or with such measures as can objectively be expected to prove effective. Any framework conditions likely to have negative effects on municipalities should in the future be identified, and a joint effort be made to improve the situation.

Government (national and local), the municipalities and the towns themselves are, however, by no means the only, nor the most influential, players in the debate on optimising the transport chain in the city. Other actors in Urban Distribution are the transhippers, wholesalers, receivers and transporters. Enforcement bodies (e.g. police), as well as other (neighbouring) cities have their specific influence too. However, the towns and cities are precisely those business communities in which targeted interventions have the most telling effect.

5.2 How to manage urban freight transport in urban development areas?

Firstly, it is necessary to be aware of some important characteristics of urban goods transport:

- a large range of vital functions in society depend on urban freight transport: goods availability determines physical survival (eating, heating, etc.) as well as essential activities related to work, leisure, etc.
- its effect results from the activities of numerous private actors who maintain, through it, complex relations.
- public actors are in a weak economic situation.

From these characteristics it is evident that no useful result can be obtained without fulfilling two conditions:

- To have a good knowledge of urban goods transport, and of the relations between it and other urban functional aspects.

- Not to make decisions before a deep concertation has taken place with the actors concerned.

In the above subject areas, COST 321 Action investigated plausible measures which had been identified by experts. The idea was to determine what effect the various measures would be able to achieve in terms of environmental pollution and energy management. These effects have been analysed in qualitative terms as recognised experts. In over twenty cases, the effects were also simulated numerically in models using actual data from selected towns. The methodology used reflects current findings.

Each particular measure can contribute to the optimisation of urban freight transport. Realistic effects are, under actual frame conditions, rather minimal. The most promising way to follow is a step by step procedure, where each step has a modest effect, but contributes to an effective improvement in the aggregated freight flows throughout the European continent.

5.3 COST 321 recommendations for European co-operation.

Recommendations can be formulated with reference to three main areas of possible action:

- transport efficiency
- infrastructure
- technology

5.3.1 General recommendations

5.3.1.1 Increased concertation.

Go-it-alone measures do not, by any means, contribute toward solving the problem. A balanced mix of different measures must be proposed from the beginning. The development task in urban goods transport must integrate various fields of technical competence. Concurrent involvement of the various political levels with their specific instruments is crucial.

5.3.1.2 Improved information and knowledge exchange

It is essential that all relevant players (with particular reference to the involved business actors) be timely and comprehensively kept informed on forthcoming laws and regulations expected to affect city distribution and urban freight handling in general. As an example, upgrading vehicle fleets as a consequence of new noise regulations requires careful technical and budgetary planning which cannot be improvised.

5.3.2 Transport efficiency.

Local action and European-wide multipliers

Locally organised forums (goods transport groups) have, in the past, proved excellent trailblazers for targeted and effective implementation of measures. The development of urban goods transport, which is desired but has only been outlined to date, also aims at effectively improving the environmental compatibility of goods transport as a whole. The local contribution made by individual towns may become significant if multiplication is launched by means of a European-wide information network.

In many countries, important studies on specifically urban effects are still in progress. National and regional authorities have called for definitive expert opinions, for example, on the effects of excessively heavy vehicles in towns, on the specific transport efficiency of professional commercial transport companies and on own account haulage. In addition, concepts have been developed and proposed for reactivating existing rail track infrastructures to provide decentralised rail transport in towns, etc. Many of these findings will shortly need to be integrated in a jointly managed information database. It has been clearly demonstrated that it is possible to learn from others, and that studies or pilot projects conducted by individual countries can provide all participating European countries with valuable assistance in planning, and in coping with, the work facing them; provided, of course, that their existence is known.

The COST 321 Action Management Committee proposes a network for exchanging data and project experience. The action should include a formulation of objectives for the exchange of information and experience through the above mentioned information platforms. City Logistics, in particular, is an area where a variety of experiments have been carried out throughout the EU, and which would largely benefit from a more organised and systematic exchange of information on both basic principles and practical experiences, with specific regard to the dissemination of information on Good and Best Practice cases. Such a network could also promote co-operation across borders using new organisational, communicational and technical innovations. The network structure should be lean and effective and should reflect similar efforts being made on other continents.

5.3.3 Infrastructure

5.3.3.1 Ongoing assessment of measures

Many cities and their surroundings are very congested in terms of traffic. Selective restrictions for heavy vehicles (HGVs) seem to be an effective short-term instrument. The criteria applied in restricting HGV traffic are varied and include effective loads,

control of exhaust and noise emissions and, especially, restricted time windows for deliveries. In spite of the wide variety of factors, isolated restrictive measures have been (partially) effective. However, not only restrictions, but also positive measures to the transport operator, such as priority or other advantages given over to the general road user, might contribute to the overall goal of reaching a sustainable town.

While it is improbable that such measures can be harmonised over large geographical areas, and to the necessary trans-national extent, the partial successes should be carefully studied and assessed. The network concept described in the following paragraph is recommended as a tool for exchanging information in this respect.

5.3.3.2 Innovation action for more efficient interfaces

One significant line of action is to link up the European urban system to high-speed transport corridors. In the future, considerably improved high-speed goods train services between conurbations, and between these and ports, could be offered. The Commission has clearly recognised the potential of such a line of action, and has therefore proposed that freight terminals be explicitly included in the scope of the TENs. Building up a powerful network of rail corridors requires long-term improvement of goods transport networks at the local level. Innovative interfaces between road, waterway and rail within conurbations have been conceptualised (e.g. underground systems), but their development is far from completion. The targets for effective investment lie, on the one hand, in economical transhipment and, on the other, in a reorientation of land management to include new functions. The technical and logistic conditions for an economical second transhipment within conurbations will have to be investigated more carefully, and in more depth than has been the case in the past. At the same time, the objectives and functions of land management in towns and cities must be formulated in a binding form (goods transport centres, logistic platforms, agreement on private and public loading and parking areas, approval restrictions for vehicle dimensions in line with town planning considerations, layout of port facilities, reactivation of the urban main railway tracks and sidings, HGV transport network concepts, new communications and information findings etc).

5.3.3.3 Internalised costs in urban areas

On urban roads, goods transport contributes to significant costs that are not covered by the generator of these costs. It remains to be seen what kind of intervention is appropriate in designing this system: imposing a road usage charge for HGVs in urban areas, regional restrictions for vehicles according to emissions and engine rating criteria, cost-reducing incentives for environmentally compatible reorganisation of transport fleets, or similar.

At the more general level of the Common Transport Policy, and in specific relation to the EU Green Paper on Fair and Efficient Pricing, the issue of internalisation of social and environmental costs is currently the subject of a variety of research and policy analyses. However, also due to the well known lack of appropriate supporting data, the role of freight transport in general, and urban freight transport in particular, is relatively minor in these analyses. This should be corrected, and external costs systematically appraised and quantified, if only to further substantiate the generally agreed belief that the potential contribution of urban freight rationalisation to the achievement of environment conservation goals is indeed significant.

5.3.4 Technology (new generation of vehicles)

The composition of the transport fleet for municipal collection and distribution services should, by no means, be left to chance. The automotive industry, transport companies and transport authorities must be urged to identify and embark on new ways and means of renewing and optimising their transport fleets. This also include new goods handling and operational solutions. Technical directives agreed at the EU level for the design of European urban HGVs are to be defined with broad margins. Above all, special care must be taken to effectively employ vehicles that have been developed specifically for this purpose by automotive manufacturers. The top priority is therefore to determine the optimum areas of application, from an economic and urban ecology point of view, for different vehicle weight classes.

ANNEXES

ANNEX A – COST 321 DOCUMENTS

List of all the COST 321 documents.

Reference	Title	EN	FR	DE
COST/221/94	Memorandum of Understanding	x	x	x
PREP-COST/321/1/93	Transport de Marchandises en ville - Programme français		x	
PREP-COST/321/2/93	Urban goods transport planning - Zürich city planning office	x		x
PREP-COST/321/1/94	National Contribution and Progress Charts	x		
PREP-COST/321/2/94	Working paper n°1 from Slovenia	x		
PREP-COST/321/4/94	"Improving freight transport in cities" OCDE survey	x		
PREP-COST/321/5/94	"Good Transport in Danish town" study on Vejle	x		
PREP-COST/321/6/94	Analysis of the effects of planning and regulatory measures on freight transport in towns and municipalities. Workshop Bonn-Bad Goderberg. October 1993	x		x
PREP-COST/321/7/94	COST 321 progress report	x		x
PREP-COST/321/8/94	Mesures envisagées par la France		x	
COST/224/94	Minutes of 8th meeting of the COST 321 Subtechnical Committee	x	x	x
EUCO-COST/321/1/94	Draft rules of procedure of the Management Committee	x	x	x
EUCO-COST/321/2/94	Short term scientific mission in the COST framework	x		
EUCO-COST/321/3/94	Proposal for projects linked to COST 321 to be included in the 4FP	x	x	x
EUCO-COST/321/4/94	Minutes of the 1rst meeting of the Management Committee held in Brussels	x	x	
EUCO-COST/321/5/94	Rules of procedure of the Management Committee	x	x	
EUCO-COST/321/6b/94	Dutch study on a distribution centre in Maastricht	x		
EUCO-COST/321/7/94	Guideline to the questionnaire submitted by WGA. Annexe: Questionnaire	X		
EUCO-COST/321/8/94	Overview of measures out of COST-documents	X		
EUCO-COST/321/8/94.Add1	Overview of measures out of COST-documents Addendum - December 1994	X		
EUCO-COST/321/9/94	Extended information on the implementation of the scheme for Short-Term Scientific Missions.	X		
EUCO-COST/321/10/94	Information related to the COST interaction Conference in Basel 9-11 October 1995	X		
EUCO-COST/321/1/95	Minutes of the Management Committee held in Brussels on 24/11/94.	X		

Reference	Title	EN	FR	DE
EUCO- COST/321/2/95	Summary records of the 2nd meeting of the WGA held on 13th December 1994.	X		
EUCO-COST/321/3/95	Draft report of the WGA "State of the art" - description of selected measures (revision of EUCO-COST/321/8/94)	X		
EUCO-COST/321/4/95	Draft minutes of the 3rd meeting of the Management Committee held in Brussels on 24th February 1995.	X		
EUCO-COST/321/5/95	Minutes of the fourth meeting of the Management Committee held in Vitoria (Spain) on 7th April 1995.	X		
EUCO-COST/321/6/95	Dutch brochure on overview of the experience with Urban Distribution Centre - transmitted by Mrs de Gooijer.	X		
EUCO-COST/321/7/95	Report of the meeting of Working Group B on 19 July 1995 in Aachen.	X	X	X
EUCO-COST/321/7/95 Rev.1	Report of the meeting of Working Group B on 19th July 1995 in Aachen.	X	X	X
EUCO-COST/321/8/95	Status Report of the Working Group B - 1st Draft	X		
EUCO-COST/321/9/95	Dutch Work Programme. Urban distribution platform. (The Hague, 20th Sept. 1995). NL + EN vers.	X		
EUCO-COST/321/10/95	Minutes of the 5th meeting of the Management Committee held in Basel on 12th October 1995.	X	X	X
EUCO-COST/321/11/95	List of COST 321 Participants.	X		
EUCO-COST/321/1/96	Urban Goods Transport in Düsseldorf.			X
EUCO-COST/321/2/96	Development of a freight matrix for Düsseldorf			X
EUCO-COST/321/3/96	Minutes of the 6th meeting of the Management Committee held in Brussels on 14th March 1996.	X		
EUCO-COST/321/4/96	Status Report of the Working Group B, by W. Dietrich.	X		
EUCO-COST/321/5/96	"Survey and Modelling in Urban Freight Transport" - a French contribution to simulation tools - LET.	X		
EUCO-COST/321/6/96	Minutes of the 7th meeting of the Management Committee held in Brussels on 31st October 1996.	X		
EUCO-COST/321/7/96	An attempt at modilisation of goods transport in urban area.	X		
EUCO-COST/321/8/96	Rationalisation of Urban Goods Transport, COWI, NTU.	X		
EUCO-COST/321/9/96	The development programme of goods transport in Helsinki. 1995.	X		
EUCO-COST/321/1/97	Minutes of the 8th Management Committee held in Brussels on the 17th February 1997.	X		

Reference	Title	EN	FR	DE
EUCO-COST/321/2/97	Minutes of the 9th Management Committee held in Brussels on the 23rd May 1997.	X		
EUCO-COST/321/3/97	Structure of the national founded programme "Logistic Austria".	X		
EUCO-COST/321/4/97	National report May 1997 - The Netherlands – Ms. de Gooijer, Ministry of Transport.	X		
EUCO-COST/321/5/97	Interim report - ETSU	X		
EUCO-COST/321/6/97	Brief report of the German contribution - IVV.	X		
	Modelling freight transport in cities -J.G.S.N. Visser, Delft University of Technology	X		

Reports

- Proceedings of the Seminar organised at Vitoria, 6-7 April 1995 "Goods Transport in the Sustainable City",1996 Brussels, CEC/DG VII, 148 p.
- State of the Art, Description of Measures and First Assessment of Selected Measures, CEC/DG VII, November 1995.
- Interim Report of Working Group A: "Urban Freight Transport, State of the art COST 321 of innovative measures planned or experimented in Europe", January 1997.

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ANNEX C – GLOSSARY

Abbreviation / Technical term	Explanation
Car	(here used as passenger car) Road motor vehicle, other than a motor cycle, intended for the carriage of passengers and designed to seat no more than nine persons (including the driver). *The term "passenger car" therefore covers microcars (need no permit to be driven), taxis and hired passenger cars, provided that they have fewer than ten seats. This category may also include pick-ups.*
Carriageway	Part of the road intended for the movement of road motor vehicles; the parts of the road which form a shoulder for the lower or upper layers of the road surface are not part of the roadway, nor are those parts of the road intended for the circulation of road vehicles which are not self-propelled or for the parking of vehicles even if, in case of danger, they may occasionally be used for the passage of motor vehicles. The width of a carriageway is measured perpendicularly to the axis of the road.
Category of road	Classification of the road network according to a) administration responsible for its construction, maintenance and/or operation; b) according to design standards or, c) according to the users allowed to have access on the road.
Gross vehicle weight Legally permissible maximum weight	Total of the weight of the vehicle (or combination of vehicles) including its load when stationary and ready for the road declared permissible by the competent authority of the country of registration. *This includes the weight of the driver and of all persons carried at the same time.*
GTC Goods Traffic Centre	Industrial park where enterprises of transportation (e.g. carriers) are located with an integrated goods station for combined traffic (at least two traffic modes). For example the GVZ Bremen.
HGV Heavy goods vehicle	Road vehicle with a weight over 2,8 tonnes
Lane	One of the longitudinal strips into which a carriageway is divisible, whether or not defined by longitudinal road markings, which is wide enough for one moving line of motor vehicles other than motor cycles.
Load capacity	Maximum weight of goods declared permissible by the competent authority of the country of registration of the vehicle.

Abbreviation / Technical term	Explanation
Local traffic	Traffic witch journey begins and ends in the specific area (e.g. traffic zone)
Modal Split	Share of the traffic modes in the whole traffic
O-D Matrix Origin – Destination Matrix (Trip Matrix)	Matrix witch contains the number of trips from any traffic zone to any another.
Originating Traffic	Traffic witch begins it's journey in the specific area (traffic zone)
Road	Line of communication (travelled way) using a stabilised base other than rails or air strips open to public traffic, primarily for the use of road motor vehicles running on their own wheels. *Included are bridges, tunnels, supporting structures, junctions, crossings and interchanges. Toll roads are also included. Excluded are dedicated cycle paths.*
Road journey	A movement of a road vehicle from a specified point of origin to a specified point of destination. *A journey can be divided into a number of sections or stages.*
Road network	All roads in a given area
Road tractor	Road motor vehicle designed, exclusively or primarily, to haul other road vehicles which are not power-driven (mainly semi-trailers). *Agricultural tractors are excluded.*
Road traffic	Any movement of a road vehicle on a given network. When a road vehicle is being carried on another vehicle, only the movement of the carrying vehicle (active mode) is considered.
Semi-trailer	Goods road vehicle with no front axle designed in such way that part of the vehicle and a substantial part of its loaded weight rests on the road tractor.
Terminating Traffic	Traffic witch has it's destination in the specific area (traffic zone).
Through traffic Transit	Any loaded or empty road motor vehicle, which enters and leaves a specific area (e.g. traffic zone) at different points by whatever means of transport, provided the total journey within the area is by road and that there is no loading or unloading in the country. *Road motor vehicles loaded/unloaded at the frontier of that area onto/from another mode of transport are included.*
Traffic mode	Traffic modes are for example: Road traffic, rail traffic, air traffic, waterway traffic

Abbreviation / Technical term	Explanation
Traffic zone	Based on urban planning, economics, urban statistical areas etc. defined area with a focal point on witch all the real characteristics can be focussed.
Trailer	Goods road vehicle designed to be hauled by a road motor vehicle.
UDC Urban Distribution Centre	Place of transhipment from long distance traffic to short distance (urban) traffic. Here the consignments can be sorted and bundled.
UDP	A forum where specialists from the business world and local, provincial and national governments are represented. It wants to assist cities to solve problems in urban goods transport.
Vehicle-kilometre	Unit of measurement representing the movement of a road motor vehicle over one kilometre. *The distance to be considered is the distance actually run. It includes movements of empty road motor vehicles. Units made up of a tractor and a semi-trailer or a lorry and a trailer are counted as one vehicle.*

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