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ROUND TABLE 91

POSSIBILITIES AND LIMITATIONS OF COMBINED TRANSPORT

EUROPEAN CONFERENCE OF MINISTERS OF TRANSPORT

PARIS 1993

ECONOMIC RESEARCH CENTRE

REPORT OF THE
NINETY-FIRST ROUND TABLE
ON TRANSPORT ECONOMICS

held in Paris on 24th-25th October 1991
on the following topic:

POSSIBILITIES AND LIMITATIONS OF COMBINED TRANSPORT

EUROPEAN CONFERENCE OF MINISTERS OF TRANSPORT

THE EUROPEAN CONFERENCE OF MINISTERS OF TRANSPORT (ECMT)

The European Conference of Ministers of Transport (ECMT) is an inter-governmental organisation established by a Protocol signed in Brussels on 17th October 1953. The Council of the Conference comprises the Ministers of Transport of 30 European countries[1]. The work of the Council of Ministers is prepared by a Committee of Deputies.

The purposes of the Conference are:

a) to take whatever measures may be necessary to achieve, at general or regional level, the most efficient use and rational development of European inland transport of international importance;

b) to co-ordinate and promote the activities of international organisations concerned with European inland transport, taking into account the work of supranational authorities in this field.

The matters generally studied by ECMT - and on which the Ministers take decisions - include: the general lines of transport policy; investment in the sector; infrastructural needs; specific aspects of the development of rail, road and inland waterways transport; combined transport issues; urban travel; road safety and traffic rules, signs and signals; access to transport for people with mobility problems. Other subjects now being examined in depth are: the future applications of new technologies, protection of the environment, and the integration of the East European countries in the European transport market. Statistical analyses of trends in traffic and investment are published each year, thus throwing light on the prevailing economic situation.

The ECMT organises Round Tables and Symposia. Their conclusions are considered by the competent organs of the Conference, under the authority of the Committee of Deputies, so that the latter may formulate proposals for policy decisions to be submitted to the Ministers.

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TABLE OF CONTENTS

GERMANY

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Germany

INTERMODAL TRAFFIC WITHIN EUROPE

(Problems - Hindrances - Propsects

SUMMARY

Hamburg, May 1991

1. INTRODUCTION

This report has been written based on practical experience. For more than twenty years, the author has been entrusted with the task of realising the advantages of containers and the principal ideas behind intermodal traffic. He started his professional life as an employee of various important shipping lines, at the time when container transport companies were just being developed. He then changed to TFG, the container division of the German Railways (Deutsche Bundesbahn) which was also only just in its initial stages. Following this, as (primarily for political reasons) the shift from road to rail transport was taking place, he changed to an important transport carrier active within Europe. Over a period of approximately fifteen years, this company's transport equipment for intermodal traffic has increased from thirty units to 3 500 tank containers and swap bodies.

In many fundamental studies, the structures and strategies of the national and international railway companies have been examined. There have also been plenty of proposals and demands for a pan-European concept. The following are examples:

-- Study on the prospects of a European network of intermodal traffic, published by A.T. Kearney (September 1989);

-- "The European Railways in the Nineties", published by the Economic Commission for Europe (ECE) of the United Nations (1990);

-- Resolution of the UIRR Annual Meeting on the future of intermodal traffic (September 1989);

-- European Agreement on important international combined transport lines and related installations (AGTC), United Nations, Geneva (1991).

The question arises whether, and when, a European railway company will be founded. Only such a European railway company can be a competent partner

for a transport industry already orientated towards the Common Market. On a European level, intermodal traffic operators have already joined together to form the UIRR (*Union Internationale des sociétés de transports combinés Rail-Route*) and Intercontainer (European railways container company). First of all, political decisions need to be made and, secondly, there needs to be a general rethinking by today's companies in all fields. Quick, practical solutions for current problems are needed.

New technical concepts, such as the bimodal system on which six European railway companies are working, offer no future prospects (see study of SGKV/BIC, September 1990). Declared as a technical innovation, this is simply a manoeuvre by the railway companies to divert attention from the real problems.

In this report other aspects will be selected in order to draw the currently predominant global ideas closer to reality. By doing this, contradictions between theory and practice are inevitable. On the other hand, not all of the ideas discussed here will be absolutely new. In the long run, it is a matter of concentrating on already existent and technically advanced transport concepts and enforcing, without compromise, the particular operational and commercial strengths of intermodal traffic.

2. SPECIFICATION AND MEANING OF INTERMODAL CONCEPTS

Below, the technical criteria are briefly described. In addition it is explained how the railway companies view and promote these technical concepts.

2.1. (ISO) Transcontainers in overseas traffic

These containers are in accordance with the international standards of the ISO (International Organization for Standardization), by which only 20 ft. and 40 ft. containers are accepted. As a consequence of this unique standardization, an economically efficient infrastructure has been established in the hinterland (wagons, facilities for transshipment, storage places).

But even here things are losing momentum, despite many competent warning voices. Shipping lines were bringing containers onto the market, higher (9 1/2 ft) and longer (45 ft) than the specifications allowed. In the ISO committees, new dimensions for a second generation container are also under negotiation.

The railway companies are only one link in a long transport chain controlled by the shipping lines. The concentrated movement by rail solves a logistic problem for the shipping lines. The services offered are more important than the price as they bind the shipping companies to the railways. The logistic problem is the real challenge to the railway companies. The necessary service package with delivery/collection in the suburban areas, technical assistance and temporary storage of containers, in practice, has priority.

All services are clearly established on a typical national level, starting with special train connections from/to national ports and ending with the equalisation of transport prices from/to competing sea ports, i.e. in the Antwerp-Hamburg range.

2.2. (UIC) Large size containers for land transportation

These are containers which are defined in the UIC Codex of the European Railway Association. In many details they are in accordance with the (ISO) transcontainers, reduced by those especially required by ocean transportation. Due to their basic similarity with the (ISO) transcontainers, the whole infrastructure for overseas containers can be used without limitation.

In the railways' view, both of these container types were the only basis, first for national and later international traffic by road-rail. They transferred by contract all activities to their subsidiaries responsible for intermodal traffic on a national level, and to Intercontainer for intermodal traffic within Europe. All attempts by private forwarding agents and transport companies as customers to contribute to these container companies (e.g. advisory board, working groups) were systematically rejected.

The railway companies determined price and service and were thus able to control development over the years. The image of the intermodal traffic was in line with the image of rail traffic in general.

2.3. Trailers, modified for intermodal traffic

These are road vehicles which, according to the UIC regulations, must have special devices, by which the trailers can be positioned and fixed on special wagons with lowered platforms. Today the transfer is done exclusively by crane onto so-called "pocket wagons".

With this technical concept, the railway companies opened intermodal traffic up to the road carrier and were able to supervise these competitors' activities. These new operators founded private economy piggyback companies. Even today their aim, among others, is to improve their service standards to be comparable with road-going traffic.

Concentration on typical rail services has very quickly led to a considerable differentiation between the piggyback companies and their own container companies.

2.4. Swap bodies/tanks for road-rail transport in Europe

These meet national rules which consequently represent extremely different requirements. Ten different types of swap body are in use, including containers according to the ISO and UIC standards. Certain swap body types are typical to the individual countries, e.g. in Germany a type of 7.15 m in length, in France 13.60 m and in Scandinavia a 7.45 m length is popular.

For years, expert groups managed by the CEN (*Comité Européen de Normalisation*) in Brussels have been endeavouring to limit the number of swap body types by preparing common European specifications for design and operation. Due to the influence by strong national interests, the CEN standards, which are expected to be released in due course, will be the result of a great number of compromises.

Until today, the railways have not been happy with these developments. In view of their contractual obligations to their own companies, they strictly divide the individual transport methods into either container or piggyback traffic. By definition of piggyback traffic, containers as such are excluded, based on non-provable technical features. In the "Montbazon Cooperation Contract" of 1983, the railway companies were able to stipulate this aspect in writing. The results of this are considerable restrictions and difficulties for the operator. The use of containers instead of swap bodies is very often commercially necessary and, in the sense of intermodal traffic in general and based on the existing infrastructure, highly efficient.

This approach, which has existed for many years, is absurd bearing in mind that the container companies are free to employ any transport technique they wish without restriction.

The relationship between the railways and piggyback companies is put under additional strain as the railway companies are also endeavouring to enter certain market segments directly. For example, the logistic trains for important customers are given the highest priority on all levels, i.e. being handled at crowded terminals and in conflict with all other activities on rails. Additional activities regarding solid and liquid bulk goods have been noticed.

In February 1990 a "Declaration of Brussels" was published defining the relationship between European railway companies on the one hand and Intercontainer and the piggyback companies' joint venture (UIRR) on the other. At first sight it appeared that this also clearly limited the railways' individual activities in the interests of Intercontainer and UIRR members.

Within piggyback traffic as defined above, the proportion of swap bodies has increased incredibly since 1989.

In comparison, the semi-trailer has become relatively insignificant. Consequently, the arbitrary hindrance of the railway companies, stating that the transport concept, "container", cannot be used under piggyback conditions, must be abolished.

2.5. Complete road-going units (rolling road)

These vehicles are transported on special wagons (low-platform wagons) and accompanied by the driver. Technical alterations, however, are not necessary although there is a restriction regarding the overall height and maximum gross weight. No terminal service is required, but the technical conditions required for the transport by rail (wagon) are extremely high.

This technical concept is considerably promoted by political circles (e.g. transit via the Alps). Nevertheless, the operation is restricted to a regionally limited area. The commercial value, especially, compared with other techniques of intermodal traffic, is largely doubted.

2.6. Semi-trailers plus rail bogie as a bimodal concept

The bimodal units consist of:

-- a reinforced semi-trailer (to carry high tractive forces);
-- a rail bogie.

The critical point is the element for being designed to connect the two units. In practice they have to be operated as block trains. The principles, which have been developed in the United States, are presently being developed in Europe by six separate railway companies.

The railway companies concerned are particularly committed to promoting this technical concept as their contribution to intermodal traffic. Indeed, this concept has advantages regarding rail transportation (higher payload, limited infrastructure). Once again, it is a classic example of railways' solo attempt in their national field, since the corresponding systems are not interchangeable without substantial technical alterations. Moreover, the compatibility with the existing technical concepts of intermodal traffic is missing.

The commercial value for the operator has not as yet been proved conclusively.

There is already much criticism from, for example, analysis and papers such as:

-- Study of *Studiengesellschaft für den kombinierten Verkehr*, Frankfurt, in co-operation with BIC, Paris (September 1990);

-- A consideration of the logistical aspects by Mr. Bernd Kortschak, published in *Österreichischen Zeitschrift für Verkehrswissenschaft*, Brochure 1/90.

3. THE POLICY OF THE RAILWAYS

Without doubt, none of the railway companies has revealed that they think and plan in a pan-European way. It has to be admitted, however, that every company still plays an important role in national transport policy, e.g. protection of national port interests or hazardous national regulations (in Germany: rail siding policy, etc).

The state of affairs has been analysed regularly and thoroughly enough. Even if the requested measures were introduced quickly -- so far there are no signs of this being the case -- they would only become noticeable in practice after several years. Besides, where will the people come from who are able to take the initiatives and have the willingness to realise "revolutionary ideas"? These ideas

can be born only through fundamental reforms, such as the container, initiated in the shipping industry.

Daily business proves that the railway companies have still not emotionally overcome the end of the steam-engine epoch.

It is generally accepted that in intermodal traffic many partners have to co-operate as links in a transport chain. Railway management recognises this, too. The role of the road transport companies as a partner is always pointed out by the railway companies when they are looking for new business.

In spite of the Declaration from Brussels and their statements regarding establishment of partnerships, the railway companies are continually working on new ideas to establish their own presence in the market. The latest argument is to participate more strongly in the value added, also when this is produced beyond rail transport. By following this idea, they disregard even their own affiliated companies and Intercontainer.

It is yet another example of power play with the piggyback companies, to determine their own role and position within the transport chain. Obviously they seek the conflict of a partnership. For a short time, the railway companies may succeed in using this to avert the real difficulties.

They are incriminating piggyback and container traffic so much that these companies -- in rare harmony -- are mutually demanding that the railway companies should concentrate on their own field of performance.

The present tariff policy is another critical factor in a co-operation which is already constantly under stress. With differentiated prices for services which are basically identical, some railway companies are even competing against each other (preference for national routes affecting transit routes). Additionally, they distinguish between prices for containers employed in the continental traffic and overseas containers on the one hand, and piggyback units on the other. Moreover, tariff increases are brought in at regular intervals and motivated by a, so far, unknown internal costing.

From case to case the whole tariff structure has been changed. Formerly, rates were quoted for a couple of transport units (drawn from road transport), whilst current rates are quoted for the whole wagon. For the near future another alternative is being discussed.

The idea of offering prices per transport unit only (UTI), divided by length and weight, is being closely followed up.

Whilst such alternatives are being dictated to their own affiliated companies and Intercontainer, the piggyback companies are proving difficult negotiating parties. Consequently, the purchasing terms of the individual companies have developed in totally different directions. As a result, the railway-owned companies are demanding harmonization, which finally is to the piggyback companies' advantage.

An immense number of hindrances and problems are created simply by the policy of the nationally orientated companies. They are hindrances for the intermodal traffic on its way to a Common European Market. In other words, intermodal traffic today is a modern traffic mode with obsolete means and strategies.

4. TRANSFER POINT OR TERMINALS

Many transfer points in the middle of Europe, particularly within FRG, are already nearly working at full capacity. In Germany it has been calculated that investments of DM 1.1 billion are necessary in order to achieve a market potential of approximately 40 million tons per year (1990 = 25.4 million tons). On the other hand, experts claim that only 25 per cent of the potential technical capacity is being utilised. This low productivity also has a negative effect on rolling material and delivery/collection by road vehicle. This means:

-- The profitability of the whole transport system is strained;

-- A terminal must be in the centre within the network of different services.

In railway language, it is a transfer point for containers, i.e. the intersection between both carriers, rail and road. This is also documented in studies of past years, such as:

-- Concept for intermodal traffic's transfer locations of the nineties, issued by the DB/TFG/Kombiverkehr (July 1989);

-- Strategy concept for intermodal traffic, issued by the Research Consortium on Intermodal Traffic (Volume 7, February 1990).

Below are some critical notes.

4.1. Terminals as multifunctional centres

In many countries, the railway companies have reserved themselves the right to construct and operate the transfer locations, thus representing railway interests. The real user is anonymous, because his interests are represented by either the railway-owned subsidiaries or by the piggyback companies as the actual partners. Thus the question arises whether these are suitable conditions for changing the transfer locations into real terminals with a wide-spread infrastructure, as is standard already in sea ports. Some examples based on practical experience may help to analyse this question.

First of all, the working hours must be mentioned. Although many night trains arrive between 2.00 and 4.00 a.m., cranage does not usually begin before 6.00 a.m. and in many cases ends in the early evening. This restriction is particularly noticeable in Scandinavia, where the terminals close as early as 3.00-4.00 p.m. In contrast to this are the piggyback companies when operating terminals on their own locations, e.g. in Antwerp/B (TRW) and Busto-Arsizio/I (HUPAC).

The same applies for terminals in France where piggyback and container companies, although on different sites, are working within the same terminal.

Only at a few locations does private enterprise lead to a better use of technical potential. This ranges from a modified terminal organisation up to the handling of a train formation (shuttle trains). It is interesting that a piggyback company has managed to enforce the "shuttle trains" principle in spite of considerable resistance at the railway-owned terminal in Cologne.

There is considerable resistance, however, against the idea of transferring containers and swap bodies straight from wagon to wagon. The effect would be that the capacity and number of block trains could be increased. Based on this principle, the Austrian Dr. Kortschak offers his patented transshipment system, "Cargo-Net". Complete trains may be loaded, discharged and completed by crane at regular intervals without shunting. By this method, the formation of block trains can be relocated from shunting stations into the transshipment locations at nights, provided the working hours are prolonged.

The new concept of a terminal being a performance centre should include the following functions:

-- *A holding area* for incoming and outgoing consignments for a period of 24 hours maximum;

-- *A stand-by space* for units which must be handled with special care due to regulations or characteristics of the goods such as hazardous cargo, reefer cargo and those goods which must be heated;

-- *A depot* for all units which stay at the terminal for more than 24 hours or which have to be stored under contract with the terminal operator;

-- *An emergency depot* at which qualified companies are bound by contract to keep equipment on hold and are able to help promptly in case of emergency.

4.2. Satellite terminals

The following developments have to be noted as a serious hindrance for the intermodal traffic:

-- An increasing concentration on large terminals as prospective head terminals for block trains;

-- The trend, promoted by politics and industry, to relieve roads, in particular in overcrowded suburban areas.

The logical reaction is to arrange movements by short trains from/into suburban areas (feeder trains) at the cost level for road transport. These movements should be done between main terminals and some sort of satellite terminals -- within the time gap of block trains' arrivals in the morning and their departures in the evening.

Larger private rail sidings must gain the status of such satellite terminals.

This presents absolutely no technical problem, especially as, for feeder trains, older wagons can be used which are no longer suitable for block trains. These ideas are resolutely barred by the railway companies, especially Deutsche Bundesbahn.

The decreasing time output, including waiting time at overcrowded main terminals as well as the increased running costs of road transportation, are to be seen against the considerable advantages for the shippers and the consignees in suburban areas. Thus the user can determine the time for loading/discharge at rail sidings according to their own needs. In addition, this offer will induce the shift of consignments from single rail traffic into containers and swap bodies. The railway companies are afraid of this effect, although they would be released from loss-producing activities, but at the same time they could support the trend to establish block trains between main terminals.

4.3. Subsidiary remarks

All available papers dealing with the subject of intersection rail-road are showing the same results. A terminal with a wide performance spectrum is the most important link in the transport chain. The ideas behind a container transfer location are badly out of date, although most of the railway companies still adhere to them. This alone is the reason why terminals can no longer be the railways' concern.

Italy has gone one step further. By act of law, the Government has defined so-called "Interporto", i.e. cargo distribution centres. This includes a terminal for intermodal traffic. Seven centres have already been established, e.g. in Verona, Bologna and Padua. A similar facility has been built in Coatbridge/Scotland (British Rail).

4.4. Intersection of European ferry lines

The European ferry lines themselves adapted very early to the intermodal ideas by operating container vessels and roll-on/roll-off ferry boats. On nearly all sea routes -- first of all with Scandinavia and the United Kingdom/Ireland -- reliable and fast liner services have been established. There are still no adequate services provided by the railway companies.

The chances to connect rail routes with ferries by co-operating closely are mainly followed up by the piggyback companies. Due to the railways' lack of willingness, the co-ordination of the timetables is still very poor. Another problem is the intersection in the port. The whole port area is traditionally considered as rail sidings in front of which shunting stations are located (examples: Zeebrügge and Rotterdam). The aim should be to establish a terminal as a centre for block trains -- with, however, regional distribution functions

(from/to the various piers) -- in front of the port facilities. Of course, the customs office and other governmental inspection authorities should be located there.

5. RAIL INFRASTRUCTURE

The railway companies are always pointing out (e.g. Deutsche Bundesbahn -- freight traffic and transport chains, published by TÜV, Rheinland in 1988) that the road infrastructure has been developed partially to the disadvantage of railways, which has led to a lack of its own, modern infrastructure. This may apply for the traditional freight services but, without doubt, on the main corridors in Europe the railway network still has to be developed.

The railway companies must concentrate on their corporate strength in order to better utilise the given infrastructure. An ideal starting point is the intermodal traffic as long as they are prepared to completely integrate all the other carriers' performance elements. So the Deutsche Bundesbahn confirms that they achieved a considerable step forward in quality and productivity of intermodal traffic with their national concept KLV 1988. They admit, however, that this is only a tendency, but so far no revolutionary strategy plan. Therefore innovations are required, among others for more efficiency of the railway network.

The question is to what extent the railway companies can realise their corporate strength in a European network in view of their national orientation and operational differences.

5.1. Operational differences

It is an internal task of the European railways to unify the different technical preconditions such as signals, power supply, clearance gauges, etc. The user is interested in and worries about other characteristics of rail traffic.

So each railway company has its own rule for the accompanying documents, including customs papers/way-bills, which regularly results in a loss of these papers under way. Alternatives suggested in order to solve this simple problem were not accepted by the railways' regulations.

In addition, the information flow is completely underdeveloped. Each consignment can only be allocated and followed up with the wagon number,

although the customer has less and less influence on which wagon is to be used. Therefore, an up-to-date information system has been required for a long time.

This means that the handicap of the system caused by two intersections (terminals) and the unaccompanied transport over the main distance, contrary to road transportation, has to be compensated.

The fact that each railway company still has in mind its own national network has the effect that the schedules for cross-border traffic are co-ordinated unsatisfactorily. Consequently, trains have to wait 12-18 hours at the border for a connection. A constant bottleneck is the French/Spanish border. Here a transshipment is necessary due to different gauges. Therefore Intercontainer has invested in container-carrying wagons with interchangeable axles, solely in order to minimise delays.

Delays very often occur because trains arrive in star-like formations at the border station where they are then assembled as block trains. Within the context of the required innovation, the solution of transferring the intermodal units by crane from wagon to wagon should be considered instead.

5.2. Train systems

The railway companies are compelled to recover the increasing loss of time at the transfer points (terminals) on rail. Consequently the intermodal trains' cruising speed is to be raised considerably, if technically possible. But, according to realistic calculations, only 5-10 hours remain for rail transport, depending on the distance, in comparison to transport by road. A consequence of this development is that a large number of existing wagons are no longer suitable.

These time schedules can only be realised by block trains between two terminals. At the same time these are the optimal production means for the railway in the sense of corporate strength. Studies show that block trains with 20 wagons are efficient and 33 wagons actually represent the maximum. By this, it can be considered that a certain number of wagons should be transported as a fixed trains formation without shunting, in spite of varying utilisation. However, even less important industrial areas have to be served in the interest of short distances by road (delivery/collection).

For this, so-called "mixed trains" are used, i.e. single train formations are coupled under way for travelling as block trains over longer distances. They are producing higher costs and do not achieve the required quality profile.

Today's railway concepts are based on the fact that it is necessary to run block trains as well as mixed trains. Indeed, there are realistic proposals for a "shunting free container transport system" which up to now have not been examined seriously. The ideas are based on a system of scheduled trains between different terminals and fixed transfer locations during transit. The period of time spent at the terminal is limited to the time which is necessary for the transshipment of individual intermodal units from one train to the other, i.e. straight from wagon to wagon. The Cargo-Net procedure from Dr. Kortschak is based on similar ideas.

Undoubtedly, the railway companies will stick to their national network for a long time to come. Therefore, the first step should be a link-up of these networks by a few, but attractive block trains between main terminals.

Such main terminals being a transit point, the international load units should change to individual national trains.

A quick changeover and good connections to the national schedules are important. The international block trains are shuttle trains, their stay at the terminals is limited to the time needed only for discharge and loading.

According to various estimates by experts, a block train with partial utilisation is already profitable. The degree of utilisation could, however, be improved with incentives in pricing and operation for so-called fill-up consignments or for empty units on a stand-by basis. So-called feeder trains between main terminals and satellite terminals could secure additional volume for the block trains.

If these ideas are followed up, complete groups of wagons could be used for round-trips over short distances during the day. This should mean that competitive conditions for rail distances of 200 to 300 km between two terminals could be likely.

5.3. Integration of other carriers

Moreover, it is often claimed that connections by ferries and on inland waterways should also be integrated into the rail network.

The willingness of the railway companies is different due to the problem that competing routes with so-called transit railways were established for years, whereby someone has direct interests in ferry lines (train-ferry). This is

particularly the case on routes between the continent and Scandinavia. Owing to private, progressive ferry services offered, the railway system could be connected to direct and logical seaways. The rail/ferry intersection is the port. There the transfer of load units wagon-vessel-wagon has to be done timely and without delay. Either this solution matches the system of intermodal traffic exactly or both carriers should consider themselves as partners in a long transport chain.

Container services on inland waterways also have to be considered by the railway companies as a logical supplementary part of the whole system principles.

An example is the given infrastructure along the Rhine river. Some piggyback companies, as well as the container company, are using the partially modernised Rhine terminals already to relieve rail transfer locations. As an intersection between waterway and rail, this role could be permanent.

The railway company would have to discontinue their competitive actions and then should start considering the different "water" terminals as starting and final points for rail connections far into the hinterland. The railways would release rail corridors and certainly gain more traffic volume for block train connections over long distances in Europe.

5.4. The wagon problem

New concepts concerning terminals and train systems affect the wagon techniques directly. Consequently, a wagon is being developed which is suitable for as many transport techniques as possible which in addition can carry high payloads at higher speeds. But the majority of railway-owned wagons are no longer in line with these requirements.

First of all, the railway companies have developed new wagon types strictly in line with their own national requirements. Larger investments, however, were made by the piggyback companies and Intercontainer. Owing to the multinational structure of Intercontainer, only this company has managed to create a truly European type. The piggyback companies' fleet, in comparison, lacks uniform ideas.

Not only the ownership structure but also the technical diversity of their wagons limit the railways' possibilities for making the best of their corporate strengths. There are signs, however, pointing towards a European orientated wagon pool. Thus, the railway companies are becoming freer in regard to their

pricing. In future, they will determine not only the efficiency of a wagon type but also control the traffic volume via the price.

5.5. Weakness caused by the system

The lack of prompt, comprehensive information should once again be mentioned.

The user has hardly any information at all about position and movement of his units. The situation becomes really critical if, during transit, unforeseen events occur. Consequently -- with regard to the individual load unit -- more details have to be collected and recorded than those usually needed for rail transportation. Moreover, this information must be available to the users at any time, i.e. a direct communication system has to be offered without channelling these via piggyback and container companies.

The railway companies should also start using advanced communication methods for investigation and follow-up of individual movements. Satellite systems are one example. These are already being tested for road transport.

In a similar way, big American railway companies are controlling their trains. It should, consequently, also be possible in Europe to develop an up-to-date communication system centred on a few points, which has continuous direct communication with trains and terminals. Safety standards would also be improved because any knowledge and information missing on regional location could be passed on without considerable delay in case of unforeseen events.

Many market research studies prove that for higher-value cargoes and transports requiring special attention in transit, there is a big market potential. A lot of things go without saying in the co-operation with shipping lines and ferry companies, but are constantly ignored by the railways. This includes the availability of electrical supplies in transit and on terminals as well as supervision under way and monitoring. Generators, fitted to the wagon and driven by the axles are a practical solution.

Individual users, but also piggy-back companies, are prepared to invest in such equipment, provided the railway companies would offer the accompanying service including maintenance/repair of such units.

6. PROSPECTS

Optimistic studies predict that the single European market will generate substantial increases in the volumes of freight. The findings moreover indicate that long-distance road transport, still expected to be the most favoured mode of transport, will have a large participation. This expectation is additionally backed up by decisions from Brussels. According to their guidelines, all quantitative restrictions for long-distance road transportation have to be abolished by 1993. Nevertheless this transport mode will be severely affected by other factors, such as infrastructure congestion and environmental and social pressure.

6.1. The role of the railways

Officials from major railways had to admit that their conventional modes can hardly cope with the resulting business. This naturally leads to the best remaining alternative -- to the basic idea of intermodal traffic which, being in effect the third mode, should get the chance to compete with conventional road and rail modes. The transport techniques, based on the container principle, need to obtain, ultimately, the freedom for more specific development in a more dynamic way.

First of all, the predominance of the railways must be reduced down for the benefit of real partnership with piggyback companies (partner : road). The facts and problems shown herein prove that there are good reasons for this. The manager for market research of Intercontainer expressed it even more bluntly when he was speaking at the Intermodal '90 in Brussels: "*The worldwide active intermodal operators are a warning to individual railways still caught in the national or 'do-it-yourself' trap. We (Intercontainer and the railways) do not act on our own behalf but want to enter the market by offering, in co-operation with these operators, an attractive service package.*"

Intermodal activities do not, by any means, need new techniques such as the bimodal one, celebrated as a brilliant innovation by some railway companies. A reliable operation performance of higher quality and productivity, as well as a comprehensive and up-to-date communication system, are required.

6.2. New organisational structure

The structure of the individual railways with their national business objectives might be regrettable.

But it can be taken for granted that, by this, the individual regional network will be promoted and extended further on. This might have distributional functions for the intermodal traffic, provided these networks are tied up by pan-European block trains. The loss of time should be kept to a minimum, which, therefore, would not affect the service quality. Thus, the terminal's functions are extended.

Concerning wagons, the trend is very positive. Investment and availability, i.e. planning and operation, are managed step by step by the piggyback and container companies. Hopefully, the wagon pools will also improve the situation on terminals. But such pools run the risk of having to take over the large number of wagons from the railway companies being suitable only for limited operation.

The major railways are about to merge their branches for operation and marketing/sale. Hopefully, it will not happen that outdated operational techniques at high cost levels will be the reason for new pricing actions.

The major railway companies are planning another step towards European activities by establishing international co-operations, i.e. so-called "axle-managements". At first, however, this cannot be more than just an organisational step as, in practice, the railways have to give away some parts of their responsibility. On the one hand, there are doubts but, on the other, this could become the basis for new ideas and a progressive promotion of this mode of transport.

Within the scope of the EEC's thoughts of a liberalised freight market, the European railways will lose their monopoly on rails. The rail network will also be opened for private companies. That is a fascinating idea, but it is not a solution for the real problems. Today both companies (piggyback and containers) already have difficulties with the function of a consolidator to fill up block trains. Their interests are concentrated on a few major routes of no significant risk. In the future this would cause hard fights -- similar to those for air traffic (slots at the airports). Each consolidator wants to depart and arrive within the best time at terminals which would subsequently mean even more strain for the terminal.

Comparable to the logistic trains, operated by the railways themselves (DB/SNCF), the railway companies will do everything possible to give priority specifically to their trains.

Both facts would lead to an increased volume of regional traffic by road, especially in the critical, overcrowded regions, since only main terminals with strong industrial surroundings would be efficient.

6.3. Summary

Railways have not maintained their cargo share over the past years. They have defended their traditional cargoes, but these were rarely in the real growth sectors. The exception has been intermodal traffic, which represents a significant part of rail's tonnage and income. It represents the only important area of growth.

To continue to be successful, rail intermodal will have to evolve. If railways are to realise their potential on a European scale, they must forget nationalist solutions, and instead see themselves as partners in a powerful, pan-European network.

The market will grow, perhaps even more rapidly than ever before. This all means more transport but not of the same mode as before. There are promising predictions and aspects which have already led to more investments in swap bodies and swap tanks as well as tank containers. Altogether, there seems to be an exciting and challenging future for the best remaining alternative for railways, if it were not for the handicaps and incomprehensible activities already explained.

Therefore, being conservative and probably more realistic, the present enthusiasm seems to be far beyond what the single European market may at first generate.

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SUMMARY

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1. FREIGHT TRANSPORT IN EUROPE

1.1. Traffic flows and potential future trends

Since the EEC was set up and as new countries have joined, intra-Community freight traffic has expanded at a faster pace than would have been the normal rate of growth related to that of each individual country's industrial activity. Thus, intra-Community trade was some sixteen times greater in 1977 than in 1958, whereas extra-Community trade increased by only about eight times over the same period. The customs union established in 1968 provided a powerful lever for the development of this trade.

Today, following the economic integration of the new members, the consolidation in certain regions of the most competitive industries and the growth in diversity of products offered in all Member States, it can be estimated that freight traffic will expand at a rate of some four per cent per year over the next fifteen years.

1.2. Modal split

Modal split changed considerably when the gas and oil fields of the North Sea began producing and transporting on a massive scale by pipeline.

The modal split for the rest of the traffic has developed in relation to the respective productivity gains of the various modes of transport. Except where major new waterways projects have been carried out, the inland waterways have seen their traffic decline, like that of the railways, as road traffic has increased.

Table 1 gives the modal split (excluding sea transport) of EEC domestic and international traffic totalling 1 047.7 billion tonne-km in 1987:

Table 1. **European Community Traffic in 1987**

Mode	Total traffic in billions of tonne-km	Total traffic in millions of tonnes	International traffic in millions of tonnes
Inland waterways	99	412	212
Oil pipelines	62.6	NA	NA
Rail	171.6	680	123
Road[1]	714.5	Over 7 600	220.6

1. Vehicles registered in Member States.

Community freight traffic by sea totalled over 170 million tonnes in 1986.

1.3. Problems arising

The very rapid growth of international road haulage has gone hand-in-hand with the expansion of the European motorway network. The requirements relating to daily journeys by private cars have always been seen as complementary to those of road haulage, much of which is carried out at night. However, owing to the growing volume carried, the road and motorway networks are increasingly being used simultaneously by these two types of traffic. The gradual saturation of these networks and the increasing number of serious accidents involving lorries have prompted the public to an awareness of the need for new infrastructure.

The construction of new infrastructure is proving increasingly difficult in the very densely populated regions of Europe which are highly sensitive to environmental problems (noise, air pollution, etc.).

The problems created by the growth of road transport now have to be resolved in the context of a liberal Europe in which the choice of mode cannot be determined by authoritarian planning but must essentially depend on the competitiveness of each mode. However, the negative impact on the community (environmental problems, scale of the investment) may mean that all possible alternatives and means of intervention have to be taken into consideration.

2. POSSIBLE REACTIONS TO THE GROWTH OF ROAD TRANSPORT

Faced with the problems described above, public authorities in Europe cannot allow such rapid growth of road haulage to continue without examining the various means of intervention.

Aside from the introduction of regulations, a number of other possibilities need to be examined.

2.1. Regulations

Some non-EC countries which nevertheless have a large volume of intra-Community transit traffic by road -- such as Switzerland and Austria -- have deliberately imposed more and more restrictions on traffic. It would seem difficult to extend such a policy to Europe as a whole unless competitive alternative means of transport are made available.

Such an approach does, however, deserve to be explored, especially in France, since simple compliance (strictly enforced) with the existing rules would put an end to certain practices which give road transport an excessive degree of competitiveness in relation to other modes. If applied gradually, this regulatory policy would certainly have beneficial effects on the health of many road haulage firms operating in compliance with the rules of the game, on road safety and on environmental problems.

Regulations might also be used to deal with the problem of setting up small road haulage firms in terms of the managerial capabilities required of the operator and the financing facilities accorded to them by leasing companies or banks. The average life-span of these small firms should then be extended, thus creating a more healthy market.

The road haulage sector might then return to more normal costing methods and so even enable other modes to become competitive. It should be pointed out, however, that such a policy is a highly delicate matter in view of its impact on the price index.

2.2. The development of continental sea routes

Where warranted geographically, sea transport is usually found to be highly competitive. The development difficulties bound up with the poor operation of certain port activities have been resolved in almost all Member countries with the exception of France, which is in the process of dealing with them. This mode of transport, which is therefore developing satisfactorily, cannot alone resolve the problem however, although it is making a by no means negligible contribution as regards traffic between peripheral regions of the Community by avoiding costly overland journeys.

2.3. Inland waterways

In cases where heavy convoys can travel on the waterways, as on the Rhine, Main and Danube, this mode is vastly more competitive than the others.

The limitations to its use are to be found in the lack of geographical flexibility, its unsuitability for just-in-time industrial policies and the large-scale investment called for in order to develop it. The difficulties experienced in completing the Rhine-Rhône link in France are indicative in this respect.

It is unlikely, however, that the development of this mode can ease the congestion of the road network since, while it is quite suitable for serving the ports, it has to rely on lengthy terminal hauls by road to channel substantial traffic towards waterway ports, thus continuing to generate a substantial volume of medium-haul road traffic.

It would be too utopian to consider creating a capillary-type structure for the waterways, in view of the loss of competitiveness that would be entailed and the enormous scale of the investment involved.

European endeavours in this sphere must therefore continue to be focused on the major infrastructure which can then help to relieve traffic on a few main arteries, due account being taken of the above-mentioned commercial limitations.

2.4. Carriage wholly by rail

This heading covers rail transport techniques for direct hauls from point to point by block trains or individual wagons between stations and/or private terminal facilities.

This mode is the ideal response to questions of safety, pollution and saturation on major road and motorway links between cities but its competitiveness varies considerably and it is not very flexible.

2.4.1. Block trains

This highly competitive technique is developing satisfactorily on the bulk trade market. Since very large volumes have to be carried between two points, it clearly does not cater for capillary-type services in a region unless it is combined with a road haulage terminal or logistical facilities whereby the value of the service as a whole can be increased so as to offset the extra cost of transfers. Depending on the type of wagons employed -- various kinds of goods wagon or wagons for the carriage of containers or swap bodies -- the technique used is similar to groupage or combined transport, as reviewed below.

2.4.2. Individual wagons

Although adaptable to unit volumes to meet the requirements of shippers, this transport technique has steadily lost market share because it is not sufficiently competitive. So much marshalling and shunting is called for when routing and coupling individual wagons, in either stations or private sidings, that the cost is prohibitive. Owing to the essential need to raise productivity, the railways have either abandoned this technique, as in the United Kingdom or improved it, as in France where the overall transport time has been lengthened so that intermediate marshalling operations can be optimised. In any event, in terms of both cost and forwarding time, the technique is becoming less attractive to customers, so it would be unrealistic to rely on it as a means of curbing the growth of road haulage.

2.5. Combined transport

Accordingly, although rail alone is not a real alternative to road haulage, it can be associated with road services to become so for certain products on particular routes in the form of combined transport, as indicated below.

3. COMBINED TRANSPORT

Combined transport involves the carriage of goods in intermodal technical units by rail or waterway as the main mode with an initial or terminal haul by road.

As pointed out in section 2.3., the possibility of using waterways as the main mode remains limited in terms of geographical scope owing to the present state of the European network of inland waterways capable of accommodating large vessels. The fact is, however, that this mode is by far the most competitive in cases where industry is heavily concentrated near waterways ports so that large flows of traffic to a single point, such as a port terminal, are generated, where the forwarding times called for are not too much of a constraint and where the geographic location allows for an acceptable performance, the best performances being along the Rhine. Where this technique is used, the rates obtaining can usually be taken as the lowest reference rate for all other modes.

This paper will now confine itself to the examination of the rail-road combined transport technique.

3.1. The actors, commercial structures and equipment used

3.1.1. Combined transport is characterised by the diversity of the services:

-- Transfers between rail and road in terminal yards (handling, storage, etc.);

-- Road transport for terminal hauls;

-- Rail traction by the railways with the use of wagons which may or may not belong to them.

The wide range of services gives rise to two difficulties:

-- Co-ordination of the actors concerned;

-- The succession of profit margins taken, which can reduce the overall competitiveness of the operation and so prevent the development of the technique.

A relatively new profession has therefore come into being, that of the combined transport operator who organises the transport in general, co-ordinates the technical interfaces and is in the best position to assess the overall competitiveness needed for the development of this "mode".

3.1.2. The following are found among combined transport operators:

-- The piggyback companies belonging to the International Union of Rail-Road Combined Transport Companies (UIRR) which deal exclusively with road hauliers, who in turn become the "distributors" of the combined product;

-- The national container companies and the international Intercontainer which deal with almost all suppliers of orders: shipping companies, shippers, forwarding agents, road hauliers using their own intermodal units or those of their agents.

3.1.3. The intermodal units used may belong to the operator, road haulier, industrial shippers, forwarding agents or shipping companies. There are several types:

-- Swap bodies;

-- Semi-trailers, far fewer of these being carried in recent years as compared with swap bodies;

-- ISO sea or land containers;

-- Small containers, mainly in France;

-- Bimodal rail-road units.

3.2. The potential market

3.2.1. Combinable traffic and the potential market

Since combined transport is closely associated with the concept of the loading unit, as indicated above, it is in principle advisable to consider the types of traffic which can be broken down into a number of smaller shipments. For example, while there is technically nothing to prevent the "combining" of bulk traffic, this is of no interest in economic terms where large volumes are forwarded

from one private terminal to another by uniform -- or virtually uniform -- block trains and where the handling can be on a continuous basis in highly competitive conditions.

For the same reasons, it is also necessary to exclude from the potential market all traffic by inland waterways, continental sea routes or oil pipelines which are not subject to competition. A more detailed examination is called for in order to determine the extent to which rail and road traffic are "combinable".

This leads to the exclusion of the carriage of commodities covered by Nomenclature Chapters 1, 3, 8, 9, 10, 11, 15 and 16, although there may be significant exceptions for particular logistical reasons. The groups of commodities involved here are cereals, live animals, sugar-beet, solid mineral fuels, crude oil, petroleum products, iron ores, scrap, blast furnace dust, crude or processed minerals and natural or manufactured fertilizers. The potential combined transport market then totals some 261 million tonnes in international traffic and four billion tonnes in national traffic, no account being taken of the distances.

To get a clearer picture of the relevance of combined transport, consideration may be given to only that part of the market relating to hauls of over 500 km, the generally accepted limit for the competitiveness of such transport. In Belgium and the Netherlands, however, there is considerable domestic "combined" activity in the 150 to 499 km bracket, totalling some 2.4 million tonnes of freight.

Where international traffic is concerned, almost all came within the category of hauls over 500 km.

The remaining potential market can therefore be estimated to be 261 million tonnes for international traffic and 131 million tonnes for national traffic.

A number of other factors still have an influence on whether or not traffic is combinable: concentration of flows, balance of flows, scope for having high-quality shipments in the corridors carrying the main flows.

3.2.2. Existing market shares

As compared with the above estimates for the potential international market, international combined transport in 1987 accounted for only 14.1 million tonnes of freight or some four per cent of the Community's international road and rail traffic but 5.4 per cent of the potential market as defined above.

The extent to which the technique has penetrated the market differs considerably according to the segment, ranging from less than two per cent on non-transalpine continental routes to between nine and twenty-three per cent on routes through the Alps.

In 1987, some 20 million tonnes of freight was carried in national combined traffic. Excluding the Netherlands' and Belgian combined traffic for hauls under 500 km, i.e. about 2.4 million tonnes, combined transport's share of the market can be estimated to be around 13.4 per cent of the potential market.

3.3. The marketing of combined transport

Marketing is now essentially based on the operators mentioned above: network subsidiaries or co-operatives (CNC, IC, TFG, etc.) or piggyback companies (Novatrans, Kombiverkehr, etc.) and their road haulage customers. Prompted by the SNCF, specialised entities have recently been set up such as Chronofroid (an SNCF service), TransEurochem and GIE, three companies of the rail group concerned with promoting combined transport on specific markets. Other networks are planning a similar approach.

The opening of the market to more operators, as desired by the Community's Directorate-General IV, might broaden the scope for development of this mode, although its competitiveness is based at all stages of the service on effective co-ordination and optimisation of the technical and commercial sides:

- The technical side as regards the handling operations in intermodal terminals;

- The commercial side as regards the terminal hauls by road so that empty runs with intermodal units are reduced to the minimum.

3.4. The cost of combined transport

3.4.1. Bases used for pricing combined transport

In contrast with road haulage, where the haulier has completely mastered pricing in the context of optimal efficiency for each lorry, the combined transport operator's pricing depends on:

-- The price of rail traction as determined by the railways, which have a monopoly in this connection;

-- The cost of the degree of utilisation of the intermodal units and empty wagons, which is bound up with the structure of the operator's overall traffic;

-- Optimal efficiency for each set of wagons, since the individual wagon system is less and less competitive;

-- The cost of intermodal terminal operations;

-- The cost of sub-contracting the terminal haul services;

-- The possibility of finding a return load within a limited area around the destination terminal.

Given the large number of factors set out above, steps have been taken to simplify the approach.

The traffic is assumed to be balanced and to use interval-timetable rail services carrying very heavy flows between two major centres some 500 km apart with a fleet of standard intermodal units working these particular axes.

These factors, which are found to be most conducive to the competitiveness of combined transport, exist on the main international lines in Europe now being operated by piggyback companies. Moreover, when flows are concentrated owing to the need to travel through a few particular points -- as with traffic heading for seaports, transalpine traffic or traffic to Great Britain -- the situation is ideal for combined transport which can then account for high proportions of total traffic.

3.4.2. The cost of combined transport

-- National Traffic

In France, on the basis of the above assumptions and for an intermodal unit with a gross weight of 17 tonnes travelling over 600 km on an axis carrying heavy traffic, the average breakdown of the total cost of FF 3 200 is:

- 35 per cent for rail traction;
- 10 per cent for transfer terminal operations;
- 6 per cent for wagons;

- 3 per cent for intermodal units;
- 46 per cent for terminal road hauls.

This cost of national combined transport in France, competitive in relation to road costs, is not sufficiently competitive in relation to the rates now obtaining for road haulage.

-- International Traffic

For an average 1 500-km run and an intermodal transport unit with a gross weight of 23 tonnes, the average cost is FF 5 320 (1), of which:

- 55 per cent for rail traction
- 10 per cent for wagons
- 2.5 per cent for intermodal units
- 5 per cent for transfer terminal operations
- 27.5 per cent for terminal road hauls.

-- Customer reactions to the level of combined transport prices

Since the market price is determined by the road haulage price, the current level of combined transport prices in France is not low enough, so improvements in competitiveness are essential if fresh impetus is to be given to the development of the mode in that country.

It would seem that the level of prices for combined transport in international traffic is competitive and satisfies customers, and traffic is steadily increasing.

3.5. Stepping up the competitiveness of combined transport

3.5.1. Rail traction

The solution to the problem of reducing the cost of rail traction lies in improvements to the load factor of trains and in reducing to a minimum the ratio: gross tonnage hauled/net tonnage of freight carried.

The present breakdown of tasks among the various actors in the combined transport chain does not make it any easier to solve this problem:

-- The railway often assumes a large proportion of the risk involved in loading the train and covers itself by means of the rates charged;

-- The investment in intermodal units and wagons usually depends on the operators who have made the investment in the light of a given tariff structure for rail traction.

It is only possible to reduce the cost of rail traction if the railways implement a tariff policy that prompts operators to work along the required lines. Several types of pricing are possible:

-- Charging by the wagonload

This system of charging is an incentive to improve the groupage of intermodal units on wagons and to take up the permissible maximum tonnage per wagon and does not reflect the normal development of rail traction costs in relation to the load hauled. It simply encourages the construction of long articulated wagons.

It does not, however, have any effect on the total loading of the train unless accompanied by diminishing rates in relation to the amount taken up per train.

-- Charging by the intermodal unit

With this charging system the railway benefits from all the productivity gains achieved in loading the train insofar as the incentive to improve the groupage of units on each wagon -- as can be done with charging by wagonload -- is eliminated. The system is not really an incentive to total loading of the train (nonetheless there is a diminishing scale of rates in relation to the amount taken up) and to the optimisation of the payload/mass hauled ratio.

-- Charging by train

This system is a great incentive to loading the train and enables the operator to obtain the lowest traction price that the railways can quote. Its drawback lies in the fact that it is difficult for an operator to assume such a large risk on his own since it involves, for a daily service five days per week, responsibility for at least 250 000 gross tonnes (total for both directions) on any given axis. It would not seem that the present financial structures of operators are geared to running such risks on a number of routes.

-- Charging by gross tonnage hauled

Representing the marginal structure of rail traction costs, this method is an incentive to the operator to acquire the most efficient intermodal units and wagons

and to optimise the groupage on wagons. As an incentive to the operator to make the most efficient use of the train's capacity on a regular basis, the method may be supplemented by a system of quota bookings and diminishing rates in relation to the amount taken up. Here, too, the system is subject to the limitation of the financial capacity of operators to assume such risks on a market as difficult as that of combined transport.

-- The ideal charging system

Such a system must clearly reflect the breakdown of traction costs with an even distribution of the risk between the railway and operator, while providing an incentive to the operator to invest in high-performance intermodal units and wagons and to make the most efficient use of rail capacity for bulk carriage.

The system must be guaranteed to remain in force for a sufficiently long time for the operator to be able to make investment decisions on a stable basis. Where changes are necessary, transitional measures must be provided to ensure that the operator's existing units are not put at a disadvantage.

3.5.2. Operations in transfer terminals

There are a number of types of operation:

-- administrative;
-- logistical;
-- handling.

The administrative operations include the establishment of transport documents, preparation of unit groupage on trains and the organisation of terminal hauls by road. Where the operator is responsible in this connection, methods of improving productivity are conventionally based on computerisation and economies of scale.

There is often considerable scope for improvement with respect to the organisation of movements within the terminal since activity can come to a standstill at certain times during the day. However, further consideration clearly has to be given to methods used for handling which at present consist of three types:

-- Gantry handling

Rail-mounted and rubber-tyred gantries transfer the intermodal units from wagons onto lorries or place them in the yard for storage if necessary.

This method of handling permits high-density storage, keeping the area of the terminal to a minimum since the gantry serves a number of rail tracks.

This costly investment in superstructure (some FF 6 million per unit) cuts down on the need for investment in the construction of permanent buildings when transfers are made without the need for storage.

This technique can give rise to disputes in cases where one investor is responsible for infrastructure and another for the superstructure.

-- Crane handling

Gantries can be replaced by superstacker-type cranes at a unitary cost of some FF 2.5 million, but a crane can serve only one rail track and calls for a larger and more solidly constructed terminal area. High-density storage can also be achieved with the cranes but more handling is required than in the case of gantries.

As the crane can be moved to another yard in the case of an exceptional transport operation, this more flexible technique is usually preferred by the operator since it enables him to adapt more readily to market fluctuations and to keep investment in superstructure to a minimum.

-- Handling by lift truck

This method, which developed with the conventional fork-lift trucks, has moved towards the use of heavy trucks equipped with multi-function spreaders (locking and clamping). These trucks, which cost about the same as the superstacker cranes, do have a drawback however, in that they can only work on the line of units closest to them. In some cases, however, the yard surface on which they operate does not have to be so solid.

-- Rapid handling techniques

Rapid handling has a number of advantages:

-- It costs less as fewer facilities are used;

-- Service quality is improved as the intermodal units are made available more quickly;

-- Infrastructure investment is exploited more efficiently if two trains on a track can be handled instead of one during peak periods at the terminal.

The CNC's average rates of unloading, at present, range between ten and thirteen intermodal units per hour, rates that are often the product of a technical/commercial compromise between the requirements of the customers of rail-road carriers -- who come to collect their swap bodies -- or the lorry drivers doing the terminal hauls, and optimisation of the technique whereby intermodal units are unloaded in sequence. All the time gained in moving the handling equipment along the line of wagons has considerable influence on the rate of unloading.

In order to ensure the efficiency of unloading the line of wagons in sequence, the terminal should be equipped with slave tractors and road semi-trailers for the carriage of containers which are put at their disposal by the rail-road hauliers or lorry drivers performing terminal hauls. The semi-trailers, back loaded with containers, will be stationed in numbered places before units are lifted.

This technique, which is more costly in terms of space (low-density storage of semi-trailers) and of equipment (slave tractors and road semi-trailers in addition), provides for a more efficient use of the rail tracks in the terminal, better organisation of movements in the terminal -- since carriers no longer have to move along the trains -- and reduces to a minimum the average waiting time of the carriers performing terminal hauls.

A technique of this kind, combined with the use of new equipment for automatic identification of intermodal units, would lead to appreciable productivity gains and some spare capacity at terminals now saturated, and would require no heavy investment other than for the construction of an additional yard in which to keep the road trailers.

The technical trials carried out show that a twenty per cent increase in productivity may be expected under this item of expenditure as a result of rates of unloading being stepped up by more than 50 per cent, but the additional investment in the above-mentioned equipment and the cost of operating it have to be set against this.

3.5.3. Intermodal technical units

-- Conventional intermodal units

Endeavours in this connection should relate to improvements in the carrying capacity in relation to the tare. All manufacturers are continuing to study this problem, and the operator often has to choose between the strength of the unit -- which permits stacking and reduces maintenance -- and a reduction in the tare weight by the use of aluminium or composite materials which are more costly and have a shorter lifespan. This choice will be strongly influenced by the pricing policy adopted by the railways.

However, the most important productivity gain lies in improvements to the turnround rate of the intermodal unit, which is bound up with its multi-functional character whereby waiting time for reloading can be minimised. It should be pointed out that the search for a return load is only economically feasible within a limited area around the terminal and this is an incentive to have units that serve as many functions as possible.

-- Bimodal units

Since it seemed there was little progress to be made with respect to the payload/gross weight hauled ratio for the conventional intermodal unit placed on a wagon, research has been focused on endeavours to reduce the cost of investment in terminals, handling costs and the deadweight hauled.

In order to try to meet these requirements, bimodal techniques have been developed whereby road semi-trailers are placed on bogies.

Current studies show that, as compared with the conventional technique (swap body on a bogie wagon), the payload/gross weight hauled ratio improves with the bimodal technique by some 12 per cent for heavy bulk traffic and about 21 per cent for light bulky products.

The economic efficiency of these new units therefore depends on the extent to which the railways help to optimise this ratio and on the reductions in investment in terminal infrastructure. The development work at present being carried out on these units shows how difficult it is to establish rapidly a Europe-wide technique approved by all the networks.

Nonetheless, if rapid transfers from rail to road and *vice versa* can be achieved in intermodal terminals and if the purchase price of the equipment

remains reasonable, this method of improving the situation is still very promising and manufacturers need to make a major effort in this connection.

3.5.4. Wagons

Efforts continue to be made to find more efficient wagons but, here too, if the operators are to decide to invest it is essential for the railways to provide an incentive by means of the tariff structure and assurances that these tariffs will be of a lasting nature.

3.5.5. Terminal hauls

Terminal hauls are a major factor from the standpoint of the quality and cost of combined transport services.

As regards quality, operators should try to establish high standards whereby a uniform service can be ensured.

As regards cost, optimisation of terminal hauls serves to broaden the catchment area for acquiring freight around intermodal terminals at a competitive price. It is generally recognised that this is one of the most important steps to be taken in order to improve the prospects for the development of combined transport.

3.5.6. Marketing and operation of combined transport

Having reviewed the various technical and tariff measures enabling the actors in this transport chain to work towards improving its competitiveness, it may be asked whether the marketing structure should not be reappraised.

As already indicated above, operators do not have the necessary financial capacity to assume in full the risk attached to purchasing a number of complete trains. Are the railways then to take their place where marketing is concerned?

It was seen earlier that the potential market is essentially that of road haulage. The possibility of rapidly developing combined transport depends on the voluntary transfer of traffic from road to intermodal by the road haulage firms themselves, an objective that can only be attained if there is real co-operation with the road sector. If the suppliers of traction, i.e. necessarily the railways, are seen as potentially direct competitors, the road hauliers will react negatively. This policy of close collaboration has been introduced in France with the recent

establishment of a rail-road consultative committee in association with the SNCF, the National Federation of Road Hauliers and Combined Transport Operators.

It therefore seems that operators should be kept active as investors and be strongly encouraged to develop their activities by guaranteeing them a competitive price for rail traction and providing them with capital geared to the objectives assigned to them and the risks they have to take.

It is not necessary, therefore, to change the existing marketing structure entirely in order to give impetus to the development of combined transport.

3.6. Factors influencing the decision to transfer traffic to combined transport services

There are two aspects to this question:

3.6.1. The shipper's decision

If the consignment in question can be shipped in a standard intermodal unit, no specific commitment will be required of the shipper, who traditionally makes his decision on the basis of the best offer in terms of quality/price, although an "easy" transfer in this way can also be the subject of rapid change if the quality of the combined transport service diminishes or the price of competing modes is reduced.

If the logistical value of the intermodal unit itself is demonstrated and the construction of special units is necessary to ensure the transfer of traffic, the shipper has to enter into commitments over a longer period so the decision will be more difficult and will be taken less rapidly. Once taken, it confirms a real commitment by the shipper to the combined transport technique since, although the approach is by road, the intermodal units do not often represent the optimum units that a road haulier would wish to use for a journey wholly by road.

3.6.2. The road haulier's decision

Here too, the decision is also difficult to make since it first calls for an investment in specialised equipment, swap bodies and road chassis in order to achieve maximum efficiency and, secondly, appropriate organisation is required at both ends of the selected routes in order to provide terminal hauls. Accordingly, access to combined transport is today quite difficult to obtain for a

small road haulage firm that does not have a national or international network of establishments.

3.6.3. Criteria governing an operator's decision to establish a new combined transport link

-- Methods employed to establish such a link

The first phase of the study to be undertaken by the operator relates to an analysis of the traditional market on which there must be a substantial volume of flows on a link of over 500 km (more than 250 000 tonnes), spread evenly over the year (thus precluding certain seasonal flows), clustered around departure and arrival terminals within a radius of some 60 km and essentially well-balanced on the outward and return runs to ensure that not too great a percentage of the intermodal units return empty and so make the operation less competitive.

More specifically, the analysis of the potential market should single out groupage traffic and traffic using sets of wagons for which there are separate service quality requirements.

In the second stage, negotiations are carried out with the railway or railways concerned to make forwarding arrangements of the quality called for by the market at a price that will ensure that the service as a whole is consistent with market prices.

The third stage calls for an examination of the process whereby the service becomes fully operational and of the allocation of the commercial risks during this period.

The fourth and last stage of market penetration is often long and costly and the reactions of competitors are felt at this time.

This description shows how cumbersome the process is, since a number of actors are involved and it can last several years if the new link calls for the construction of new terminals. It is therefore in no way confidential and so enables competitors to organise themselves.

It is therefore important to have a network of establishments in advance in all areas offering large enough volumes of traffic so that new links can be opened quickly with some chance of success.

-- Interest to an operator

• In the short-term

An operator will only find the project of interest if the combined transport is sufficiently competitive in relation to market prices, especially if setting up on the link calls for investment in intermodal units, handling equipment or even wagons.

Given the average level of road haulage prices, such a situation is seldom found today in domestic traffic in France, most of the operators living on the strength of the fact that equipment has been largely amortized and the terminals and establishments already exist. A margin of competitiveness can only be found for certain long-haul sea traffic, since the fact that there is no cost involved for a road haul or for handling at the port terminal means that this phase of combined transport is on the same footing as road haulage.

• In the long term

Competitiveness in the long term must be assessed in relation to road haulage costs. Combined transport can here be attractive to shippers and carriers on links of over 500 km carrying heavy volumes of traffic. What has to be done in France at present is to redefine the network and rail's operating methods with a view to optimum productivity.

3.6.4. Prerequisites for the establishment of a network

The current policy of developing combined transport on individual axes, as described above, has its own limitations:

-- There is only a limited number of major centres between regions with optimum flows as described in Section 3.4.1.;

-- Combined transport would be unable to reach the point of having over fifty per cent of the traffic on an axis without incurring the decisionmakers' disapproval of a mode having a monopoly situation.

The main means of extending the scope for combined transport, other than by optimising the terminal haul services by road, is to establish one or more centres for the artificial concentration of flows from a number of dispatching regions to a single destination region, thereby attaining on each of the sections of the journey to the centre point the critical volume needed to make the rail links

profitable. At these central points, moreover, it would be necessary for inter-train transfers to be carried out very quickly to avoid lowering the standard of the main part of the forwarding operation.

If such a system is to be set up, the railways' tariff policy has to take account of the costs of operators or groups of operators who become established at a number of places and manage a number of links on axes so that they can finance the cost of transfer operations at the main junctions.

Accordingly, the establishment of a basic network that is readily and economically accessible will be received favourably by major shippers who are looking for an overall package of services to a number of destinations. Owing to the size of their establishment, some of them may even originate satellite terminals which should be linked up with the basic network.

3.6.5. An economic return on investment

In the breakdown of responsibilities among the actors concerned, the operator may have to invest in terminal infrastructure, handling equipment, intermodal units and wagons, so it may be useful to consider what the operator's position may be with respect to such investment by making a simple assessment of the overall investment package.

The assessment will be confined to the optimum case of an operator working in both directions, 250 days per year, on a single 600-km axis under the conditions set out in Section 3.4.2., with traffic of thirty swap bodies each seventeen gross tonnes in weight which are loaded on thirty wagons. The intermodal terminal at each end will be equipped with two cranes so as to ensure a reasonable time for loading and unloading trains.

The investment needed can be estimated as follows:

-- Infrastructure for the two terminals	FF 50 million
-- Cranes	FF 10 million
-- Wagons (60)	FF 21 million
-- Intermodal units (60)	FF 4 million
	FF 85 million

On this traffic, the gross profit of the operator on turnover minus subtracting for rail and road hauls amounts to FF 9 million for domestic traffic in France in accordance with the data given in Section 3.4.2. The same investment in road

vehicle combinations would generate some FF 51 million per year in turnover (on the basis of FF 0.6 million per coupled combination estimated at FF 1 million per unit), no account being taken of the additional carriage of freight performed by any road haulage firm which would amount to nearly six times more.

In making the comparison, account would have to be taken of the fact that all the investment required for combined transport takes three times as long on average to amortize as investment in road haulage vehicles. Even in this case, the comparison is still very unfavourable for combined transport in terms of capital and it would be desirable for the investment requirements to be broken down among the railways, public authorities and operator.

In France, the SNCF finances terminal infrastructure in most cases under a programme that has been accepted and subsidised in part by the public authorities.

The operator is invited to invest in the other equipment which is confined to handling facilities and wagons for piggyback companies.

The investment covered by operators is therefore reduced to FF 35 million (or FF 31 million in the case of piggyback companies) for a gross profit of FF 9 million. The comparison with investment in road vehicle combinations is then more evenly balanced in that extra-terminal investment in combined transport takes only twice as long to amortize as the road vehicles.

This ratio of an investment of FF 3.5-4 per FF 1 of turnover, while less satisfactory, is easier for an investor to accept if a real economic return can be obtained.

The operator's profit largely depends on factors over which he has no control: the quality of the forwarding operation and the price of rail traction. Guarantees of the competitiveness of rail traction and of the lasting quality of the forwarding operation have to be given to him if the investment is to be made on a stable basis. At the same time, it is uneconomic for the community if the terminal infrastructure made available to operators is not exploited more intensively. It should be possible for the operators and railways to work out an agreement whereby joint objectives can be determined together with their respective responsibilities.

In France, intermodal units are at present written off over seven years and wagons over fifteen years, figures which are slightly high and show that French operators are experiencing difficulties at present and are waiting for an improvement in market prices before beginning to invest again.

This attitude of French operators suggests that the development of combined transport -- as desired by the public authorities in view of all the benefits it offers the community -- now calls for effective government support, in view of the very low prices of competing road hauliers.

3.7. Prospects for combined transport by the year 2005

What has been said in the preceding sections shows that combined transport should become sufficiently competitive in the medium term to obtain substantial market shares.

The saturation of the motorways should speed up this penetration, more particularly on axes where the conditions are most favourable for combined transport. A recent forwarding-looking study accordingly predicted that international combined traffic would triple by the year 2005, the scenario being one of rapid penetration of the potential market on the main routes in a context of macroeconomic growth of international flows of four per cent per year. The outlook as regards volumes for 2005 is therefore as follows: International combined transport: 43 million tonnes, or about eight per cent of the potential market.

A number of studies have been carried out in France with a view to drawing up a master plan for combined transport and establishing traffic forecasts. A rate of growth of 7.4 per cent per year, all types of traffic combined, would seem to be credible and means that traffic would double between 1987 and 1997.

3.8. The limitations of combined transport

3.8.1. Technical limitations

The potential volumes of combined transport indicated above are concentrated on some thirty major international axes (some fifteen of which are prospective), thus calling for a review of the investment in rail and terminal infrastructure to ensure a normal flow of traffic, since bottlenecks are primarily located at terminals and on a few rail sections, some on the outskirts of cities.

3.8.2. Financial limitations

The above-mentioned survey of international traffic in Europe shows that an investment of approximately FF 28 billion in infrastructure and equipment is essential.

Similar analyses in France have shown that infrastructural investment of about FF 1.5 billion is also essential to ensure the desired development of combined transport. Operators, forwarding agents and shippers also clearly have to invest at least FF 200 million in handling equipment, wagons and intermodal units.

The existence of a monopoly in rail traction and the specific nature of some of the investment projects means that they cannot be carried out unless combined transport shows an adequate rate of return for the investors with a guarantee that the competitiveness of the monopolistic part of the transport will be maintained.

The absence of such a guarantee would curb the desired development.

3.8.3. The limitations of combined transport with respect to resolving various other aspects of the problem

-- Impact on road haulage

As pointed out earlier, international combined transport is now equivalent to only about four per cent of international road haulage in the EEC.

The three-fold increase in international combined transport hoped for by the year 2005 will amount to no more than three years' advance on the normal growth of international road traffic flows. In any event, moreover, the growth of combined transport cannot prevent the development of capillary road services, especially in urban areas where roads into the cities or motorway by-passes will be constructed in any case.

Is the development of combined transport then to be seen as some sort of manipulation by the media? Given its impact on the question of the environment, that would not seem to be the case.

-- Impact on the environment

• Dangerous goods

While it is more environmentally friendly for inter-city journeys, combined transport does not really lead to any overall improvement in terms of pollution.

However, such transport is certainly of interest from the standpoint of risk, since the risks inherent in the carriage of dangerous goods may be wholly incommensurate with the volumes carried. A high-standard combined transport service can provide much better guarantees in this connection, at any rate on the main part of the journey.

Combined transport services may therefore have a major impact in the sphere of dangerous goods, especially if regulatory steps are taken to provide a strong incentive to use these services for the carriage of such goods.

Despite the small volumes carried, risks would be considerably reduced.

• Noise

In some high-density urban areas, located on corridors carrying heavy long-distance traffic in transit at night, combined transport can offer an effective remedy for noise pollution which is very disturbing for people living in the area.

• Energy conservation

In this sphere, combined transport has an impact proportional to its gain in market share. Studies carried out in France show that the public authorities hope to have an annual saving of 150 000 TOE by 1998 and have introduced a policy whereby financial incentives are provided.

4. CONCLUSIONS

Faced with the rapid expansion of intra-Community flows of traffic, which will be accelerating with the opening up of the East European countries, national and Community authorities have to examine every alternative possibility to the growth of road transport.

The possibilities offered by combined transport, though limited, would seem to be sufficiently attractive that everything possible should be done to ensure that the technical and financial obstacles to its development are promptly removed.

This process of development, primarily on the long corridors carrying heavy flows of traffic, should be extended over the whole network by setting up efficient interchange centres.

A policy of this kind cannot resolve the problem of a saturated road network but can help to delay saturation and can improve road safety by providing alternative routes for the carriage of the most dangerous goods.

Close co-operation will have to be established between the railways, operators and public authorities in order to ensure that the large volume of investment needed to implement this policy can be carried out on a profitable basis.

To conclude, it will be necessary for the various networks to begin to co-operate as soon as possible to ensure that the new technologies can be rapidly harnessed to serve the requirements of international combined transport.

NOTE

1. *Source*: A.T. Kearney.

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NETHERLANDS

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SUMMARY

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1. INTRODUCTION

In May 1990, the Netherlands Institutes, INRO-TNO at Delft and NEA at Rijswijk completed a study, on behalf of the Netherlands Agency for Energy and Environment and the Ministry of Transport and Public Works, entitled: "Towards a Really Combined Transport".

The project was carried out by a team of several collaborators of the institutes mentioned and the study was written by H.F. de Leijer of INRO-TNO, with the objective of analysing the problems which stand in the way of a smooth use of combined transport. The final goal assigned to the study was a list of recommendations and guidelines which could easily and rapidly lead to a change in the practical situation. A second goal was, of course, the development of a policy towards combined transport in the longer term.

The approach chosen is directly connected to the practice as observed today and to the characteristics of transport demand and its reaction when confronted with combined transport. Although macro-economic approaches have clearly emphasized that combined transport is -- in theory -- a promising mode of transport and that considerable potentialities exist, they could not explain the reasons for its limited use nowadays, despite subsidies and facilities offered, and discrepancies between the use on some relations and others; differences between national use and (low) international use is one example. On the other hand, various shippers surveys, notably in the Netherlands and France, have shown that the organisation of the transport chain is quite complex and that at the level of the firm many factors play a role. From the result of such exercises, one can conclude that the perception of combined transport techniques from the point of view of the final users -- the carrier who belongs to the *road* market and the shipper -- does not follow the global approach of the *rail* supplier in terms of costs, tariffs or times.

The study undertaken by INRO-TNO and NEA has attempted to isolate those factors which are of importance in the decision process of the road transport company in relation with combined transport. The study makes an attempt to

examine the question of combined transport from a "road" approach; for this reason, resources were concentrated upon two corridors, one covering relations between the Netherlands-Germany-Switzerland/Austria-Italy, and another the relations between the Netherlands-France/(Italy)-Spain/Portugal.

The results show the possibilities and limits of combined transport and -- amongst other things -- prove that a better understanding of (road transport) organisation will certainly contribute to a more adequate supply of combined transport.

For this reason, the present paper consists of an extensive summary of the contents of the study. The author has designed this summary by "looking through the glasses" of a civil servant whose task it is to develop a policy of environmental protection by promoting combined transport but at the same time promoting the interests of the transport industry, the efficient use of public money and the economic interests of a country that wishes to remain a specialist in the distribution business, whatever mode of transport is chosen by the shipper.

2. THE TRANSPORT MARKET AND THE POSITION OF COMBINED TRANSPORT

2.1. Introduction

The potential growth for combined transport is to be found in present-day road transport. In this respect, an important distinction should be made between continental transport, whose origin and destination lie on the European continent, and maritime incoming and outgoing transport, where goods either come from or go to overseas destinations. The latter type of transport includes a major part of container transport, the former handling conventional road transport by articulated lorries, semi-trailers and swap bodies.

In view of the combined transport environmental objective, the international road transport market offers the highest potential for combined transport. In this respect, the haulage of maritime containers to and from main ports is also to be regarded as (part of) international transport, even when performed on national routes.

2.2. Volume of transport

The analyses in the Netherlands of today's transport market is directed at indicating the volume and composition of transport on the two axes to and from the Netherlands: the eastern axis (Germany/Austria/Switzerland/Italy) and the western axis (France/Italy/Spain/Portugal).

In view of the very great differences in transport between the western and eastern axes, discussions on future developments nearly always consider only the eastern axis. As a result, discussions on transport in Europe seem to focus exclusively on the Alpine issue. Further segmentation of the transport market will prove this rather one-sided attention to be unjust. In statistical analyses an initial impetus is given to a product-market segmentation, because segmentation of the market, coupled with the package of services to be offered by combined transport will lead to better balanced supply and demand and, consequently, towards an increased use of combined transport.

Road transport forms the potential market for continental combined transport to and from the Netherlands. On the eastern axis it has a volume of nearly 44 million tons and on the western axis 11 million tons (1989). Indicating the volume of transport flows in tons or in ton/kilometres, as is customary in transport statistics, gives relatively little information, as these units are not the proper ones to work with in actual practice. The transport flows in tons should therefore be translated into trips made daily in road transport. In 1986, 9 700 loaded trips were made daily on the eastern axis, the major part going to northern and central Germany, however. If we restrict ourselves to the area in southern Germany, that is, at a distance of over 500 km from the Netherlands, the total number of daily trips amounts to 1 835. On the western axis, too, the volume of transport is largest for areas close to the Netherlands and, again, if these areas which are irrelevant to combined transport are disregarded, a total number of 805 daily trips would remain.

Analyses show that there is a great imbalance for Italy, with its marked shortage of supply of cargo for the Netherlands. Indeed, on all longer-distance connections there is more cargo going out of the Netherlands than coming in. This is a problem particularly on the eastern axis and sets the limits to the alternatives of combined transport. Currently there is a cargo surplus from central Germany to the Netherlands, which would be impossible when using combined transport. Another remarkable detail is the transport to and from Spain, which is more intensive than that to, for example, Austria or Switzerland and which is, moreover, balanced. In view of the distance to Spain and the intensity of traffic to and from the Netherlands on a small number of routes, it is remarkable that so

little attention has been paid so far to combined transport services to and from Spain, or to the South of France (with the gauge problems in Spain in mind).

As will be clear from table 1., the present share of combined traffic is rather modest compared to road transport and in "piggyback" traffic it is limited to only a few connections. Container transport by rail is on a more extensive scale and shows a better spread.

With a more detailed segmentation of the transport market on the two axes, it becomes important to make a distinction between conventional road transport and containerised transport. As a matter of fact, the volume of transport that is now being carried by conventional means is the proper market for piggyback transport, container transport being the potential market for container companies. The total volume of transport should therefore be further subdivided into:

-- Imports/exports;

-- Transit, not containerised (through the Netherlands);

-- Transit, containerised (idem).

Although the maximum levels of containerisation in the transit flows have not yet been achieved, it may be stated that the non-containerised transit constitutes a potential piggyback transport market.

Although the road container flows from the two following tables are only approximations, comparison to railway container flows shows that this type of combined transport takes up a truly reasonable position in the market for long-distance container transport as opposed to piggyback transport, where there is still room for some major improvements.

2.3. Goods structure

Not all types of goods are equally suitable to be handled by way of combined transport. There are certain types of goods that do not qualify for combined transport or only to a certain extent (e.g. flowers, live animals, sand and gravel), cargo volume and trip characteristics are to be considered (several loading/unloading operations) and whether or not having return cargo may play a role, etc. A.T. Kearney (1987) classified the transport market into A-, B- and C-goods, thus indicating their suitability for combined transport. The A-goods, together with goods and transport characteristics that make them ideal for

combined transport, make up some 25 per cent of the market. Moderately suitable are the B-goods with approximately 12 per cent; and with nearly 63 per cent, the C-goods are only slightly suitable for combined transport.

For the situation in the Netherlands, a survey has been made according to the types of goods carried in international road transport on the two axes. A combination of volume and suitability factors produces the following results:

-- Category A goods: more than 100 trips daily;

-- Category B goods: more than 20 trips daily;

-- Category C goods: up to 20 trips daily.

The conclusion is that there is a large and growing potential for combined transport. If we include, in the potential market area of combined transport, the category A goods from road transport's incoming and outgoing flows, the volume of non-containerised transit and all of the cargo containerised so far, the eastern transport axis Netherlands-southern Germany/Austria/Switzerland/Italy has a potential of 1 600 units to be carried daily, and the western axis Netherlands-South of France/Spain/Portugal/Italy, 700 daily. Comparing these figures with the current combined transport flows, we find that there is a vast transport market for combined transport.

However, one critical note should be made in this positive conclusion. Interviews have shown that an increasing number of carriers are using so-called volume transport and volume units. Because of existing dimension regulations, these units do not qualify for combined transport at the moment. Estimations are that, on the two transport axes referred to, about two-thirds of the total transport falls under the category of volume goods -- i.e. when volume instead of weight determines the shipment size -- which are already (or will be at a later stage) carried in volume units. This means that, on average, two-thirds of the trips, and even much more on some connections such as Spain, will be lost for combined transport if no facilities are developed for the handling of these units by combined transport.

In the analyses, attention has frequently been drawn to the difference between piggyback and container traffic, but the potential computations have invariably included these two types of transport. In the present situation, the potential will fall partly to railway container transport (particularly the maritime containers that are now carried by road) and partly to piggyback transport (the type of transport currently handled by conventional road transport). However, in

the present situation this means that this distinction must also be made when the feasibility of new combined transport is pointed out. For a number of connections, splitting up this potential will make it impossible to start up combined transport services, because both types of combined transport will fall short of the required threshold value. It is therefore highly recommendable to start from a single type of combined service in this combined transport service scheme, so that the threshold value for a new connection will be more readily achieved. It is also possible to offer a comprehensive combined transport package on connections that presently feature container transport but no piggyback transport, by combining the two types. In the long run, the only correct approach to the market potential will be the one based on a single, comprehensive package. The present market organisation impedes the development of combined transport and should therefore be adjusted.

3. SUPPLY POTENTIAL

3.1. Piggyback companies

The piggyback companies offer combined transport for trailers, swap bodies and rolling highways. This refers especially to "road transport units"; hence, piggyback company customers are first and foremost road carriers and forwarding agents. The majority of piggyback companies were established by road transport companies, which possess a substantial number of their shares.

The piggyback companies offer transport facilities to and from some 170 piggyback terminals in Europe. The majority of these terminals only allow vertical transshipment, i.e. units can only be put on the wagon by means of a crane.

A total of about one million shipments are handled by European piggyback transport companies, two-thirds of which are domestic. The volume of transport to and from the Netherlands, as compared to the other European countries, is very small, even more so when related to the total volume of road transport. This becomes even more remarkable when juxtaposed with the volume handled by the Belgian TRW piggyback company. The volume carried by TRW turns out to be 3.5 times higher than the one handled by Trailstar, a substantial part of this volume coming from Dutch transport companies. The particular reasons for this will be explained later; in general, it may be noted that the great financial interests connected with important combined transport countries (like Germany

and France) to Dutch domestic transport, form an important factor in the supply of combined transport services from the Netherlands. Indeed, national interests easily outweigh international ones, causing optimalisation of network and package of service to be effected generally from this national approach. This may be illustrated by the fact that between the two major combined transport countries, France and Germany, there is only a very small volume of combined transport.

Improvements in combined transport can only be achieved internationally, with national interests *not* prevailing over international ones. As a matter of fact, France and Germany have recently realised some market improvements in their combined transport services, which will cause the still small volume of transport flows to increase rapidly. Dutch interests in German combined transport are as yet very small, with consequently low priority for efficient combined transport services to and from the Netherlands. Only on a single connection has it proved possible to use direct trains from the Netherlands; in most cases, the German network is linked up, with shunting and other connected delays. In addition, this linking up has an adverse effect on the efforts to realise favourable arrival and departure times, because these times are based on the German domestic timetable. The recent tariff increase for the German part of the rail-leg for international transport (which appeared to be higher than the increase for domestic transport: 8-9 per cent international; 4-5 per cent domestic) also favoured domestic transport over international. A similar situation is found in France, be it less critical owing to the absence of a considerable volume of combined transport.

When we look at the various connections offered by Trailstar to and from Rotterdam/Venlo on the eastern axis, it may be noted that discrepancies in terms of both rates and travelling times are remarkable. Rate differences in various countries and the number of railway companies involved in the service seem to lead to rate differences that do not appear quite logical at first glance. With regard to distance, the rates for Austria, for example (distance from Rotterdam 1 200-1 400 km) are relatively low as compared with Chiasso/Lugano (distance from Rotterdam approximately 1 000 km). There are very great differences in the travelling times on the outward and return routes, sometimes amounting to a factor of two.

It is evident that there are quite a number of problem areas and that, consequently, combined transport could also be improved. In spite of the weak supply situation, its use is not inconsiderable and on a number of routes combined transport is competitive with road transport. Improvements on the supply side will no doubt enhance this position.

3.2. Container transport

In 1967 Intercontainer was established, which had for objective the organisation and promotion of international container transport on the European continent for the benefit of the railway companies. Intercontainer offers its services in some 25 countries through the national railway companies or their affiliates. Initially, maritime containers in particular were carried to and from the hinterland areas, but later they were joined by land containers and swap bodies. Maritime containers, however, still make up the bulk of transport. Containers are carried by rail over a network containing some 2 500 delivery points, 650 of which are rail container terminals.

Piggyback traffic mainly serves the road carrier who is especially interested in terminal-to-terminal service, while he himself takes care of the remaining volume of transport. The customers of container companies are mainly ocean shipping companies and shippers setting greater store by door-to-door or terminal-to-door service. With piggyback transport actually, a choice is made for road transport, part of the route being covered by rail; with container transport there is an initial choice for containerised transport by shipper or shipping company, the manner of transport being the second choice. Owing to the difference in character of the two types of service, they did not used to be really competitive, but things have changed with the coming of swap bodies. Swap bodies cover the great gap between the piggyback company and the container company, because they are handled by both types of companies and outward characteristics are getting more and more similar. For the road carrier, too, container companies can offer an alternative, e.g. when a piggyback company does not serve a particular destination, because it is obviously possible to have goods carried exclusively terminal-to-terminal. When services are brought from Intercontainer, the only condition is that (part of) the transportation is done by rail. Any remaining services (delivery and pick-up from the terminal, loading and unloading, etc.) can be handled by the customers themselves or by Intercontainer. Interviews have shown that, in actual practice, carriers already employ both organisations. This is a somewhat surprising market situation, where railway companies, by way of their affiliated companies (the container companies), compete with one of their main customers (the piggyback companies).

Since 1983, Intercontainer customers have had containers from the container pool at their disposal, which presently comprises fifteen countries. The containers supplied by the companies participating in this pool offer the possibility of transport on the basis of "single" rates. The problem of positioning, as well as seeing about return cargo with its attendant costs and risks, lies with the container

organisation. It is therefore imperative for Intercontainer to achieve balanced transport flows on the various connections.

The services offered by Intercontainer differ from those offered by the piggyback companies in that the principal completes a transshipment form for each shipment, which is handed to the organisation, together with any transport documents prescribed by Customs or any other government authorities. Rates are not fixed per unit or per ton but individually, depending on the type of goods, the way in which they are delivered, how they are to be handled and their destination. A delivery term can be agreed on in writing, which will be guaranteed by Intercontainer.

3.3. The railway company

Together with the combined transport companies the railway companies are an important party on the supply side. The railway companies make up the trains and draw up the timetables, whether or not in consultation with the users. The combined transport companies also frequently hire equipment from the railway companies. Another task of the railway companies is the handling at the terminals.

It has appeared that new trains are not put in until the volume of actually supplied transport on a given connection is sufficient and, consequently, risks for the railway companies are minimal. However, insight into the existence and size of new markets to be served is very limited. This is an important observation for piggyback transport: the potential is unknown and this is one of the reasons why almost no new connections are added.

Within the combined transport strengthening process, the railways are an important party and they hold the key for starting or stopping important developments. One of the important aspects, to be further discussed, is the combination of the various types of combined transport at common transshipment centres and in one train service. At present, container wagons and trailer and swap body wagons are not put together on one train because of different terminals and shunting of container trains by way of the "hill system", which is impossible for piggyback trains.

3.4. Competitive positions and product/market segmentation

A large number of parties to combined transport are involved in its organisation; they partially serve the same market and are partially complementary. This situation, which is a result of historical factors, has led to a division of the market which, in the present transport market, can hardly be called logical. The most striking aspect is that railway companies compete with their best customers (the piggyback companies and the road transport companies employing them) by means of affiliates (container companies).

The ever-growing overlap between the two types of transport, with its subsequent ambiguous allocation of one type of user to one container transport company, has given rise to an unclear situation. Recently, in Germany and France initiatives were taken that even add to the indistinctness of the market. The French railways have founded Chronofroid and the German railways Bahn Tank Transport for the transportation of refrigerated swap bodies and tank containers, respectively, which organisations do business directly with road carriers and forwarding agents. There are also plans in France to establish Chronochemie on behalf of the chemical industry. Consequently, these companies will take up even more intensely competitive positions with respect to piggyback transport companies than container companies. Interfrigo has also announced its intention to set up a refrigerated swap body system (stockable). They say that this service does not compete with the piggyback companies because the services are not going to be run between the economic centres, but via out-of-the-way terminals. Door-to-door transport will be handled in co-operation with Intercontainer. In short: the market situation is only getting more and more obscure while the overlaps between the various types of combined transport are becoming increasingly larger.

The railway companies actually carry on combined transport from two different angles:

- Railways make combined transport possible in a co-operative form with transport companies, and service consists only in railway transport (current piggyback traffic);

- Railways carry on combined transport by making integrated market supply to shippers and shipping companies with both railway and road transport (door-to-door container traffic).

Although the existence of various types of services is a good thing as such, there is a great deal of overlap in the market situation as it is today. The package

of services and the division of the market, however, should be based on a well-founded product/market segmentation instead of on a situation with a historical background. This calls for an analysis of what type of customer is present in what type of market segment. On the basis of such analysis, a network and package of service should be organised. If this fails to be done, situations like the present will continue to arise, characterised as follows:

-- Different sales organisations for the combined transport product, selling partially comparable products to the same parties under different conditions and at different rates;

-- Different terminals;

-- Separate trains.

Everybody will understand that in this situation operating costs are unduly high and that the establishment of new connections is restricted by the split-up of transport potential.

Recently, the railway companies have taken steps to solve this problem partially in that they have worked out the integration of the two tariff systems for the two market segments (piggyback and container transport). This is a first step in the right direction having, however, the disadvantage of raising the railway tariffs for the piggyback companies and thus making the market position of piggyback transport more difficult.

As far as product/market segments are concerned, it may be noted that in actual practice in Germany there appear to be twelve product/market segments, two of which represent 80 per cent of the total volume. In the Netherlands, distribution over the product/market segments is different and the concentration in some segments is probably stronger, consisting mainly of terminal-to-terminal transport (carrier and forwarding agent) and seaport-terminal transport (sea shipping company). The share in combined transport that can be indicated as integrated market supply is very limited.

3.5. Possibilities of co-operation

Continuation of the present market segmentation and division will not be to the advantage of piggyback traffic. A product is offered which, in view of the relatively small use made of it, does not fully meet the user's wishes, particular the road carrier's. For he also employs the competitor, the container company.

Interviews show that the main reason for this is the absence of efficient piggyback services on certain connections. The product/market segmentation as described before should only be reflected in promotion or sales activities, while operational aspects of the various products should be combined as much as possible. This means the supply of combined transport services carrying all units and servicing all existing connections for all types of transport, as well as a choice between terminal-to-terminal, terminal-to-door and door-to-door transport. As an indication of feasibility, a brief summary of the overlaps and differences between the various organisations and types of transport is given below.

The first difference is in the structure of the organisation. Container transport services are organised by one "European" company, whereas piggyback services are more or less independent national companies. Container companies therefore have a much wider range of possibilities to set up an optimal package of services because national interests only play a limited role. Piggyback traffic, on the other hand, has to enter into negotiations with foreign parties, whose priorities, under the present circumstances, tend towards inland transport, rather than international transport. The organisation of efficient combined transport services (at least in the case of the Netherlands) is therefore only possible on a few connections.

Another important difference between the container and the piggyback companies is in the nature of the services offered. Through its agents, Intercontainer offers door-to-door services, which means that transport in all its aspects is managed on behalf of the customer, from establishment of origin to final destination. If so desired, the user can carry out part of the activities (e.g. pick-up and delivery) himself. Piggyback companies mainly offer only terminal-to-terminal transport, i.e. transport organised between terminals of departure and arrival. Whatever happens before or after is for the customer's account. This implies that the organisation of transportation at the final destination is, likewise, for the customer's account. Interviews show that for a number of potential customers this is a considerable impediment to the use of piggyback transport.

The reasons for the different natures of the service can largely be found in the different backgrounds of the two organisations. Intercontainer is a co-operative organisation of European railway companies. Piggyback companies are almost entirely controlled by road transport companies. Road carriers regard piggyback traffic as part of the road transport they organise. If piggyback companies were to engage the entire organisation of shippers' transport flows -- e.g. by putting in piggyback organisation abroad and a road transport company -- it would be in a competitive position towards road carriers in the field

of shippers' transport organisation. It will be clear that road carriers would not welcome such a situation.

Such differences form an important impediment to co-operation between the two companies. However, such co-operation is desirable and possible. It is possible because there is an overlapping package of services and a similar type of transport. It is desirable because in this way important improvements can be realised in the combined road-rail product, such as enhanced package of services, higher service level, removal of organisational bottlenecks and unambiguous customer approach. In addition, co-operation would involve a broader base and better capacity utilisation of wagons and other facilities, allowing for considerable cost savings.

Such co-operation could be realised by the joint employment of facilities such as terminals serving more destinations and the combination of container trains with piggyback trains, which would make it easier to put in direct trains. This last aspect would have an effect on the travelling time, which for non-direct trains may run up to three times the driving time, mainly because of shunting. On other levels, too, there should be more co-operation: in the first place, co-operation between combined transport companies, aimed at better international connections and a greater number of direct trains; and in the second place, co-operation on an international level between railway companies. At the moment they do not function as a unit either, and national interests greatly prevail over international interests. As a result, for instance, combined transport companies have to negotiate on rates with various railway companies, making combined transport rates a stack of separate rates. Even though the eventual combined transport customer is charged a single rate, international transport rates might well be systematically excessive, certainly as compared with inland transport rates.

The forms of co-operation, as described between the parties on the supply side of combined transport, are desirable and even necessary for improving the quality of the combined transport product and for strengthening its position. Ultimately, the various companies could be joined in one company. In view of the different backgrounds of the organisations, this suggestion will probably receive very little acclaim from the various back parties. It is conceivable, however, that several sales channels remain, while operational affairs are put together. In some countries there have already been good results in this field, e.g. in Germany and France. Also in the Netherlands changes are being planned. However, co-operation between parties that have a different position on the transport market (e.g. a co-operative society of shippers and forwarding agents, like Netrail, and a company owned by road transport companies, like a piggyback

company) appears to be extremely difficult as soon as the, in practice, existing co-operation is put into a formal structure.

The above analysis indicates that an altered market structure is desirable in order to realise improvements on the supply side.

3.6. Technological problems

Technological problems are not the real cause of the limited use of combined transport: the cause is rather organisational. Yet, there is still ample room for technological improvements and new developments are constantly under way.

Technological problems impeding further increase of the use of combined transport, are found on two levels: standardization of technical designs (dimensions of loading units, grab points, etc.) and the application and further development of the various systems.

The main problem with regard to transport technology is the lack of a long-term vision, both with respect to the types of combined transport that exist and regarding the kind of transshipment required. The share of semi-trailer transport with respect to the total volume of combined transport is declining in favour of the share of swap body traffic. This decline is expected to continue. (However, in the Netherlands a stabilization may be noted and the possible introduction of the new "Alpentrailer" may also change this.) The existence side by side of different systems requires the availability of various types of wagons, transshipment techniques, etc. The question is whether in the long run semi-trailer transport should be maintained, or that the aim should only concern containers and swap bodies with their more positive characteristics. The parties concerned lack a relevant overall vision.

Technical and organisational aspects also play their parts with regard to the possibility of combining the various forms of combined transport. One technical aspect is the maximal pulling and pushing forces; normal wagons can take shunting shocks up to 2000 kN; in Europe 850 kN has been suggested for the dual-mode semi-trailers. Under the present conditions, this would render the combination of dual-mode with ordinary trains impossible.

Vertical transshipment techniques are, of course, used in container and swap body traffic, but vertical transshipment is also increasingly being adopted by semi-trailer transport. Conventional horizontal transshipment systems are outdated and consequently losing ground.

Two basic solutions are possible: upgrading horizontal transshipment techniques, or discarding them altogether and using only vertical techniques. Upgrading horizontal transshipment does away with disadvantages (e.g. rotary platforms to allow selective loading and unloading), but may introduce new ones (e.g. making wagons unfit for containers and swap bodies). Unco-ordinated initiatives for improvement will give rise to a whole range of transshipment techniques with an equally large number of different requirements regarding vehicles or loading units: in various countries new transshipment techniques and wagon systems are under development with comparable characteristics, which, however, are not interchangeable. This means a formidable waste of effort and financial means and ensures the failure of setting up a powerful combined transport system. Moreover, the vertical transshipment technique will always be maintained to handle containers and swap bodies. It is therefore recommendable to further upgrade the vertical transshipment technique and if the horizontal one should after all turn out to be necessary or, under certain conditions, cheaper, to try and achieve one upgraded, generally accepted and standardized horizontal technique.

From an organisational point of view, too, there are problems in using different modes of transshipment. Indeed, this calls for either the installation of different terminals for the different types of transport (as is now often the case with piggyback and container traffic), or investments in various transshipment facilities on the same terminal. Both situations involve additional investments and organisational efforts. In actual practice, terminals have limited transshipment facilities, so that not all modes of transport can be served and market penetration by combined transport is less than would be possible and desirable.

On the other hand, the physical extension potential of terminals with vertical transshipment plays a part: this potential is limited by lack of capacity (in Germany up to 4 per cent, in France even up to 22 per cent, according to a recent investigation by A.T. Kearney). This might mean a strong push for (separate) terminals for dual-mode systems, which hardly require any investment in transshipment equipment (although they do in space!).

Consequently, in addition to the absence of a long-term vision with respect to the techniques that will be maintained -- only containers and swap bodies or semi-trailers -- there is an essential bottleneck in the existence of various transshipment methods, for which no vision has been developed, either. Both visions are necessary for developing a sound concept.

3.7. Standardization of loading units

In addition to the problems mentioned above, there is the lack of standardization of loading units. Both problems stand in the way of long-term decisions and investments. The trend for "longer, wider and higher" found its way into road transport some time ago and is now manifesting itself in combined transport. Along with the high cube containers (9 ft 6 in), the longer containers are coming to Europe. In the United States there are already 53 ft containers for inland transport. In view of the current legislation on vehicle length, these units may not be carried on European roads without special permits. Besides, there is a distinct rise in volume transport with its attendant large-volume swap bodies. Since the EC Council's Decision of December 1990, it is clear that these larger units (larger than 7.82 m) are not going to be permitted on the European road system.

A growing number of countries permit road transport widths of 2.55 or 2.60 m instead of 2.50 m, and the same will also soon apply to swap bodies. As to the lengths, Europe has a multitude of loading units. The fact is that, in continental transport, swap bodies simply suit customers' desires better, ISO containers simply not being good enough (two standard pallets cannot stand side by side). Dimensions of units and vehicles are a great problem to the organisations concerned. Moreover, outside Europe, units are designed that do not fit European dimensions but which do have to be transported in Europe. So either dimensions must be made correspondent or these units have to be transshipped in the harbour into units that can be transported. In short: the standardization problem forms a substantial impediment to optimally combined transport and speedy decisions in this field are most welcome with a view to the realisation of long-term investments in combined transport. In view of this, it is worth noting that, as far as containers are concerned, a world-wide standard is much to be preferred to an isolated European one. Final decision-making in Europe should therefore be postponed until the completion of the COST-315 study on the impacts of introducing larger containers and swap bodies and the outcome of the second seminar on the same subject organised by the UN Economic Commission for Europe in September 1992 in Geneva.

3.8. Conclusions with respect to technological aspects

Containers and swap bodies are the most suitable techniques in combined transport from the point of view of both social advantages and the market (more efficient use of loading capacity, lowest costs). Also semi-trailer transport will probably -- also in the long run -- continue to be used as a combined transport

technique in view of its market, which will remain, and in view of its new possibilities in avoiding problems with tunnel gauges when using new types of wagons. The rolling highway technique should be restricted to some specific short-distance connections such as the Alpine transit (and the Channel Tunnel).

Container and swap body traffic has been fairly well developed as regards transshipment and transport technology and conceptual improvements are not necessary right now.

However, a number of technical improvements might be made, such as:

-- Designing wagons carrying units of greater height than the current maximum (e.g. the high swap body and the high cube container) on the entire European railroad system. Solutions are available or being developed for containers and the majority of swap bodies, but extremely high swap bodies (3.10 m) remain an impossibility. If the COST-315 study proves that the market for large volume transport will keep growing, it would be desirable to develop solutions for them, too;

-- The use of the newly-developed dual-mode systems for container and swap body traffic does not seem to offer real advantages and is too complex (either carrying along chassis, or separate floor board, with all the additional handling and repositioning problems, or developing new containers and swap bodies which can absorb the pushing and pulling forces directly);

-- Reducing the weight of containers while retaining rigidity, in order to increase efficient carrying capacity.

For semi-trailer transport it is not easy to make a choice between the various techniques (standard horizontal transshipment techniques, vertical transshipment, wagons with rotary platforms and dual-mode systems), although it can be safely assumed that the first technique will disappear. Although it is possible for different systems to be used on different routes, it is necessary now to make a choice between the other three transshipment techniques so as to promote the general applicability of combined transport. Of great importance here is the possible inclusion of the various types of transport into one operation (terminals and the running of trains). Within the systems there should be maximal flexibility, because for the time being (to be considered as a transition period) there will be a rather wide range of means of transport, which allows for standardization only on essential points. As to semi-trailers, for instance, this means that they have to be of the closed type, because only they are sufficiently

burglar-proof (wagons are not guarded on their way), but also because this type can be basically used as a self-sustaining unit (greater rigidity).

3.9. Infrastructure

In the framework of this paper no thorough attention is paid to infrastructural problems of combined transport, most of them being well known.

Parts of the railroad system are overburdened, some sections are operated at almost full capacity and on a number of terminals, especially in Germany and France (and partly also in the Netherlands and Italy) there is little room for expansion of activities.

Apart from the capacity problem, there is a limited number of connections which have a sufficiently large clearance gauge (C). Particularly in France and the Transalpine tunnels (especially Italy) this clearance imposes restrictions on the loading height. Although there are plans to enlarge the clearance gauge, this is not to be expected in the near future. The development of new and lower wagons, also allowing for, e.g., volume transport, could be a short-term solution.

A more detailed survey of the infrastructural problems may be found in the A.T. Kearney study (1990), from which some conclusions are derived in Chapter 7.

4. THE USERS OF COMBINED TRANSPORT: THE DEMAND SIDE

4.1. The structure of the road transport market

a) The Netherlands

The professional Dutch road transport market includes 7 500 companies. The contribution of this sector to the national income was approximately 1.5 per cent in 1986. Internationally, Dutch road transport companies have a strong market position: 27 per cent of international transport in the EC is carried out by Dutch companies (18-20 per cent in long-distance travel), whereas the population of the Netherlands comprises only 4.5 per cent of the total EC population and the

Dutch contribution to the gross product of the EC is only 5 per cent. A third of the 7 500 companies is involved in international transport.

The road transport sector in the Netherlands comprises a great variety of markets. As a result it is very fragmented. There are a large number of small companies active on the market, but they differ strongly in the kinds of operations they are engaged in and in the areas in which they are active. From an analysis of these differences, it appears that it is particularly the large companies that form an interesting market for combined transport. Although small companies are responsible for a large part of total transport, their activities mainly concern domestic transport or short-haul international transport.

b) Germany

Compared to the Netherlands, the German market is dominated to a much greater extent by small companies. Many companies are extremely small in size, operate very traditionally and work only regionally. There are comparatively few large companies.

The strict regulation of the German market, which has been in force for a long time, has prevented competitive selection and the system of minimum rates has led to poor utilisation of equipment (utilisation of transport capacity is about 60 per cent). Although it is expected that some kind of rates system will continue to exist for the domestic market in Germany, structural changes can already be felt, e.g. the pressure to rationalise, take-overs and more co-operation. The competitive ability of the small and large companies is good, but this does not apply to the medium-sized companies. Reasons for this are the failure to reach a critical mass (balanced flows, incomplete networks, limited capital, lack of EDI and professional management).

As a result of their protected position, German road carriers are strong opponents of cabotage, and competition from foreign carriers is feared. It remains to be seen whether this fear is justified. A rationalisation process will undoubtedly take place and some companies will go under. But the result will be lower rates in domestic transport and as a result an improvement in hinterland transport from German seaports. In addition, German short-distance carriers are feeling more and more confined by their limited range of action.

It should be emphasized that the strict regulation of the German market does not mean that the German carriers concentrate only on the German market, as is sometimes believed. German road carriers play an important role in international transport, as is indicated in their high share of international EC transport. Studies

show that there are few differences in competitive ability between Dutch and German carriers.

c) France

Until some years ago, the French transport market was comparable to that of Germany. There was a strongly regulated domestic market with a rates system. The French Government, however, liberalised the market and abolished the rates system as of 1st January 1989. The French carriers concentrate even more on their domestic market than the Germans. There is a relatively large number of larger companies, but they are mostly organised in national networks. Supporting points of these companies are often located close to the French borders and international transport is carried out from these locations, e.g. Lille for transport to the Benelux countries.

The professional carriers in France are predominantly small companies. The domestic market is more important to the French carrier than the international transport market, as indicated by the fact that international transport makes up only 6 per cent of the total transport (tons) of the carriers.

d) Spain

In Spain there is an extremely large number of small companies. Eighty-eight per cent of the companies have only one vehicle and 99 per cent have less than five vehicles. However, the Spanish road transport market is becoming rapidly more important and is currently the fastest growing market in western Europe. In particular, the Spanish entry into the EC has boosted international transport and the number of Spanish vehicles on the French, Belgian and Dutch roads is increasing rapidly. Generally, the Spanish road carriers have very modern equipment at their disposal, for instance, refrigeration and deep-freezing trailers.

e) Italy

The vast majority of the more than 200 000 Italian professional road carriers are also small concerns: 82 per cent of the companies have less than two vehicles.

4.2. The shippers

The shipper is responsible for commissioning transport and therefore plays an important part in combined transport. If the shipper has transport on his own account, we speak of private transport, something that virtually does not occur with medium or long distances. Hence, at the moment, shippers are not users of piggyback transport, although developments in France (*Chronofroid/ Chronochemie*) and Germany (*Bahntanktransport*) suggest that this might change. In the container transport sector, shippers do deal directly with the suppliers of combined transport, although their market share is limited. According to Intercontainer, only 6 per cent of the freight is commissioned directly by shippers.

The role of the shipper as a direct user of combined transport, then, seems limited. However, shippers do have an interest in high-quality logistical service, so they may well have a great influence on the choices made by the transport companies.

4.3. Other parties

In addition to carriers and shippers, some other parties are of importance on the user side:

-- *Ferry companies*

The transport of trailers between Great Britain and the Netherlands has traditionally made an important contribution to the combined transport (piggyback) to and from the Netherlands. Although it is possible that the ferry companies arrive at their choices in the same way as the road transport companies, they nevertheless play an important role in piggyback transport.

-- *Shipping companies*

The largest part of combined transport in the broadest sense of the word concerns the transport of maritime containers to and from seaports. The container shipping companies generate the largest inland combined transport flows. The market has traditionally been the territory of the railway companies (Intercontainer). Until recently, the container shipping companies looked upon the transport of maritime containers as distinct from the continental transport market, which was the preserve of the road carriers. The road carriers were hired to transport maritime

containers to and from the hinterland. Now this is beginning to change. More and more container shipping companies (Nedloyd, CSX) are becoming integrators who are at home in all sectors of the transport market. These companies are rapidly buying road transport companies and creating their own inland networks in Europe. Hence, their interest in the continental transport market is growing and in the future they will also start to take an interest in other loading units. For instance, Sea-Land is researching the possibilities of swap body transport.

-- *Purchasing organisations*

Until some years ago, users of combined transport services hired capacity directly from suppliers -- container companies or piggyback companies. Generally, volume discounts apply to purchasing, i.e. the more transport, the less expensive. To be able to obtain volume discounts for small purchases, Netrail has been founded in the Netherlands. In other countries similar organisations have been in existence for a longer time.

Netrail brings together the demand for capacity of its individual members and obtains volume discounts for these members on the basis of the total demand. The members of Netrail are mostly shipping companies, shipping agents and a number of road carriers. At the moment the service of Netrail is limited to the transport of containers to and from other countries. Domestic transport is left to Holland Rail Container (subsidiary of Dutch Railways). Since expansion of services to include piggyback transport seems a logical next step and the mobilisation of forces seems a good catalyst for more co-operation between container and piggyback transport, the Ministry of Transport and Public Works has urged co-operation between Netrail and Trailstar. However, Intercontainer and the shareholders still have difficulties in formalising this idea.

It is conceivable that other kinds of purchasing combinations, e.g. through the road transport organisations, will be formed in the future. When considering improvements in combined transport, it is important that this market party be taken into account.

5. SELECTION CRITERIA FOR COMBINED TRANSPORT

5.1. Shippers

The idea that the shipper in principle selects road transport, after which the road transport company either chooses to use combined transport or not, appears to be mistaken. On the contrary, the shipper affects to a large extent the freedom of choice which the transport company has with regard to combined transport. Without exception, the shippers do not consider combined transport to have any added value. They all see it as a substitute for road transport in terms of the kind of service provided. It is noteworthy that the image of combined transport is dominated by railway transport. Most shippers consider combined transport to be synonymous with railway transport. The image that shippers have of the railways and therefore combined transport is plainly negative.

All shippers would find it unacceptable if the carrier were to switch to combined transport without prior consultation. Doubts about railway transport are still great and some explicitly require carriers not to use combined transport. The carriers' or shipping agents' freedom of choice, then, is limited. Most shippers have the impression that the railway companies pay little attention to their interests. They see themselves as important customers, yet they feel they are not approached accordingly by the railways. Contact is minimal. The shippers who do have dealings directly with railway companies -- for instance in the case of bulk transport and such -- also complain that the railways do not seem to devote much thought to their needs.

The doubts shippers have regarding the railways and the combined transport companies are a consequence of the market's lack of transparency. The shippers see the combined transport market as fragmented (lack of a single identity) and as being of low quality. The lack of transparency on the supply side (various parties offer partly comparable and partly different services) is seen as a problem.

Most shippers, however, do feel that combined transport has a good future. Some shippers ship part of their cargo via combined transport for tactical, defensive reasons. Since road transport will probably be restricted or curtailed in the future it may be opportune to invest in combined transport now. For some types of transport (dangerous goods, tank transport) shippers prefer combined transport. It appears, moreover, that shippers are willing to consider combined transport as an alternative to road transport if they are properly informed by the carrier about the pros and cons of combined transport and if quality of service is guaranteed.

The preference of shippers for road transport is the result of a combination of factors: delivery time, flexibility (in terms of time, space, quantity and ability to improvise), differentiation and range of supply and personal relations.

5.2. The road carriers

Combined transport and railway transport have a negative image among road carriers, in the same way as among shippers. In most cases this is due to unfamiliarity or negative past experiences. There is a large difference in perception between users and non-users of combined transport. In most countries this difference has been demonstrated.

As far as costs are concerned, it may be concluded that the use of combined transport can offer cost savings in comparison with road transport. The advantages are limited, however, and strongly dependent on the type of trip. In the case of longer connecting routes or if there is no return load, combined transport quickly becomes disadvantageous. Hence, if combined transport is to be a large-scale alternative to road transport, larger cost savings are necessary. The best chances of achieving such savings can be found in the removal of organisational restrictions, as outlined in one of the previous chapters.

As far as legal aspects are concerned, pick-up and delivery of combined transport is usually considered as cabotage or short-haul transport under current regulations. This means that combined transport can only be engaged in with a foreign partner or by establishing a foreign office with a domestic transport licence. A recent change in EC Guideline 75/130 has pick-up and delivery of combined transport freed of these restrictions as from 1st January 1992. Although, in practice, the implementation might be burdensome in the beginning, by this liberalisation it will be possible for a (small) carrier to offer two or three units to combined transport and transport one unit by road, in order to have a truck available on location to perform the pick-up and delivery.

The non-users

According to the non-users, the most important barrier to using combined transport is the size of the vehicles (volume transport) and the end-haul organisation. In addition, speed as well as arrival and departure times, in combination with specific characteristics of the goods (bulk, flowers), are cited as problems. The role of the shipper is also mentioned as a contributing factor in the choice for road transport. These arguments stem from the non-users who

have never used combined transport; those who have, but then discontinued always mention high costs and poor reliability.

In conclusion, it may be noted that there are possibilities for (partial) substitution with regard to non-users. If all the improvements in combined transport desired by the carriers were carried out, a considerable share of long-distance transport would be replaced by combined transport, according to the non-users. However, an important distinction in this regard is the question whether or not the carrier is engaged in volume transport. Carriers who are not engaged in volume transport estimate that the share of combined transport for their own transport on the two axes to and from the Netherlands could be between 45 per cent and 100 per cent. Carriers who are engaged in volume transport estimate that, for them, the maximum share of combined transport would only be between 0 per cent and 20 per cent. These are important data, in view of the expected strong increase in volume transport in the future.

The users

For about half of the users the choice is often fixed from the beginning, but the users not only show a fixed preference for road transport in some cases (e.g. with volume transport or where the railway service is poor on some connections), but also for combined transport in other situations (e.g. where a combined transport company offers high-quality service or if the weight of the shipment makes combined transport preferable). The other half of the users balance the pros and cons of road transport and combined transport in any given case. The shipper usually plays a part in this as well.

As for the reasons for choosing combined transport, half of the companies base their choice on cost considerations, sometimes in combination with other aspects. It is noteworthy that, apart from low costs, many different reasons are mentioned. Each company seems to have its own specific reasons for using combined transport. The most important reasons are: to restrict road transport of dangerous goods, to avoid regulations governing driving hours, higher carrying capacity of combined transport (tonnage), absence of return load(!), increased utilisation, flexibility and reliability.

All users of combined transport are aware of the existence of several organisations for container and piggyback transport. Most carriers only make use of piggyback transport companies (Trailstar, TRW, Kombiverkehr). Intercontainer is used only sporadically. The quality of service supplied by the piggyback companies is considered to be higher (faster, less expensive); Intercontainer is opted for only when there is no piggyback service available on a given

connection. Moreover, the fact that the piggyback companies supply only terminal-to-terminal service plays a role. With regard to the competition that exists in combined transport, most carriers think there are advantages in more co-operation on the supply side (higher efficiency, expanded services). On the other hand, the current situation also clearly has its advantages (i.e. more co-operation has its disadvantages), e.g. the competition that keeps the combined transport companies alert and a stronger negotiating position for the road transport companies *vis-à-vis* the railway companies.

The users of combined transport only expect a considerable increase of combined transport on long distances, both in general terms and in regard to their own activities. In particular, the share of combined transport from the Netherlands to Italy is expected to grow even more. In addition, Spain is constantly mentioned as the most suitable market for combined transport. On these two connections, the carriers might switch completely from road transport to combined transport, assuming of course that the required facilities are available and the necessary improvements have been made. On other important connections a complete switch is not possible, but the carriers expect combined transport to gain a substantial market share. In comparison to the long-distance connections with Italy and Spain, the quality aspect (particularly travelling time) is even more important on these connections (southern Germany and southern France).

As far as improvements were concerned, the factor regarded as most important was the price. According to the carriers, combined transport rates are 10 per cent to 20 per cent too high to make combined transport an interesting option. Other elements which the carriers would like to see improved were (in descending order of importance): travelling time, delivery times, shipping, standardization, end-haul organisation.

5.3. The other parties

Ferries

Ferry transport forms an important basis for combined transport to and from the Netherlands. This mainly applies to trailers carried between Great Britain and other European countries by way of Dutch ports. The majority of transport to and from the ferries is done by road. The type of transport -- accompanied or unaccompanied -- and the characteristics of the ferry company largely determine whether combined transport is used. There are ferry companies whose function is limited to taking accompanied vehicles from other transport companies across

the sea. This mainly concerns road transport. This type of ferry company does not attach much importance to good combined transport facilities. Their wait-and-see attitude will only change if important customers start asking for combined transport or if orders are lost due to lack of combined transport facilities. In that case, an important question for the ferry company will be who will have to make the investments -- the company itself, the railway company or the port authority, etc. The situation is entirely different in the case of unaccompanied transport (trailers only) and in those cases where the ferry company is also engaged in road transport (and therefore transports its own units). For this type of ferry service, combined transport is important as it benefits from good combined transport services.

6. DEVELOPMENTS INFLUENCING THE TRANSPORT MARKET: EFFECTS ON COMBINED TRANSPORT

6.1. Europe 1992

The measures taken within the framework of Europe 1992 have no direct effect on the organisation of inland shipping and rail transport other than that, for instance, customs inspections are dropped. As a result of the Mannheim Act, transport on the Rhine has in fact already been liberalised and rail transport cannot be changed as a result of its very structure (national, monopolistic, management of infrastructure and exploitation all in the same hands). Indirectly, however, both types of transport are nevertheless affected, as their competitive positions with respect to road transport are changing. As the available possibilities are being increased, competition between transport companies will be stronger, which is very likely to lead to lower transport rates. In the United States, where the trucking industry was already deregulated in 1980, this development did, in fact, occur and the increased productivity (65 per cent drop in empty trips, capacity shake out, $30 billion productivity improvement) was attended by a drop in rates and costs (saving $65 billion on overall logistic costs). The Kearney report for the European railways predicts reduced rates for transport by 12 to 15 per cent (A.T. Kearney, 1990). In view of the importance of the "rates" factor when choosing between road transport and combined transport and the minor difference between the two in the current situation, the rates for combined transport will have to be reduced as well.

Apart from a possible improvement of the possibilities in the end-haul organisation for combined transport (*Anschlusscabotage*), an internal European

market will, in general, worsen the competitive position of combined transport. In order to maintain, if not to improve, the competitive position, the rates will have to be lowered and adjustments in the rates structure may be required as well, for instance, by introducing a one-way fare, resulting in a flexibility comparable to road transport.

6.2. Alpine transits

The transport policies of the Alpine countries will lead part of the road transport to a more or less forced switch to combined transport. If the current measures do not have a direct result, more rigorous steps are conceivable; the minor effect of the night-driving ban in Austria already gives an indication that these results will not be realised.

In the Alpine countries, the problem of transit traffic ends at the border and therefore systems like the rolling highway, considered less desirable in other transport corridors, receive much attention, too. The rolling highway is considered an alternative for the small road carrier here and is being further developed for that reason, in spite of the 50 per cent difference in rates which exists between accompanied and unaccompanied transport (according to Okombi).

Although it appears from the interviews that Dutch road carriers, too, make frequent use of the rolling highway connections in the Alpine transits, the most important aspect will be the use of the unaccompanied combined transport of trailers, swap bodies and containers. In fact, these latter forms of combined transport are the only ones that affect the Dutch situation. The vast majority of the people interviewed (92 per cent) think that in the future a more intensive use of combined transport will be necessary because of restrictive measures which Austria and Switzerland as well as other countries (are about to) impose on road transport.

6.3. Environmental aspects

Research shows that the rolling highway does not contribute to the reduction of energy consumption in the transport sector. In addition it may be concluded that trailer transport by rail may provide energy gains, provided that the distance of the rail track is over 800 kilometres, that the track does not cross mountainous areas and that the rest of the characteristics of the trips are favourable as well. In roll-on/roll-off transport, limited savings are possible too, provided that the trip characteristics are favourable. The most interesting transport method is swap

bodies, for which there are significant reductions in almost all situations. With respect to all types of transport, one can say that not all trips should be substituted in this way. In particular, the characteristics of pick-up and delivery largely determine the energy gain or loss in case of a switch to combined transport or inland navigation. Long pick-up and delivery distances negatively affect the comparison and when an empty vehicle is used on one of the parts of the trip, for instance, on the trip to the terminal to pick up a load, the scales soon tip against combined transport.

Generally speaking, the comparison of the energy consumption of combined transport in the present situation does not always tip the scales in favour of combined transport. Energy consumption, however, is only one of the factors in the social comparison between road transport and combined transport. It is clear that factors such as reductions in the emission of hazardous substances may multiply energy gains. Factors like road congestion, noise pollution, safety, etc., should be included in the comparison. Such an overall comparison will be more positive for combined transport than a comparison on the sole basis of energy consumption would suggest.

6.4. International transport policies

Without doubt, the most important aspect affecting the position of combined transport (to and from the Netherlands) is the large gap between national and supranational interests. The study lays special stress on the large gap between domestic transport flows and international flows in France and Germany, emphasizing the secondary importance granted to international transport and a system which is anything but ideal for such transport. The main cause for this in France is the manner in which French road carriers operate, with domestic centres, plus the traditionally limited French interest in matters concerning other countries.

In Germany, another element plays a very determining part: the harbour policies of the German Government. The strength of the north German seaports, Hamburg and Bremen, is primarily determined by their good rail connections with the hinterlands and corresponding rates systems. On 1st April 1988, the Maritime Container Network, with the so-called in-grid rates system, became operational for western North Sea ports like Rotterdam and Antwerp, for transport of maritime containers to and from the German hinterlands. One all-in rate to and from a seaport applies to all places within one grid. In practice, the rates of the various seaports are very different and, generally speaking, transport to one of the north German seaports is apparently cheaper than transport to the western ports.

In one case, the distance to Hamburg is over 40 per cent shorter, but the rate is 11 per cent higher. In a second case, the distance to Antwerp is 8 per cent shorter, whereas the rate is 40 per cent higher. The same applies to other destinations in Germany, like Frankfurt, which is 63 kilometres closer to Antwerp than to Hamburg, but for which the Antwerp rate is 8 per cent higher. The main reason for these rate differences seems to be the agreement that the implementation of the in-grid and KLV-NEU rate system for the western seaports should not be at the expense of the north German ports (Gohlke, 1989). The main goal is a substitution of road by rail.

In view of the longer rate distance, the transport of domestic units is much more interesting for German Rail than the transport to and from the Netherlands and Belgium, in which cases part of the profit has to be shared as well. Apart from the rate difference for both maritime containers and the transport of swap bodies and trailers, there are also quality differences between transport services starting in Germany and those from the Netherlands. The differences between the Kombiverkehr and Trailstar schedules for Verona and Busto-Arsizio, for instance, are typical.

It will be clear that real combined transport can only be realised when national transport interests no longer prevail above international interests. The question is whether or not certain sectors in Germany itself will tamper with the rates and harbour policies of German Rail. The gigantic losses suffered here cause the pressure on the road transport sector and on inland navigation to increase. These sectors also increasingly urge for an adjustment of the rates without the political aspect playing a role in this any longer.

6.5. Logistics, developments in transport flows

The transport sector is in a transition process as a result of logistic changes in the shipping trade, transport policy developments and conceptual changes in the transport sector itself, among other things. The basis of the changes lies in the developments taking place in the shipping trade. Logistic developments for shippers lead to changes of locations and shipping patterns, which affect the organisational aspects. There are, in fact, two main developments with a number of related or derived aspects. First of all, there is the development from a sellers' market to a buyers' market and secondly the increasing international branching and competition. This trend of internationalisation (towards global markets and global products) is greatly facilitated by the ever-improving transport potentials. Production is increasingly aimed at a global market, with assembly facilities localised in such a way that the advantages of the various markets are combined.

Quite often more independent business units in the various countries perform specialised tasks for the entire company, which restricts its own activities to management and co-ordination.

In general, the number of suppliers is decreasing. This tendency can be summarised as a concentration within a de-concentration. This results in a different structure of freight flows, plus the development of new transport concepts. This second development leads to shifts in production, assembly and distribution structures, which may imply both a concentration and a de-concentration of activities. Fast and reliable transport techniques enable this globalisation. The transition from production for an anonymous market (buyers' market) and the corresponding increasing variety of products and decreasing lifetime-cycle result in increasing demands in terms of flexibility and quality, both with respect to the product itself and regarding production and services to other companies and, finally, the customer. These increasing demands with respect to flexibility and quality will necessitate changes in the production process and consequently, changes in transport. With respect to production, the answer lies in increased flexibility, internal process control systems and integration of functions, just-in-time production and delivery, decreasing stocks and concentration of activities. The implementation of these changes is strongly connected to the nature of the production process.

The functions of the various parts in the chain will change from being consecutive and more individual links and tracks towards chain management. Functions may shift: transport companies, for instance, taking over warehouse management and assembly tasks from production companies, trading companies taking over distribution functions, etc. The relations among the several parties involved are increasingly moving towards "co-makership" or, in the case of transport companies, "co-shippership". Not every transport company is capable of acting as a logistic service company. This requires a certain scale and, in addition, a guaranteed high quality. In the present situation there are only a limited number of larger companies in the Netherlands that can be classified as logistic service companies. Very small companies will increasingly be acting as subcontractors for these logistic service companies, thus retaining their right to exist. Smaller and medium-sized companies are facing a dark future if no substantial changes are made in their strategies.

Generally speaking, the logistic trends in combination with other trends such as the internal European market may be translated into:

-- Changing organisation, more (international) co-operation;

-- Changing road carrier/shipper relation and, consequently, an extension of the activities package of the road carrier;

-- Improved productivity;

-- Increasing computerization;

-- Specialisation and diversification;

-- Growth of long-distance transport;

-- Smaller shipments and higher frequency;

-- Increasing containerisation, use of standard loading units.

The analyses in the study show that combined transport fully belongs to the road transport market and that the characteristics of this type of transport should fit with the operations of the road carriers. Thus combined transport is a link in the road transport chain and the question to answer is whether combined transport fits into the new logistic concepts.

A number of the trends will have a positive effect on combined transport. The tendency towards co-operation, improved productivity, the growing long-distance transport and the increasing use of standard loading units are examples of this.

The changing relation between road carrier and shipper can have various consequences for combined transport. The road carrier takes over activities from the shipper and performs these in close consultation with the shipper ("co-makership"). For the execution of several elements of the job, the road carrier may contract third parties, for instance, for the transport function ("co-shippership"). In these cases, however, the exchange of information between the parties involved should always be optimal, so that the various processes will be properly adjusted to one another. One of the prerequisites is a good information system, which is becoming more and more important for combined transport as well. Services will only be contracted out if the service company in question is able to guarantee the high quality of the product offered. For combined transport to be successful as a partial transport substitution, therefore, this implies that it will have to offer benefits comparable to road transport.

The rise of Just-in-Time systems in general implies a reduction in volume of shipments and an increase in frequency. In short-distance transport this leads

to the deployment of a greater number of vehicles in the short term and the deployment of smaller vehicles in the longer term. Naturally the transport costs per unit increase significantly and the necessity for consolidation of several smaller shipments will grow as well, certainly for the longer distances. Contrary to shorter distances, the benefits of improved productivity are greater than those of transporting more frequently with smaller units. For longer distances, then, there is a development towards deploying larger vehicles, with much attention being given to the consolidation aspects. Smaller cargo volumes will, then, have no effect on the use of combined transport.

In short: the developments towards a changing organisation of transport, and consequently towards higher productivity and increasing transport flows, all contribute to the position of combined transport. Changing volumes and frequency have little effect on long-distance transport and consequently on combined transport, although some road carriers hold a different view on this. An important point is the increased attention given to aspects such as quality, speed, reliability, frequency, flexibility, etc. and, in connection with these aspects, the availability of a proper information system.

6.6. Information technology

One of the characteristics of combined transport is that part of the route by road is substituted by rail transport. So combined transport is in the first place a matter for road carriers. Information systems will have to adapt accordingly. In other words, information systems are essential for the railway companies but should not necessarily be the central element. Road carriers must be able to obtain part of their information from the railway system, but they will have to communicate electronically with their customers as well. The (co-operative) piggyback organisations might be most suitable for this job. However, the international standard messages for road transport should be duly considered. The standards of the European rail system, HERMES, are not suitable because they have been set by UIC, not by the international standardization organisations.

For present-day combined transport, computers are linked up to only a limited extent. If they are linked up, it is always bilaterally, i.e. ad hoc between two of the many involved. Within UIRR, a working group is working on an information exchange pilot. The individual combined transport companies and the railways are also building information systems specifically for combined transport. Recently the DISK system (Dispositioning and Information System for Intermodal Transports) became operational in Germany on 28 terminals for combined transport. At the moment, DISK contains checking and monitoring

functions and functions for the exchange of information between sender, carrier and receiver. In France, CNC developed the INFOTAINER system. The electronic mail service system contains functions for order processing, tracking and tracing, electronic invoicing as well as a database.

The interviews indicate that the information supply in combined transport is as yet insufficient. This refers not only to the connection of their own information systems to those of the railway or combined transport company, but also to supplying information in general. It was pointed out, for instance, that the sending or receiving parties were not informed when problems (like delays) arose during a transport operation.

Actually, increased computerization in transport will not immediately affect the use of combined transport. This, at least, is the opinion of over 70 per cent of the people who were interviewed. This percentage is slightly lower for the non-users of combined transport. An indirect negative effect, however, is possible if the combined transport companies do not adequately respond to the developments described. Thus a good information system in combined transport is one of the quality characteristics which co-determine the competitive position with respect to road transport.

6.7. Standardization, dimensions and weights

In addition to the remarks made in Section 3.7. above, it may be noted that one of the main problems in combined transport is the lack of standardization of freight units. Following the basic philosophy of this study, which takes the wishes of the users as its starting point, the problem is approached from this angle as well.

For combined transport this means that the developments which are feasible in road transport are to be considered as a starting point for the question of what standard dimensions are to be introduced. Road carriers are, after all, the potential users of combined transport. This means: longer, wider and higher than is possible at present. To virtually every road carrier in the Netherlands, combined transport is only a side activity, which will consequently not be decisive with respect to the shaping of his fleet. More often the opposite will be the case.

On the other hand, the wishes of the road carriers are restricted by the actual possibilities and regulations concerning the road and rail infrastructure.

Without the use of standardized loading units, however, combined transport will never reach the degree of efficiency that is necessary to be feasible. Therefore, the finding of a compromise between the wishes of the road carriers (and their shippers) on the one hand, the requirements of the railways concerning an efficient operation and the financial possibilities of governments for infrastructure adaptations on the other hand, will be very difficult.

It is hoped that the project COST-315 (study on the economic and social costs and benefits of the introduction of larger standardized dimensions) and the discussion under way within UNECE, Geneva, will lead at the end of the day to a new standard that is acceptable to all parties concerned.

7. IMPROVING COMBINED TRANSPORT

The combined transport market is facing a tremendous challenge. An enormous market is still waiting to be explored and, with respect to a number of interesting connections for combined transport, this (potential) market is not actively broken into. The political climate is also favourable to seriously promote international combined piggyback, swap body and container transport. Congestion in the road network, problems with the Transalpine connections and environmental disruptions of freight traffic on the roads are the main arguments in this respect.

It is clear that, in view of the volume of transport, the developments in the user target group and the improvements which are possible from the supply side, a considerable expansion of combined transport will be possible. However, the analyses also show that combined transport does not offer an alternative for road transport everywhere. In certain geographical relations, for particular goods, for specific units and for certain trip characteristics there is no alternative for road transport. One should not, therefore, get the impression that the promotion of combined transport is the only solution for the problems in international transport. Other matters, especially improvements in efficiency in road transport, remain of prime importance. However, it is clearly not a choice between either/or but rather and/and. In that case combined transport is one of the important means to provide solutions for transport problems in particular cases (connections and types of transport).

In promoting combined transport, its limitations should be taken into account, but also its realistic possibilities. In specific cases, combined transport

is a viable alternative to road transport. The advantages in terms of energy consumption, emission of hazardous materials, etc., cannot be disputed and there are also demonstrable advantages for the user, which is an essential precondition. These advantages, however, will only be available if the organisation of the system (terminal locations, schedules, etc.) is such that combined transport is an attractive alternative. Unfortunately, this is only the case on a few connections at the moment. The previous chapters have shown that the current market still provides sufficient room to expand the combined transport volume.

To achieve a real breakthrough in the market for combined transport, a "jump ahead" is needed. In order to achieve this, it is necessary to break through the *status quo* and to remove a number of obstacles.

Improvements

There is ample opportunity to expand combined transport, while maintaining the current structure of the market, but this expansion does not materialise because the existing obstacles are sustained. Only a "jump ahead", in which case the various parties may have to leave their historically acquired positions, will really enhance the position of combined transport.

To indicate where the improvements should be made to achieve the first goal (improvements in the current market) or the second goal (actual strengthening of the position of combined transport), it may be useful to give a short summary of the problems or weak points obstructing the use of combined transport, as derived from the previous chapters:

-- Adequate provisions for combined transport are only supplied on a number of connections;

-- The competitive position as compared with road transport (rates, frequency, time) is favourable for a few connections only;

-- The supply structure is too rigid (the rates system, for instance);

-- Combined transport has a bad image (synonymous with rail transport for the users' group);

-- The network of terminals is sometimes too limited (in the Netherlands, for instance);

-- Certain loading units used in road transport cannot be accommodated by combined transport companies;

-- Restrictions on the demand side (with respect to organisation) obstruct more extensive use;

-- The facilities beside the transport service itself are too limited (terminal facilities, unit pooling, information supply).

This summary provides those points that directly relate to the service itself and consequently to the user. Other problems mentioned before are, in fact, the causes for the weak points listed above. For instance:

-- International interests are secondary to national interests, obstructing the building of a good European network;

-- Co-operation between the parties is limited, which has a negative effect on both the number of services supplied and the costs.

The improvements which would be desirable to alleviate these problems and weak points cover various fields, including:

-- Infrastructure;
-- Technology;
-- Market relations;
-- Legal aspects;
-- Competitive position with respect to road transport;
-- Package of services;
-- Changes on the side of the user;
-- International transport policies.

Infrastructure

The most important improvements for infrastructure concern the removal of bottlenecks. The A.T. Kearney research includes an inventory of the tracks involved and presents an estimate of the investments that will be required.

However, by merely improving the infrastructure one cannot guarantee that an adequate network structure will be implemented. What is lacking is a related network of terminals, which can cope with an optimal bundling of the transport demand and which offers adequate connections to a network of a lower order (regional connections) as well as to a network of a higher order (the European

terminal network). In this respect it is important not to look at the network of a specific country as an isolated structure, but in combination with the networks of neighbouring countries.

When developing such a network, the first thing requiring attention will be the consequences for the services themselves and the transport costs involved. Secondly, the possibilities may be studied of acquiring additional means to optimise the network from an environmental point of view.

Technology

The most important improvements with respect to technology concern the developments in volume transport. It is significant that the developments in combined transport are derived from those in road transport. It was concluded that containers and swap bodies are to be preferred to the trailer in combined transport for various reasons. As yet, the dual mode systems that have been developed cannot offer a competitive alternative to conventional piggyback transport. If the market is to function optimally, it is probably better to strive for a certain degree of standardization and to develop and introduce alternative techniques only when their commercial advantages have been demonstrated. A diversification of transport and handling methods will inevitably lead to compatibility problems and require additional investment in terminals.

In view of the fact that a large segment (the size may differ by country/region) of combined transport is related to sea transport, it is very important to adjust developments in both sectors when developing new technologies. Standardization of loading units is one of the major conditions for the realisation of an efficient and effectively operating combined transport system.

Market relations and co-operation

An essential element in working towards an effective and sound combined transport system in Europe is the realisation of a clear and well-organised market structure, which is first of all directed at sub-markets as distinguished by transport demand, and which is not being dominated by historically-based segmentations and alleged conflicting interests. This calls for transport services that are directed at each of the different product/market combinations. This does not alter the need for the creation of a wide variety of transport choices, taking into account the form of the transport unit, the desired terminal haul organisation and so on.

The confusing competitive positions between container transport companies and piggyback carriers should be broken through. Operational co-operation is

needed in the form of joint exploitation of lines and terminals. After which, commercial co-operation may be achieved by combining sales outlets and sales organisations. In order to achieve this, it is probably desirable that an independent co-ordinator should be appointed, who acts independently of the parties and prepares suggestions for operational and commercial co-operation.

A very good catalyst in realising co-operation might be achieved if the decisions of the EC Council of Ministers concerning allowing third parties to the (railway) network, the introduction of the so-called *Trennungsrechnung* (separation of exploitation and infrastructural costs) and commercial co-operation between national railway companies, were to be implemented.

Competitive position

The competitive position of combined transport in relation to road transport is only favourable for a number of connections. Transport quality (time, frequency, pick-up and delivery times) should be comparable to road transport. What appears from analyses in the Netherlands is that the possibility for cost cuts is a precondition for the use of combined transport.

The competitive position of combined transport may be qualified as weak. The quality of the service must be improved and obvious cost advantages are an absolute prerequisite. The question is whether the competitive position of combined transport is coming under more pressure. For it is still not clear how the scales will tip in the cost ratio. The cutting of costs, expected in road transport especially after liberalisation, should be counterbalanced to a certain extent by higher costs as a result of environmental taxes and so on. Since the building of new highways is no longer politically acceptable in all areas, developments such as increasing road congestion will unfavourably affect the quality of road transport.

Instead of waiting to see how these insecurities will turn out, it is imperative that cost savings be considered, in particular:

-- Strengthening international co-operation;

-- Making the rates system more flexible and adjusting it to users' demands;

-- Reduction of rail transport costs (according to A.T. Kearney, 20 per cent savings are possible in the chain);

-- Improvement of productivity.

The future strategy

The strategy to achieve a substantial increase in combined transport will have to consist of a well-chosen combination of the above-mentioned possibilities for improvement.

A strategy plan must be developed on a European scale and should include:

-- The development of a long-term vision on techniques in combined transport and handling methods. Failing investments as a result of the lack of such a vision, e.g. investments in terminals and equipment, should be avoided;

-- The supply structure required, for instance concentration on only a few main routes, or a secondary network as well (for instance, the connecting lines to the main terminals) and perhaps a basic supply (from all shipping points), but always based on demand characteristics;

-- Paying attention to performance characteristics and productivity improvement;

-- Co-operation between the various parties. Working towards one organisation with perhaps several branches or towards an open, clear competition;

-- Supply must be adjusted to the product/market segmentation; the right product for the right market.

What is important in all this is that the traditional approach is turned around: combined transport should be shaped to the market and by demands within the market.

TABLES

Table 1. **Number of road transport trips (units, conventional and containers) per day, for two-way piggyback traffic and container transport by rail (only 1986 figures were available for all categories)**

Country	Road	Piggyback	Container/rail
West Germany	8 865	3	128
North + Central	7 865	0	84
South West	535	0	24
South East	465	3	19
Austria	160	10	15
Switzerland	175	4	76
Italy	625	41	139
France	2 200	0	27
North	1 800	-	16
South	400	0	11
Spain	250	-	3
Portugal	30	-	0

(0 = nil; - = absent)

Source: NEA, CBS, Trailstar, Intercontainer.

Notes to the above figures:

-- Since 1986 there has been an increase in combined transport to and from the Netherlands; there have been, however, no structural changes. The share of combined transport compared with road transport is still very small;

-- The region indicated is not in all cases the final destination. Some figures show combined transport to Munich, the final destination, however, being in Austria and the last part of the trip being performed by road;

-- Many Dutch road hauliers use terminals abroad (especially Antwerp, but also terminals in Germany);

-- The daily number of road transport trips refers to loaded trips, while the combined transport figures also include empty units. According to Trailstar, approximately twenty per cent of the units carry no cargo and with Intercontainer some twenty per cent of the containers to and from the Netherlands are empty. For the sake of comparison: in international road transport the share of empty trips is also approximately twenty per cent.

Table 2. **Outgoing transport trips (1986) arranged according to exports, non-containerised transit and containerised transit**

	Exports	Transit non-cont.	Transit cont.	Total
South-west Germany	215	47	23	285
South-east Germany	255	38	22	315
Austria	65	17	8	90
Switzerland	90	20	10	120
Italy	275	46	9	330
Eastern axis total	900	168	72	1 140
South of France	178	25	12	215
Spain	105	13	7	125
Portugal	12	2	1	15
Italy	70	13	2	85
Western axis total	365	53	22	440

Source: NEA, CBS.

Table 3. **Incoming road transport trips (1986), subdivided into imports, non-containerised transit and containerised transit**

	Exports	Transit non-cont.	Transit cont.	Total
South-west Germany	195	35	20	250
South-east Germany	110	31	9	150
Austria	60	7	3	70
Switzerland	40	11	4	55
Italy	150	16	4	170
Eastern axis total	555	100	40	695
South of France	162	15	8	185
Spain	110	12	3	125
Portugal	13	2	0	15
Italy	35	4	1	40
Western axis total	320	33	12	365

Source: NEA, CBS.

SUMMARY OF DISCUSSIONS

SUMMARY

1. OVERALL PICTURE

There is a great deal being said about combined rail-road transport as a possible answer to what seems to be the inevitable saturation of road infrastructure. Environmental problems are also tending to make combined transport a focus of attention, while flows of traffic will be increasing with the establishment of the Single Market. In such a context combined transport would seem to be an ideal solution since it apparently reconciles rail and road. Its development has not come up to expectations, however, despite the environmental benefits and energy savings that the mode offers. It is of course a fact that the railways may also act as forwarding agents and, as such, may well be more concerned with supervising the commercial aspects of freight than with the transport modes that they operate. Moreover, combined transport uses public facilities and operates in a European context; intervention by the authorities is necessary, although budget resources have become scarce in a period of slow economic growth. These difficulties are compounded by equipment standardization problems: companies are independent and it is difficult to ensure the necessary consultation among them.

The development of combined transport is situated in a specific context. There was, in fact, a very substantial increase in intra-Community freight transport between 1958 and 1977. Intra-Community traffic expanded by a factor of 16 as compared with only 8 for extra-Community trade during the same period. The leading economic areas are becoming stronger. Transport flows are concentrated and growth rates for freight traffic are put at 4 per cent a year for the next fifteen years. The development of the European road network has been accompanied by a steep increase in international road haulage.

Road network saturation and proneness to accidents are problems at a time when the building of new infrastructure is meeting public resistance for environmental reasons. To curb the growth of road haulage, some transit countries have opted for a regulatory approach by restricting traffic. In many countries, alternatives to road transport would be more competitive if only the basic rules on driving time were complied with. But it is difficult to do anything

about the situation because there are so many small operators who are not complying with regulations because they are subject to the usual pressures brought to bear on sub-contractors.

As an alternative to road haulage, combined rail-road transport is seen almost as a transport mode in its own right. The complexity of combined transport, however, has to be remembered, for it involves many different parties and a wide range of equipment. The problem which may arise is that of co-ordinating these various parties and also, in economic terms, the build-up of successive profit margins. The combined transport operator must co-ordinate the technical interfaces for the general organisation of transport operations. Intermodal technical units are an important aspect of combined transport. The weight of goods that can be carried differs greatly depending on whether the rolling road or swap body is used. Since the dead weight of the tractor vehicle does not have to be carried in the latter system, it appears economically more efficient.

Compared with end-to-end road transport, combined transport generates productivity gains on the main rail haul and losses during transfers of load. This limits the routes on which combined transport is competitive. In France, where road haulage prices are tending to diminish owing to very keen competition in this sector, combined transport becomes competitive at distances of 500-600 kilometres or more.

The market share that can be taken by combined transport will depend on the concentration of flows, their balance and the possibility of providing quality transport on rail's main routes. The Round Table specialists considered that combined transport had substantial growth potential but that this would depend on the quality and cost of services provided. Cost itself depends on rail traction which has remained a railway monopoly. The other three factors which affect the price of combined transport services are the cost of positioning intermodal technical units, the cost of intermodal transfers and the cost of terminal hauls by road. The ideal is to have interval-timetable services carrying very heavy flows between two major centres. Terminal hauls by road are an essential factor in the efficient organisation of distribution channels. Since the price of combined transport is not sufficiently competitive in many cases, it is essential to improve productivity with respect to all of its component parts.

Any policy for developing combined transport calls for the provision of the kind of service that shippers want and a selection of routes on which this kind of service can be offered. The railways must also avoid an unstable tariff policy and keep to a steady tariff base so that operators can optimise the use of the technique and plan their investment policies. Loading/unloading operations must also be

speeded up so that two trains can be handled within the same time slot. The necessary investment would probably depend on the railways or the authorities, so that some rules would have to be modified. When a carrier decides to change to the combined transport technique, he has to invest in a number of intermodal technical units, a major investment decision that is difficult for small and medium transport operators to take.

2. FACTORS IN THE DEBATE

Overall, combined transport cannot provide a solution to motorway network saturation. Its potential can be put at the equivalent to one or two years' growth in road traffic. The technique of channelling dispersed flows towards a junction point in order to set up a complete train may extend the areas open to combined transport. Combined transport is competitive on long routes between major centres. Its advantages in terms of energy savings, limited environmental disamenities and the safe transport of hazardous goods are therefore quite obvious.

At present the volume of traffic won in competition with road haulage is small. New ideas are needed to organise logistical systems and make better use of existing infrastructure with rapid services.

Some specialists at the Round Table considered that the role of railways had to be limited to their basic function of hauling trains. Terminals would thus be multifunctional centres used by separate partners. The high cost of combined transport cannot be justified without increased productivity and smooth operation. Services must, in fact, be geared to the market and designed to meet demand. Profitable operation requires a marketing system ensuring that trains are used to full capacity. If there were to be competition on networks, rail transport might also be obliged to operate more profitably. Structures could then be created in which all the parties concerned would compete on an equal footing. It should also be noted that, insofar as combined transport will be developed on major routes, it has to be incorporated in a European and not in a national transport policy. This is particularly the case because the competitiveness of combined transport depends on the prices charged by road hauliers and it seems reasonable to say that the latter's services are under-priced.

A number of the specialists thought rail has too much influence in combined transport and that this has a detrimental effect. Railway management reportedly

has its shortcomings and suffers from bottlenecks. Here we are speaking about administrative problems, whereas the aim should be to promote private initiative -- particularly for the operation of terminals -- and consider doing what is done in road transport, i.e. separate infrastructure from operation. Heavy subsidy for rail without an increase in efficiency would thus be avoided.

Other specialists pointed to the complexity of the rail system in which capacity is limited by the fact that trains do not run at the same speed, different routes are selected for high-speed passenger trains and goods trains. Passenger and goods trains could run at the same speed if they had a dedicated track, which would considerably improve line throughput. However, with the opposition of environmentalists to new infrastructure, it takes considerable time to build new lines, so the tendency is to seek to improve network efficiency in the short term. Some specialists even consider it more important to improve existing infrastructure than build new lines. For example, line performance can be stepped up by means of new information technologies.

Despite the progress made, the lack of flexibility in rail services was unanimously deplored. Owing to the heavy investment required in combined transport, operators must co-operate with the railways, which by no means leaves rail with a minor role. If markets are to be organised, there is a real need for consultation and co-operation among the parties involved in combined transport.

Since railways are abandoning traffic by individual wagon, they cannot do without combined transport activity. Where railways are not only carriers but also freight forwarders, a commercial conflict may arise when they have to choose between their subsidiaries and other operators specialising in combined transport. This commercial decision will take another form with the allocation of slots by means of contracts. Notwithstanding co-operation with rail, the problem of the fair allocation of available train paths will arise. The price mechanism may have a regulatory function, but what will happen in the event of delays or the non-respect of timetables?

At various points in the Round Table proceedings it was pointed out that shippers very often do not wish to deal directly with the railways, the explanation being that road hauliers are much more flexible. For example, it is very difficult to run combined traffic trains on passenger lines at certain times. In France, the TGV uses the conventional network in the vicinity of towns. In Paris, a goods train may take three hours to move from the suburbs to the loading site.

Some Round Table participants considered that rail was not trying to improve the quality of its services, for example, by guaranteeing forwarding

times. But this view was not shared by the majority. On the contrary, some participants thought that the quality of service has been improved. Delays are due to various factors such as the occasional strike, works and incidents which are compounded by the saturation of the rail network. In terms of quality of service, what counts is that the goods should arrive on time and not the possibility of obtaining a refund in the event of a delay. This is due to the spread of "just-in-time" logistical operations, in which it is essential for the customer to be warned in good time of any incidents so that he has a measure of real-time control over the shipment of goods. As stressed at the Round Table, a change in rail practices is essential for this purpose.

As regards the productivity of rail services, it can be said that the equipment owned by a piggyback company performs a much greater annual mileage than equipment owned by rail. The same applies to transhipment yard operations, in which private operators' employees outperform rail employees. Considerable productivity improvements can therefore be made by the railways.

Combined transport can be seen as a specific transport mode that depends on how it is run by the railways. The Round Table participants considered that if combined transport was to have a future, it would have to be given its own infrastructure, its own administrative system and an appropriate form of management, with some activities being run jointly with rail.

On the question of whether combined transport should be provided on a network or only on the main routes, it clearly emerged that the latter solution is the only conceivable one, since the growth potential for combined transport is on the road haulier's major routes. In a route's initial development phase, the progressive growth of combined transport may have to be accompanied by investment. On the other hand, there is probably a limit to the penetration which will be psychologically acceptable to shippers. But the Round Table specialists asked what the penetration rate in Europe would be for combined transport were it not for the restrictions on road haulage that had been introduced, more particularly in Switzerland and Austria. Combined transport is in fact a young transport mode which has not yet realised its full potential. At present rail is passing on its weaknesses to combined transport, whether they be bottlenecks or high wage costs. By separating infrastructure from operation, the cost factors will probably become clearer. But some of the Round Table specialists considered that the management structure has to be modified by turning railway undertakings into private firms subject to private company management rules. This would be the only possibility of saving rail from an enormous debt burden and halting its declining influence in all spheres except high-speed lines.

The combined transport system must improve the quality of its services through greater reliability and real time information for shippers. It is also possible that the system will benefit from road network saturation and will then appear as a viable alternative, provided that sufficient capacity exists. Combined transport's growth potential will come from the road, especially since road haulage is bound to become gradually more expensive as external costs are internalised, since the road sector consumes non-renewable resources such as energy, space and the environment. In addition, road infrastructure will age and maintenance costs might double in the next twenty years. If greater allowance is made for external costs, the development opportunities for combined transport will increase. The Round Table participants thought that combined transport will develop but that its growth rate is still uncertain. It should also be borne in mind that the availability of too many techniques can serve to deter an operator who is ready to invest. On this subject, the Round Table specialists did not unanimously agree on the future or the potential for the bimodal technique.

As regards the organisation itself of combined transport services, it must be said that terminal hauls in urban areas are very expensive. Another critical point on the profitability side is the productivity of transfer operations since waiting times add to the cost of services. Commercial practices would have to be modified so that demand is spread more evenly over time. Finally, it should be noted that, at present, the return on investment in combined transport is low and it takes considerable time to reach the break-even point, which calls for stability in combined transport operating conditions. Public financial aid for investment in terminals may prove essential. This aid must be used to build terminals and not to purchase equipment or subsidise operation. Funds must also be provided for the improvement of saturated rail infrastructure and the renovation of some terminals in town centres.

3. CONCLUSIONS

Some specialists considered that there is no future for combined transport without private initiative. Private companies must be set up by users and operators. The public rail system does not give the profitability and efficiency that would be achieved if each party contributed his own particular know-how. Co-operation between railways and operators should also be improved and consultative committees could be created for this purpose. Terminals should offer services in addition to transport, in order to take their place in the shippers' logistical systems, by providing for storage, sorting and packaging possibilities,

etc. In this connection, the compatibility of information systems is of great importance for the future development of combined transport.

Combined transport will be developed by providing time slots on major routes. A network may take shape at a later stage when efficient routes have been established. At junction points, it will be found that interfaces are needed in the information system, thus confirming the basic role of information technologies.

A number of parties, in some cases from different countries, are involved in combined transport. A uniform information system is therefore required so that consignees can locate their goods in real time. Data interchange is an essential instrument for the organisation and information of the parties involved in combined transport.

There are at present many new projects in terms of technologies, and this tends to be counter-productive by leaving operators uncertain about the investment to be made. Specifications must be worked out by operators but they should not call into question the work done with a view to standardization.

In due course dedicated goods traffic lines are inevitable if combined transport is to absorb heavy flows on the main routes. Here again the aim is to improve service reliability.

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POSSIBILITIES AND LIMITATIONS OF COMBINED TRANSPORT

One priority of European transport policy is to develop combined transport, a mode that is seen as providing a solution to the problem of road congestion while at the same time protecting the environment. Such transport is not developing as swiftly as might be hoped, however, and obstacles are arising in terms of, among others, productivity in multimodal terminals, terminal hauls, saturation of rail infrastructure, standardization of equipment, and the cost of transhipment facilities.

Round Table 91 deals with these issues and also draws attention to the positive aspects of the growth of combined transport. The analysis is based on factual data and conducted from the broader perspective of the contribution that combined transport can make to sustainable economic development.

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