COMBINED TRANSPORT TRANSSHIPMENT TECHNOLOGY TRENDS IN EUROPE

This paper is dedicated to the development of combined transport (CT) transshipment technology in countries in western Europe. The analysis is based upon facts about general preconditions for national and international CT, the existing CT system as well as government and EU measures intended to stimulate transport services and technology development. The purpose of the paper is to describe national features that logically should guide the development of combined transport transfer technology. It also discusses national and EU R&D support measures and includes an analysis of how national or international conditions guide a number of current development projects and in what way they are technically compatible. The conclusion is that CT development in general is country-specific and do not facilitate efficient international CT. This national diversity is to some extent more prevalent than is warranted by the differing national preconditions for CT. So far, EU policy has failed to address this problem, but it is hoped that the fourth framework programme will do so.

1. INTRODUCTION

This paper elaborates on the development of combined transport transshipment technology in countries in western Europe. Equipment used for over-arching the differences between transport modes is often highlighted in CT discussions due to its importance for the overall performance and that the terminals is the significant difference in comparison with single-mode transportation.

The analysis is based upon facts about general preconditions for national and international CT, the existing CT system as well as government and EU measures intended to stimulate transport services and technology development.

Due to the additional costs of terminal handling and local road haulage, transport relations must exceed a certain minimum distance to allow CT to compete with pure road trans-

* Department of Transportation and Logistics, Chalmers University of Technology, S-412 96 Göteborg, Sweden.
port. This implies that international CT is of greater importance than domestic CT for most European countries and compatibility between national networks is of utmost importance. Contrary to this fact, transfer technology development is still considered to be governed by national policies and preconditions. However, the role of international support and coordination will be strengthened as the EU’s fourth framework programme gets underway. The transport R&D budget is 240 million ECU, a considerable part of which will be dedicated to CT related research. Hence, a separate section of this paper is dedicated to analysing the predicted effects of the programme.

The purpose of the paper is to describe national features that logically should guide the development of combined transport transfer technology, national and EU R&D support measures and, finally, to analyse whether national or international conditions guide a number of current development projects and in what way they are technically compatible.

The presentation is demarcated to the transshipment function, as shown in fig. 1., regardless of whether it is terminal-based or integrated with a vehicle or a load carrier.

![Intermodal Transshipment Technology](image)

Fig. 1. The transfer function in a combined transport context.

The paper is divided by country, so that the conditions, demand and R&D policy for CT is treated for the EU countries, excluding Eire, Greece, Portugal and Spain but including Switzerland due to its significance for CT through the Alps. For each country, current development projects are checked against the prevailing conditions and policy.

The analysis starts out from a CT reference terminal that is equipped with one or more track-overreaching gantry cranes with counter-balanced trucks as back-up. Such a terminal can handle ISO-containers, swap bodies and semi-trailers in direct or indirect transshipment throughout the day. However, rail-to-rail transshipment is normally carried out through marshalling of wagons. The different countries are treated based on this reference system, i.e., only differences from the reference system and only systems carrying out the same function are treated.

The paper is prepared using a set of complex data gathered through studies of numerous product brochures, academic papers, industry journals and through attendance to conferences and exhibitions, all during a long time of accumulated research. The topography and demography is studied in various geography books and atlases. This wide variety of
informal sources imply that literature references are only given in specific cases and then primarily for the readers’ convenience.

2. THE REFERENCE MODEL

Traditionally, transport systems are designed according to geographical and infrastructural conditions as well as the demand for transport services in terms of goods flow and desired transport quality. However, environmental issues have become increasingly important and the external costs are in the process of being internalised by way of appropriate fees or taxes. Consequently, transport systems and subsystems designed today must take environmental factors into account since they will influence the long term economies of the implemented technologies.

Mother nature stipulates the basic conditions for all human activities, transportation certainly not excluded. The pattern of mountains, marshes, seas, lakes and rivers influences the choice of transport mode and the cost of establishing the networks. Nature has also influenced the geographical pattern of human activities. Location of natural resources, the climate and the soil all influence where humans have decided to settle and thus indirectly the demand for transport services. Consequently, transfer technology development must take possibilities for different transport modes as well as the potential size of the transport market into account.

According to Manheim’s basic relations model [1], the performance of the transport system in the long term influences localisation of manufacturing and other human activities. However, this long time interdependence is ignored in this paper since CT is only a part, and so far only a marginal part, of the total transport system serving Europe.

Another factor that influences transshipment technology development is the CT industry and the structure of its market. The focus of the analysis is on significant differences from what can be considered as "average" European conditions. The competition with road transport is especially emphasised.

Up to today CT has generally proven to be unprofitable for the companies involved while the society as a whole has benefited from the transport system’s environmental friendliness. The European national railways are now transformed into organisations with strict profitability goals. Hence, until the external costs have been internalised, publicly funded R&D will play an increasingly important role in the design of CT systems, and particularly the interface between the relatively mature road and rail transport modes. Most notable of these programs is arguably the EU’s fourth framework programme, but the issue is also addressed by smaller programs within the EU.

A reference model can thus be outlined. Factors that are included are: (1) the general preconditions, e.g., topography and demography; (2) the current CT system regarding infrastructure, production system and competition and; (3) governmental and EU policies for financial support for R&D, investments and transport service operation. These factors all
affect the general lists of functional specifications for new terminal technologies that apply to each country or the EU as a whole. Of course, the lists lined out here are restricted to a logical analysis, the lists actually guiding technology development might be quite different from company to company. Finally, country by country, a number of current development projects are compared to the special features expected to guide the development.

The model is graphically presented in fig. 2.

Fig. 2. The reference model guiding the analysis.

3. PRECONDITIONS FOR DOMESTIC AND BORDER-CROSSING COMBINED TRANSPORT IN WESTERN EUROPE

The topography and demography of a country affect the terminals in two ways; (1) by stipulating possible rail links, i.e., the configuration of the network and (2) the competitiveness of CT services giving the total goods flow for the terminals to handle. The theoretical base for the network configuration and its implication on terminal technology were defined in earlier research within the TEMPUS-programme [2].

In addition to the market-related factors, transfer technology trends are also influenced by public R&D policies. Ideally, such policies should be consistent with the other preconditions, but regardless of whether that is the case, there is still an influence to be reckoned with. The countries are listed in a purely geographical order, starting from the north.
3.1. NORWAY

Norway is largely mountainous with a large number of fjords and inlets that cut inland from the coast and the winter climate is extremely harsh. Transport to the northern parts go through Sweden because the Norwegian national rail network misses a link to the far North. This means that nature dictates a hub-and-spoke structure or a corridor with rather long feeder links to be employed. The topography also implies the competitiveness of coastal shipping. In addition to the barren topography, the scarcity of population means that CT is only feasible in some areas. No substantial CT funding programme has been employed in Norway.

3.2. FINLAND

Finland is situated on the eastern side of the Gulf of Bothnia, which means that most connections to and from Western Europe comprise a sea leg. Therefore, a trimodal system (road/rail/sea) is often required. On the infrastructural side, the wider gauge of Finnish railways means that there is no use transporting CT wagons to Finland.

Due to the paucity of population, CT only exists in some regions in Finland. In addition, the large size of lorries further reduces the competitiveness of CT and yield lorries that are not adapted for carrying unit loads. On the positive side, Finland is very aggressive in its intention to serve as the main gateway to Russia and the Far East by the Trans-Siberian railway. The long experience of trading with the Russians makes the transport route via St Petersburg and the Port of Kotka very interesting until new and efficient rail links has been built directly to Western Europe. The gateway function has led to a concentration to ISO-containers that are suitable for transshipment eastwards and can be used for sea transport directly to Germany.

3.3. SWEDEN

As is true for all Nordic countries, Sweden’s small population dictates that CT is not feasible in all areas. Road vehicles are very large in Sweden - 24 metres and 60 metric tonnes - which further reduces the competitiveness of CT. It also makes the interface road/rail more troublesome since the length is not efficiently used with unit loads and, consequently, Swedish road transport is dominated by articulated vehicles.

Swedish national R&D policy aims at stimulating development of technologies suitable for low density demand and for short sea shipping. This is in line with Sweden’s limited population and peninsular lie. A parliamentary committee for analysis of the future of Swedish transportation in a wide context has recently been appointed. The directive to the committee reveals a desire for stronger governmental involvement and the establishment of further integration between the transport modes. Sustainable mobility, external costs and
information technology are emphasised in the text. Furthermore, financial aid to CT is considered as possible in a near future.

Development of CT technology has been governmentally sponsored through the general programme for technology development. The new CT company Rail Combi - formed of parts of Swedish State Railways - invests largely in existing, very conventional terminal technology. Emergence of new transfer technologies requires that the financial burden that existing equipment constitutes for the terminal operators be dispensed with.

3.4. DENMARK

The dominant geographical feature of Denmark is its position as a gateway between the rest of the Nordic countries and continental Europe. In addition, Denmark in itself is too small for substantial domestic CT, which further strengthens its role as a transit country. The other dominant feature is its abundance of islands, which means that all transit transport will comprise at least one ferry leg.

For transports destined to and from Denmark, the dominant market feature is that semi-trailers are not frequently used.

3.5. GERMANY

Germany is the economic centre of Europe, which means that a major demand for transport services is generated in the country. In addition, its geographical position in the heart of Europe means that a lot of transit traffic flows through the country. Topographically, Germany is flat in the north and increasingly mountainous in the south. The large flows of German CT means that the traffic to a large extent can be arranged as direct connections, but the industry concentration along the river Rhine and other inland waterways makes a corridor layout feasible. Integrating road, rail and inland waterways is obviously a task for German transport system designers.

Germany is heavily populated with industry particularly concentrated to areas such as the Ruhr. This means that space for CT terminals is limited and, due to road congestion, the size of pick-up areas is rather determined by haulage time than distance.

The size of the German CT market means that transfer technology R&D is largely market-driven and therefore governmental R&D policies less consequential, even though some technologies has emerged through governmental sponsoring. German CT has benefited from substantial economic help for terminal investments, i.e., the demand side of the CT terminal equipment market is sponsored rather than the supply side.
3.6. THE BENELUX COUNTRIES

The Benelux countries are, with the exception of the Ardennes region in the south-east, flat and populous. In addition, they are not large enough to warrant domestic CT. Instead, the main source of CT demand is the hinterland transport by rail or inland waterways of goods that flow through the major seaports in the area, chiefly Rotterdam and Antwerp.

The CT terminals in these regions are organised in three levels. The first is government-subsidised port terminals, the second is inland main terminals, also government-subsidised, and the third is secondary terminals, a regional concern. What needs to be considered for the port terminals is that the critical distance for using CT is shorter when trafficking a port since there is only one road haulage and one extra handling compared to hinterland distribution purely by road.

3.7. THE UK

The UK differs from continental Europe in that it has a limited loading profile on rail, which means that load carriers have to be limited in height to be rail-transportable in the UK. In addition, much of the rail network can be seen as being in less than mint condition.

Semi-trailers dominate road transport in Britain, indeed swap-bodies were only recently introduced in the UK. However, standard semi-trailers cannot be used on rail because of the limited loading profile. Consequently, current R&D policy is aimed at making piggy-back transports possible on the existing infrastructure.

Although UK is the home of rail transport, UK politicians are generally considered to have an anti-rail attitude.

3.8. FRANCE

The French rail network is - as is much of the society as a whole - largely centred on Paris, which assumes the function of a national hub. In the different regions very different preconditions exist. The country’s topography ranges from plains in the north to the extremely mountainous south and south-east. Industrial regions coexist with purely rural regions as well as regions dependent on tourism. France also serves as a transit country for transports to Italy and the Iberian peninsula, where a wider rail gauge is employed.

The CT system of France is today merely a domestic phenomenon. Almost all international traffic can be referred to as transit between Germany and the Iberian peninsula. Instead, French trade with Germany and the Benelux countries often contains one domestic CT service, but due to lack of technical and infrastructural standards the goods passes the border on rubber wheels.

French State Railways (SNCF) enjoy a strong position in the French society. The R&D policy, of which SNCF are responsible for a large part, is aimed at developing fast
transshipment techniques, which is consistent with the hub-and-spoke structure of the rail network. Another problem to solve is the impact of the substantial transit traffic by articulated road vehicles.

3.9. SWITZERLAND AND AUSTRIA

Switzerland and Austria are largely dominated by the Alps, which means that the rail network is largely confined to the available mountain routes. Together with France, both countries receive a substantial amount of transit traffic as they form a link between northern and southern Europe. Existing tunnel profiles are limited implying dominating use of swap bodies in stead of special Alp tunnel-adapted semi-trailers.

For environmental reasons, road traffic is severely restricted and CT is subsidised. The technical problems concerning emission evacuation, safety measures and tunnel dimensions all favour rail or rail shuttle solutions instead of the highway alternative. The Channel tunnel is a recent example of this technical choice, and the coming base tunnels in Switzerland will probably be built purely for rail and shuttle traffic. This will obviously favour CT, since once the terminal cost is paid, the rail distance can favourable be extended outside the tunnel openings. This is also the main reason for the high market share of Alp crossing CT today.

Austria also faces problems with the East-West traffic with severely polluting lorries from the former Eastern Bloc. This traffic has been transferred to rail by use of up to 80% subsidisation for rolling highway services together with high road tolls. From the beginning of 1995, however, this traffic is to a large extent lost to road again since Austria has been forced to lower the road tolls and decrease enforcing activities according to EU regulations.

Neither Switzerland nor Austria is large enough to make traditional domestic CT feasible for time-sensitive cargo. Consequently, R&D policy is aimed at developing transit traffic solutions and small-scale terminal techniques for low value cargo.

3.10. ITALY

Italy is mostly mountainous. The most outstanding regional difference is that the industry is concentrated to the northern part, whereas the southern region is more rural. Due to Alp transit by CT, Italy is one of the large European CT countries when it comes to international traffic. In fact, together with Germany, Italy account for 95% of all international CT in Europe [3]. Italy also serves as a transit country for transport to Greece via Port of Brindisi. However, Italian CT is seriously unprofitable and far-reaching measures are needed to enhance the economic performance.

On the network operation side, the terminals in the north sometimes operate as gateways between domestic and international CT. This is a coming trend with the purpose of integrating different networks without restricting the possibilities of optimise each network.
for the common preconditions. Also empty positioning of wagons can be decreased by transferring unit loads instead of marshalling wagons.

At the moment, there is no governmentally sponsored R&D programme dedicated to transshipment technology. R&D policy is focused on the CT related issue of freight villages (interporti), primarily on the management side.

4. SPECIAL PRECONDITIONS ON THE EUROPEAN LEVEL

European CT is not as feasible as its North American sister system. In line with the reference model a comparison is of interest to judge whether the American system can serve as an example for European CT. Actually, the conditions are quite different. First, the topography does not seriously hamper CT by seas and lakes between the main industrial areas giving short rail distances between ferry crossings in the USA. Second, the industrial pattern is favourable since it consists of urban areas well scattered over the continent with focus on the shoreline of the oceans and the Great Lakes contrary to the European pronounced concentration. These factors are shown in fig. 3. below.

![Fig. 3. Topographical and demographical comparison between Europe and the USA.](image)

Third, the uniformity in terms of rules and regulations for road vehicles and railroads make technical and commercial co-operation easier in the USA and Canada. Fourth, a rail loading profile of a fair size makes large scale train services feasible. Both double-stack and up to three kilometres long trains give outstanding economies of scale. Consequently, American development rather stresses economies during rail haulage, e.g., the new triple-
stack containers, than terminal technology and small scale systems for competition on shorter distances.

4.1. RAIL DEREGULATION AND IMPLICATIONS FOR COMBINED TRANSPORT

The European rail industry is in an intense restructuring phase. The important directive 91/440/EEC on rail deregulation is especially strong when it comes to CT. Any railway arranging an international CT service shall be granted access to the tracks along the chosen route. In a number of years, any CT actor will probably be allowed to haul its own trains and only pay infrastructural fees to the governments in the transiting countries. This makes current co-operation agreements obsolete, but due to large economies of scale and technical incompatibility in terms of signalling systems and power supply, it is most likely that the national railways will work together in CT rail haulage long into the future. However, large programs for rail network integration will most likely change the conditions for the CT operators.

4.2. INFRASTRUCTURE PLANS

The trans-European networks for rail, highways, inland waterways as well as CT as such will obviously influence CT services. Interesting to notice is that the terminals are part of the CT network outlined by the EU. However, the situation is not clear and today the EU neither has the available funds nor the authority to force national governments to establish the networks. If the EU is convinced of establishing the network including terminals, it will strongly affect coming terminal technology development and investments. The general attitude of the EU commission [4] is that they trade subventions for a certain degree of control.

4.3. EU’S FOURTH FRAMEWORK PROGRAMME

The giant four-year fourth framework programme for R&D is the most important single action for promoting European CT terminal technology development. The transport R&D budget is 240 million ECU, and it aims to increase efficiency and environmental friendliness in transport systems. It also aims at facilitating interconnections between different transport networks and modes, which means that it is largely dedicated to different types of combined transport technology.
4.3.1. BACKGROUND

Following the ratification of the Treaty on the European Union, all Community activities in the field of research, technological development and demonstration are covered by the European Community Framework Programme for Research and Technological Development.

Framework Programme IV was adopted on 26 April, 1994. It has a duration of five years (1994-1998) and a budget of 12.3 billion ECU. Framework IV contains four activities and a number of specific RTD programs (see Appendix 1). Transport-related research features predominantly in four of the specific programs of the framework; Telematics, Industrial and Material Technologies, Non Nuclear Energy and Transport.

4.3.2. A SPECIFIC RTD PROGRAMME IN THE FIELD OF TRANSPORT

The Transport Programme of the Fourth Framework Programme will contribute to achieving the objectives of the Common Transport Policy, which has been the subject of considerable Community effort over the last few years. The development and implementation of the common transport policy calls for research to achieve efficient and cost-effective transport networks for goods and passengers under the best possible environmental, social and energy consumption conditions, within the general objective of sustainable mobility.

The transport research programme intends to improve the efficiency of the individual transport modes and speed up their strategic integration into European transport networks. The research will provide information to support decision-making and quantify the foreseeable impact of the various possible options, thus promoting Community transport initiatives at both national and European levels.

The aims of the proposed programme are:

1. to develop a more efficient, safer and more environmentally friendly transport system for passengers and goods,
2. to facilitate the interconnection and interoperability of the separate transport networks,
3. to increase the efficiency of each individual mode and improve co-operation between them,
4. to promote the design and management of infrastructure with a view to reducing the damage to the environment and improving the quality/price ratio, and
5. to provide industry, transport operators, users and authorities with the appropriate decision-making instruments based on better knowledge and understanding of mobility, traffic flows, their interactions and interdependencies.
4.3.3. INTEGRATED TRANSPORT CHAINS

Integrated Transport Chains (ITC) or Combined Transport (CT) is a part of the Transport programme and should be considered as a coherent logistic operation. Therefore any RTD activity in this field needs to be validated and its contribution to the logistics service and its potential market value has to be demonstrated.

The scope of the programme covers all modes of transport and their interchanges. Thus, ports and airports, inland waterways as well as coastal shipping and ferries fall into this domain. In other words the network between terminals as well as terminals themselves are the focal points of the programme and the relationship between the abstract terminal network and the physical infrastructure links between them will be closely examined.

The research activities within this programme will principally address the identification of problems requiring new technologies, specific applications and solutions, evaluations and overall integration. The validation of technological innovations developed elsewhere in the fourth framework programme will also be covered.

The range of the programme relates to strategic or socio-economic, technical, information aspects and their interplay as they affect the functioning of the network and the terminals. These three aspects together form the basis of the systematic approach adopted in the work programme. They are so closely interlinked that one cannot omit one item without damaging the programme as a whole.

4.3.4. STRUCTURE OF THE ITC PROGRAMME

The research tasks in this area of CT have been defined along two axes:

1. **Quality of the network**: To outline an "optimum network" of infrastructure, transport equipment and services for the realisation of CT services, allowing for interplay of SME’s and big enterprises, integration of small and large consignments and flows under the conditions of sustainable transport. The latter means not only economic efficient operations at each stage in the network but also under safe and optimum social and environmental/spatial conditions.

2. **Quality of the terminals/transfer points**: Improvement of terminal operations allowing for an optimum service package in conjunction to the network operations.

The only way to make CT competitive on medium (200-500 km) transport distances is to considerably increase the efficiency of combined transport transfer. Furthermore, this will enable CT to gain economies of scale by attracting larger volumes of cargo. The research shall take into consideration all the network modes and it should concentrate on standard unit loads, i.e., ISO containers, semi-trailers and swap bodies. This will contribute to increasing the competitiveness of CT compared to single mode transportation.
4.4. CONCLUSIONS, EUROPEAN INTEGRATION

Generally speaking, it can be said that the extensive CT networks that exist today seem well-suited for co-operative actions at a European level. Some state that such efforts have not been forthcoming from the EU prior to the fourth framework programme [5]. However, the framework programme does seem to address these issues as it is aimed at achieving transportation networks that are efficient and easily connect to each other. In addition, supra-national efforts are more necessary in Europe than in the USA because of the unfavourable conditions for CT that prevail in Europe together with the pronouncedly national rail networks. These conditions would otherwise make expansion of CT unlikely, since an exclusively market-driven expansion would be unlikely or only serve the main markets and thus not improve the cohesion of the Union.

5. LOGICAL TRANSFER TECHNOLOGY SPECIFICATIONS AND CURRENT DEVELOPMENT PROJECTS

After having established the preconditions and policy, it is useful to transform these factors into specifications for transfer technology for the respective countries. In addition, some examples of current development projects and developed systems are listed to verify if these are consistent with the established specifications. However, presenting different technologies is not part of the aim of this paper, so for facts about the systems mentioned other sources are recommended, e.g., [1], [6], [7] and [8]. The systems mentioned mainly focus the transshipment function, but some other interesting projects influencing terminal design have been added.

5.1. NORWAY

The preconditions in Norway does not favour CT. Any concept dedicated to the Norwegian CT system must facilitate small scale handling and a low fixed to variable cost ratio. Coastal shipping and the harsh climate must also be taken into account in the design process.

Probably due to the small size of the domestic market, no revolutionary CT transfer technologies have emerged in Norway, and negotiations of bringing a Swedish invention to the market has stalled. However, the Norwegians are not technology unfriendly; a small-box concept - similar to the Cesam system now abolished in Sweden - is introduced and a bi-modal technique has been commercially tested, although without success.
5.2. FINLAND

Finland’s geographical position, which means that transport between Finland and the rest of the EU comprise a sea leg, calls for transfer technologies that are suited for transshipment between road, rail and sea vehicles and vessels. The focus on ISO-containers calls for equipment that is specially adapted to that load carrier. The modest population in Finland, however, means that there is no need for high-capacity equipment.

Technologies that have been developed in Finland include the Wheelless system and a container handling device that uses an inclined plane. Both these technologies are low-capacity systems that are suited to all transport modes and ISO-containers. They can therefore be said to match the established specification.

5.3. SWEDEN

The most notable factors that influence the development of transfer technologies in Sweden are the limited population density, which means that technologies for low-density flows are needed, and the peninsular position, which means that short sea shipping needs to be integrated into the operations. The first factor is more generally prevailing than the second and therefore most development projects have been aimed in that direction.

Examples of Swedish low-capacity technologies are CarConTrain, the Stenhagen System, Supertrans and special technologies for dry bulk material transports. The Hiper-net/Titan development project addresses both factors, while side-loaders focus on serving the short and deep sea shipping markets with hinterland distribution.

In general, the Swedish inventions contribute to solving the special needs for the Swedish market but have also attracted attention from foreign markets.

5.4. DENMARK

As is the case with Norway, Denmark has not established itself on the map of CT technology inventions. However, a commercial service with bimodal technology was recently started between Denmark and Italy. The intended cargo, meat southbound and vegetables northbound, calls for refrigerated units and the project implies that the Danish CT industry is open for new technologies. The role as gateway for the other Scandinavian countries also means that some technology adaptations are needed.

5.5. GERMANY

The high population density and concentration of industry in Germany mean that transfer technologies need to be suitable for fast transshipments along corridors. Terminal
operations should also be possible on small terminal surfaces. Another requirement is that integration with inland waterways should be possible since these carry a significant traffic volume.

German transfer technologies that facilitate fast transshipment in a corridor network with limited space demands include the Krupp Fast Handling System and the Thyssen Container-Transport-System (CTS). Other transfer technologies that require limited space are the Noell Fast Transshipment System and the Mercedes Benz Kombilifter. A special device, Umschlagfahrzeuge Schwanhäuser/Lässig (ULS), was developed using governmental support, but the technology was not popular within the German State Railways (now Deutsche Bahn AG) since the technology did not meet the requirement of fast transshipment.

Moreover, stackable swap bodies have been developed for the purpose of stacking at terminals and easier handling with top-lift spreaders. The new swap bodies can be integrated with inland waterways navigation and require little handling space at terminals. Most German transfer technologies are therefore in general in accordance with the established specification.

5.6. THE BENELUX COUNTRIES

To handle hinterland transportation in these countries, transfer technologies need to be adapted to ISO-containers. In addition, the transfer technologies need to function well with inland waterways and make efficient port handling possible. For the domestic CT terminals, finally, transfer technologies need to be suited to small traffic volumes.

An automatic barge loading system, Rollerbarge, that is well suited to the inland waterway interface has been proposed by co-operating consultants and a design company and is currently evaluated by the Technical University of Delft [9]. Efficient sea-port handling is achieved by the ECT/Delta Sea-Land System. However, the large amount of containers generates substantial amounts of traffic to the port area and the urban area suffers from pollution and congestion. In order to decrease these problems, ECT - the company that operates the container port - plans an innovative new system called the Multi Trailer System for moving the interface towards road, rail and barge traffic from the actual port area [10].

In addition to these, the Abroll Container Transport System (ACTS) and an inclined plane technology have been developed for the special needs for transshipment and distribution generated by ISO-containers.

5.7. THE UK

The main problem that dictates the specification for transfer technologies in the UK is the need for equipment that allows CT with the semi-trailers that today dominate road transport. An obvious alternative to increasing the tunnel and bridge clearances is to adapt either the semi-trailers or the rail wagons to letting the combined carriage use the existing rail net-
network. In addition, the Channel tunnel places specific demands on the transfer technology that is to be used in connection with this traffic.

Technologies that address the first problem include the Finnish-developed Tiphook System, in which semi-trailers (but with slightly cut upper corners) are used, and the EU-supported spine wagon for the Comobicorridor. The spine wagon is also suitable for use in the Channel tunnel and investments of £70 million will give a core network for standard semi-trailer CT [11]. Since the new wagon is an alternative to increasing the loading profile at enormous costs, the EU is considering financial help for investments in new wagons. Other than that, rolling highway technology are used for the Channel tunnel traffic, but so far only for the core tunnel distance.

5.8. FRANCE

The chief requirement in France is for a transfer technology that is suitable for use in a large-scale hub facility in Paris. In addition to this, technologies are also required for use in the Channel tunnel and to handle road transit traffic.

Two development projects for the hub-type transfer technology are Commutor and an automatic marshalling yard. These are both developed by SNCF and one is to be chosen for operative use. Another R&D project of SNCF regards large-scale rolling highway techniques with new and independent infrastructure in order to handle transit traffic by whole road vehicles.

5.9. SWITZERLAND AND AUSTRIA

The conditions for Switzerland and Austria generally require technologies for transit traffic through the Alps and, in addition, small-scale solutions for the much less dominant domestic transports.

Standard rolling highway technology is used for the transit traffic of articulated vehicles. Technology development on decreasing maintenance and problems related to the the small wheels’ speed of rotation is emphasised. Existing small-scale technologies include ACTS and other turntable systems. However, development projects within the EU’s fourth framework programme are currently underway.

5.10. ITALY

Italy needs technologies that are suitable for use as connections to the transit traffic through the Alps and, in addition, small-scale solutions for the less dominant, but still substantial, domestic transports. Development projects must cut operations costs or enhance the overall system performance in order to attract high value cargo. The Italian CT industry
must strongly prioritise long term profitability in order to survive in the new era of the European national railways.

Traditional rolling highway is normally used for the Alp traffic, since it is what is used in other areas along those routes. However, as mentioned in the section for Denmark, a Bimodal technology is now also used in this function. Existing small-scale technologies include the Firema Twistwagon (a turntable system) and also the Ferrosud Bimodal System.

5.11. SYSTEM COMPATIBILITY

Today’s systems are generally compatible since the terminals contain all specific equipment for the transshipment operation. Most terminals active today were also established during a short period of time implementing the best technology available then. The gantry crane and counter-balanced trucks of the reference terminal previously described is with few exceptions the transshipment equipment used in European CT. Wagons are rather universal and so are the unit loads. Exceptions are semi-trailers intended for use in the UK or on Alp transit routes as well as 2,77 m high swap bodies that are not compatible with all current European rail loading profiles.

The new systems however, are, as is indicated by Appendix 2, to a large extent designed with dedicated wagons and all unit loads are not technically suited for the new systems.

6. CONCLUSIONS

As seen in Appendix 2, the developed technologies correspond to the national preconditions rather than those for the EU as a whole. Even worse for European integration, the systems are to a large extent designed with specialised wagons giving nationally restricted networks and services. In order to avoid a scattered European CT system with pronounced national CT networks due to shifting technology choices, the EU has an important coordinating role to play in the future. If the fourth framework programme is not successful to develop technologies for later commercial implementation, the integration programme for European railway infrastructure will be obsolete for CT. Of course, the gateway principle with transshipment at network interfaces is feasible, but the optimum is certainly compatible systems and full trains operated directly between two terminals where the demand is sufficient. The potential buyers of new transshipment technology must carefully decide whether to go for a national system or invest for the future in systems compatible over national borders and thus competing for the most promising part of the European CT market.
REFERENCES


## APPENDIX 1: BUDGET BREAK DOWN FOR THE EU’S FOURTH FRAMEWORK PROGRAMME

<table>
<thead>
<tr>
<th>Field</th>
<th>Activity 1</th>
<th>Funding (MECU)</th>
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<td>VII. Targeted socio-economic research</td>
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**Activity 2**

Cooperation with third countries and international organizations 540

**Activity 3**

Dissemination and exploitation of results 330

**Activity 4**

Stimulation of the training and mobility of researchers 744

**Total** 12 300
**APPENDIX 2: EUROPEAN DEVELOPMENT PROJECTS REFERRED TO IN THE TEXT**

<table>
<thead>
<tr>
<th>Project</th>
<th>Countries</th>
<th>Wagon</th>
<th>Dedicated requirement issue</th>
<th>Development Phase</th>
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<td>Trimodality, simple terminal</td>
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Explanations for the Wagon column: S = Standardised; D = Dedicated; n. ap. = not applicable.