Final Report for Publication

IDIOMA

Innovative Distribution with Intermodal Freight Operation
in Metropolitan Areas

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Executive Summary

Considering that the increase in total kilometres driven in EU urban areas is forecasted with 40% between 1995 and 2030, cities are being forced to think about alternative transport concepts and policies which will reduce the pressure on the cities' infrastructure and inhabitants. Such policies include new co-operation schemes such as the co-ordinated distribution between several forwarders as well as the development of concepts integrating other modes of transport than road. Being well aware that the final part of the transport chain towards the delivery point can in most of the cases only be operated over the road, the question arises whether new intermodal concepts could be applied where the connection between different modes and especially where the transhipment points play a significant role.

The supply of goods is fundamental to sustain urban life style as well as trade activities which in turn are an essential prerequisite for generating wealth. Efficient transport so can play a significant role in the competitiveness of an urban area and hence is an integral part of the urban economy. It supports employment and the generation of income on city level. However, freight transport also causes negative effects on traffic and environment in urban areas. Therefore urban freight transport is an important factor in the sustainability of urban areas. This view is also supported by the importance granted to it in the current strategic planning of the European Union.

The IDIOMA project, a project supported by the European Commission, followed the main objective to demonstrate the possibilities to improve the distribution of goods within metropolitan areas and between intermodal transport terminal/freight centres and metropolitan areas. Given the different situations at five test sites in Europe the IDIOMA project got validation results on a broad spectrum of prevailing conditions which proved the interoperability of the systems developed across modes and countries.

8 partners together with 27 associated partners from the transport industry (e.g. intermodal operator, transport companies, logistics service providers, railways companies), transport and information technology, cities and public authorities and the research and consulting business co-operate to fulfil the task of this project. 5 validation sites characterised by different technical, operational and organisational elements were implemented, demonstrated and evaluated in detail.

In the follwing a brief overview on each demonstrator is summarised:

The Nürnberg demonstrator focused:

- on a reduction of inbound oriented long-haul traffic volume of the VEDES company located in the metropolitan area of Nürnberg, by bundling several amounts of small good flows from different suppliers in defined areas of origin towards one general GVZ-forwarding agency.
- to intensify the interaction of ex-regional long-haul traffic and regional delivery traffic and the relevant logistical processes of the DPD company with the help of small, flexible and multi-modal shippable logistical load units, called “profitainer” (1/3 swap bodies).
- to develop and introduce a robust and flexible city logistics multi-format scanner for the Nürnberg city logistic ISOLDE.

At the Öresund site the following survey and demonstration activities were carried out:

- to implement express goods distributions for small and medium sized consignments to the City of Linköping combining passenger railway transport with environmentally adapted biogas vehicles for pick-up and deliveries.

- to survey and demonstrate three different organisational concepts for co-ordinated distribution – City logistics. In particular the tasks aimed at a technical solutions for co-ordinated composite distribution in the City of Stockholm and at a co-ordinated public purchase in the City of Malmö. The validation site leader TFK together with Frigoscandia, Frigoscandia Logistics and the City of Malmö demonstrated the approaches on city logistics.
- to evaluate the effects on the regional logistics (intermodal integration within the region) caused by the building of the new rail/road Öresund Bridge and to elaborate how different freight centres and companies within this region handle the change process.

The Paris – Ile de France – demonstrator demonstrated:

- the implementation of telematic applications for road and intermodal transport on the basis of already existing and new software and on-board applications. The aim was to optimise and automate as far as possible the capacity booking on trains. In particular, the demonstrator approach included the installation of a mobile data communication network, enabling a two-way data link between the transport planners (supported by telematic services) of Initial Rouch and TAB and their (vehicle) fleet as well as to the combined transport operator, NOVATRANS.

The Randstad site aimed:

- at the simulation and one particular demonstration of the Flownet system, an innovative distribution concept with intermodal freight operation in the metropolitan region of Amsterdam, The Hague, Rotterdam and Utrecht.

Zürich demonstrated and evaluated the following combined transport technologies:

- an innovative Combibox-System for intermodal logistics. The approach comprised the demonstration of a complete transport and information chain of a Combibox based distribution process of the PISTOR company.
- an innovative horizontal transhipment technology. The Neuweiler AG and Guha AG developed an innovative and cost effective horizontal transhipment equipment "RTS-500 Furmia" especially for intermodal terminals with medium and small volumes.

Furthermore, an analysis on the system integration between ACTS (Abroll-Container-System) and conventional combined transport technologies was carried out in Zurich.

Consolidated conclusions

IDIOMA made once more obvious that new initiatives in urban areas distribution are needed especially in the pre and end haulage of intermodal transport chains. IDIOMA demonstrated a variety of different approaches of new technology and distribution concepts integrating – as far as possible – intermodal transport.

Most significant IDOMA results are

- Regional or local bundling projects in urban freight transport as demonstrated in Nuremberg, Randstad, Öresund and Zürich, were only partially successful. IDIOMA proved that on the one side a reduction of emissions can be achieved, especially when regarding intermodal transport chains. On the other side, it turns out that such approaches are extremely difficult to implement in the current transport business environment.

- City/Small container concepts can significantly reduce environmental impacts of freight transport. However the concepts demonstrated in IDIOMA met with technical problems and were therefore not commercially viable. It can be stated that the technical problems can be solved, but the economic perspective is still uncertain. To become economically viable city container concepts will either require large investments in infrastructure and equipment or entirely different transport patterns. Without such efforts small containers will play a marginal role in city distribution.

- The integration of traffic information turns out to have a striking impact on the efficiency and competitiveness of the goods distribution system in urban areas. The approaches demonstrated in IDIOMA showed that a substantial part of the delays in intermodal transport can be eliminated if high quality (reliable, detailed and up-to-date) traffic information is available in time.

- For the horizontal transhipment system RTS-500 Furmia as demonstrated in IDIOMA, it has to be stated that it is presently not commercially viable and can not be marketed yet. The main reason is that it is at present still costly and difficult to work with for the terminal personnel. However when properly adapted and integrated in the terminal infrastructure it may very well become operationally feasible in the future. A next generation of this kind of equipment is demonstrated in the INHOTRA. Two major trends are influencing the market prospects for the horizontal transhipment system. On the one side the system has to compete with similar, other transhipment systems and other innovations to make small volume terminals more profitable. On the other side the current terminal building plans in various EU member states include the building of a number of small terminals and these plans will of course enhance the chances of the transhipment system.

- The ACTS system proved already its capability for short distance rail transport, mainly for bulk goods. From IDIOMA it is concluded that there are no real technical barriers to apply the system also in non-bulk transport chains in urban and regional distribution. However this expansion of markets will impose additional, higher requirements to the logistic organisation of transport companies. They are currently not accustomed with these requirements. So instead of a technical challenge it was found that the real challenge is of an organisational nature.

- On city level a significant reduction of emission level has been observed in IDIOMA due to the use of alternative fuels. However, it should be noted that in a global view the use of alternative fuels might well be negative if one takes the generation of these fuel types into account. The basic economic problem with the use of alternative fuels in freight transport is that one has to compete in a commercial environment with other products having an already present massive fuel supply infrastructure and very efficient supply chains. In IDIOMA it became clear that a kind of temporary market protection for alternative fuels will be indispensable to migrate to large scale introduction. However, under the current conditions there is a clear limitation of this solution on local and regional transport in a commercially protected environment.

- The advantages of integrated transport of passengers and freight to urban areas are fast access to city centres and high priority transport. However the type of cargo is limited in size and the transhipment of cargo is not ideal and even clumsy when this has to take place on passenger platforms. The main problems turned out to be of a commercial nature (poor profitability) and difficulties with the internal organisation. Given the expected developments in urban freight transport, it seems that there might be indeed scope to renew interest in integrated passenger-freight transport. E.g. taxis could play a role in home shopping deliveries.

In summary it can be concluded that IDIOMA covered a broad range of facets of alternative approaches on urban goods transport having all positive impact on the environmental performance. To adopt such concepts the commercial performance is the crucial factor for the market players in urban transport. Regarding IDIOMA from this view some demonstrators passed these barrier's and will be continued even after the end of the project. After all, the majority of the demonstrated approaches can not be marketed yet. Due to the introduction of the Heavy Vehicles Fee (HVF) in Switzerland in the end of the IDIOMA project it was possible to show – as one of the first project – the influence of this fee on intermodal transport and in particular on urban transport. Considering the introduction of such charges also in other European countries in the near future the relevance that there is a need to develop and to employ improved concepts on the pre and end leg of intermodal transport chains becomes obvious. Best practices are one thing that is needed, new kind of transport and logistic organisation – including Public Private Partnerships (PPP) - is the other prerequisite to reach such an adoption. In this context more field trials applying innovative technologies and concepts would certainly contribute to more sustainable urban goods flows.

1 Introduction

Considering that the increase in total kilometres driven in EU urban areas is forecasted with 40% between 1995 and 2030, cities are being forced to think about alternative transport concepts and policies which will reduce the pressure on the cities' infrastructure and inhabitants. Such policies include new co-operation schemes such as the co-ordinated distribution between several forwarders as well as the development of concepts integrating other modes of transport than road. Being well aware that the final part of the transport chain towards the delivery point can in most of the cases only be operated over the road, the question arises whether new intermodal concepts could be applied where the connection between different modes and especially where the transhipment points play a significant role.

The supply of goods is fundamental to sustain urban life style as well as trade activities which in turn are an essential prerequisite for generating wealth. Efficient transport so can play a significant role in the competitiveness of an urban area and hence is an integral part of the urban economy. It supports employment and the generation of income on city level. However, freight transport also causes negative effects on traffic and environment in urban areas. Therefore urban freight transport is an important factor in the sustainability of urban areas. This view is also supported by the importance granted to it in the current strategic planning of the European Union.

Main focus of the EC funded IDIOMA project "Innovative Distribution with Intermodal freight Operation" was to prove the applicability of concepts improving the pre- and end haulage and to assess the improvements by an overall evaluation. Vital demonstrators showed innovative technological but also organisational solutions at the beginning and the end of intermodal transport chains. It was the goal to demonstrate the possibilities to improve the distribution of goods within metropolitan areas and between intermodal transport terminals / freight centres and metropolitan areas.

In particular the IDIOMA project comprised concepts focussing on:

- Regional or local bundling of urban freight transport, using common carriers or co-operative distribution concepts;
- New loading units in urban (intermodal) transport;
- Improving operational and commercial information exchange in intermodal transport by means of innovative ICT-applications;
- Innovative transhipment systems in intermodal transport;
- Use of alternative fuels and energy sources in urban freight vehicles;
- Combined passenger and freight transport concepts.

The pilot demonstrators were developed on the basis of existing transport activities and business contacts of the operational consortium partners. Each of the demonstrators comprised the development and application of practical and transferable aspects for the enhancement of intermodal transport in urban areas.

IDIOMA made once more obvious that new initiatives in urban areas distribution are needed especially in the pre and end haulage of intermodal transport chains. IDIOMA demonstrated a variety of different approaches of new technology and distribution concepts integrating – as far as possible – intermodal transport. But, IDIOMA showed also that for almost all IDIOMA demonstrators a reduction of emission level could be evaluated. In this respect, the project approach contributes to the policy of the EC to support more sustainable transport approaches in urban goods transport.

The four main IDIOMA deliverables D 2.1 “Design process results”, D 2.2 “Verification process results” D 3.1 “Consolidated evaluation results” and D 1.1 “IDIOMA best practice handbook” create the basis for the results of the IDIOMA project.

Within this reports a clear description of the IDIOMA demonstration processes is given starting with a brief description of the overall IDIOMA objectives (chapter 2) and the means used to achieve these objectives (chapter 3). The main part of this report creates the scientific and technical description of the work packages' results (chapter 4). This is described according to the following structure:

- General description of the demonstrator, by describing the regional background of the demonstrator and giving an overview on the demonstrator concept.

- Detailed description of the demonstration activities by describing the technical layout of the demonstrator.

- An evaluation of the demonstration results.

The chapter following thereafter highlights the site specific conclusions from the demonstration sites (chapter 5). Finally, the overall project results and follow up measures were outlined (chapter 6).

2 Objectives of the project

The IDIOMA project followed the main objective to demonstrate the possibilities to improve the distribution of goods within metropolitan areas and between intermodal transport terminal/freight centres and metropolitan areas. Given the different situations at five test sites in Europe the IDIOMA project got validation results on a broad spectrum of prevailing conditions which proved the interoperability of the systems developed across modes and countries.

The objectives specified and the achievements at each side can be described as follows:

The Nürnberg demonstrator focused:

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Furthermore, an analysis on the system integration between ACTS (Abroll-Container-System) and conventional combined transport technologies was carried out in Zurich.

3 Means used to achieve the objectives

The IDIOMA project started in December 1998 with a duration of 30 months. The IDIOMA project is characterised as a demonstration project investigating the feasibility of different technical and operational concepts as well as a telematic application on intermodal transport in urban areas in different European countries.

Referring to this, the project was subdivided into five horizontal and five vertical work packages as follows:

Horizontal activities

WP 0 Project management

WP 1 Best practice

WP 2 Demonstrator design and follow up

WP 3 Validation and Evaluation

WP 4 Dissemination and Exploitation

Vertical activities

WP 5 Validation site Nürnberg

WP 6 Validation site Öresund

WP 7 Validation site Paris

WP 8 Validation site Randstad

WP 9 Validation site Zürich

Starting with the design phase in which the demonstrators specified their design and layout (described in deliverable D 2.1 “Design process results”), followed by the demonstrator verification (deliverable 2.2 “Verification process results”), set up and implementation phase the different IDIOMA demonstrators were carried out. In parallel the horizontal activities of the IDIOMA project accompanied these phases by carrying out a detailed evaluation of the demonstrator activities (described in deliverable D 3.1 “Consolidated evaluation results”). Details on the individual demonstrators and tasks are described in the following chapter “Scientific and technical description of the project”.

In addition to the demonstrators conclusions and the results IDIOMA activities focussed also on the documentation of existing best practices from previous projects and to derive best practices from the IDIOMA demonstrators (described in the deliverable D 1.1 “IDIOMA best practice handbook”).

Furthermore several documents (reports, deliverables, newsletters and brochures) were produced during the project life time describing the project progress. The publications have been distributed to interested parties. A list of all publications is given in the annex.

4 Scientific and technical description of the work packages

In IDIOMA, five demonstration sites provided results on a broad spectrum of prevailing conditions aiming to prove the interoperability of the systems developed across modes and countries. The innovative solutions demonstrated on the five IDIOMA test sites in Europe were:

- Nürnberg, Germany; focussed on a more efficient handling of intermodal transport via the freight village; parcel services with small containers.

- Öresund, Sweden; tested a 'Multi-Temperature-Zone' vehicle for food logistics and co-operative city logistics solutions.

- Paris / Ile de France, France; employed telematics and positioning tools in pre and end-haulage, and road traffic information system in order to determine container availability in close temporal proximity.

- Randstad (Amsterdam, The Hague, Utrecht, Rotterdam), The Netherlands; demonstrated parts of the urban rail network system “Flownet”.

- Zürich, Switzerland; focussed on the demonstration of an integrated small container solution, of the horizontal transhipment equipment Furmia and the system integration between ACTS and conventional transport technologies

By this means IDIOMA contributed to a more efficient and environmentally friendly freight distribution in cities and regions. By integrating a broad range of users during the definition and also during the test of the demonstrators, the importance of the user-oriented approach was taken into account.

4.1 Validation site Nürnberg

Nürnberg is one of the 15 biggest economical regions in Germany with more than 500,000 inhabitants within the city-limits and 1.5 million inhabitants in the surrounding area. With its international airport, the Rhine-Danube-Channel, the goods- and passenger-rail-road-links and many highways Nuremberg is connected to the whole European economical system. The main industries in Nuremberg are the automotive parts industry, the railroad vehicle industry, the toy industry and the pencil industry. Besides that, Nuremberg is attracting millions of tourists each year and is the shopping centre for the whole metropolitan region with large pedestrian zones and many events and fairs.

In Nürnberg 3 different approaches were demonstrated:

- Co-operative intermodal inbound logistics to city
- Innovative containerised load units
- Multi-operator tracking and tracing system for co-operative “city logistics” delivery activities

4.1.1 Co-operative intermodal inbound logistics to city

The central idea of this task was to collect toy industry transportation goods for the Nuremberg region with origin all over Germany in bundling or consolidation points. For the main haul the goods should be sent from the bundling points to Nürnberg by railway instead of by road. This approach intends to reduce negative external effects over the whole transport chain and additionally to provide positive economical effects because of the goods' consolidation. The approach was carried out with Nürnberg's famous toy distributor VEDES/INTERCONTOR. On the basis of a transport planning application developed by WISO the economical and ecological effects of the bundling of goods, of the consolidated transport and of the modal change was simulated.

4.1.1.1 Transport chains and good flows of the demonstrator

Within IDIOMA, the operation of co-operative intermodal inbound logistics was implemented and tested at the toy retailing company VEDES.

The present procurement processes of VEDES are characterised that each toy producer sends his mostly small goods amounts directly to the VEDES central warehouse in Nuremberg. Therefore, a high number of relations in long value chains appear. This leads to negative environmental effects because of unnecessary driving and to negative economical effects for the transport agency and the receiver (VEDES) because of a high number of vehicles waiting at the VEDES ramp.

Another problem which exists is that the logistic-chain is defined by the consignor. Therefore there is no logistical collaboration between the different involved groups (transport agencies, toy producers, VEDES). Hence, synergetic effects are not exploited yet.

The following graphic pictures out the main problems of the current status. In the VEDES example exists only one receiving point with lots of connections from areas of origin.

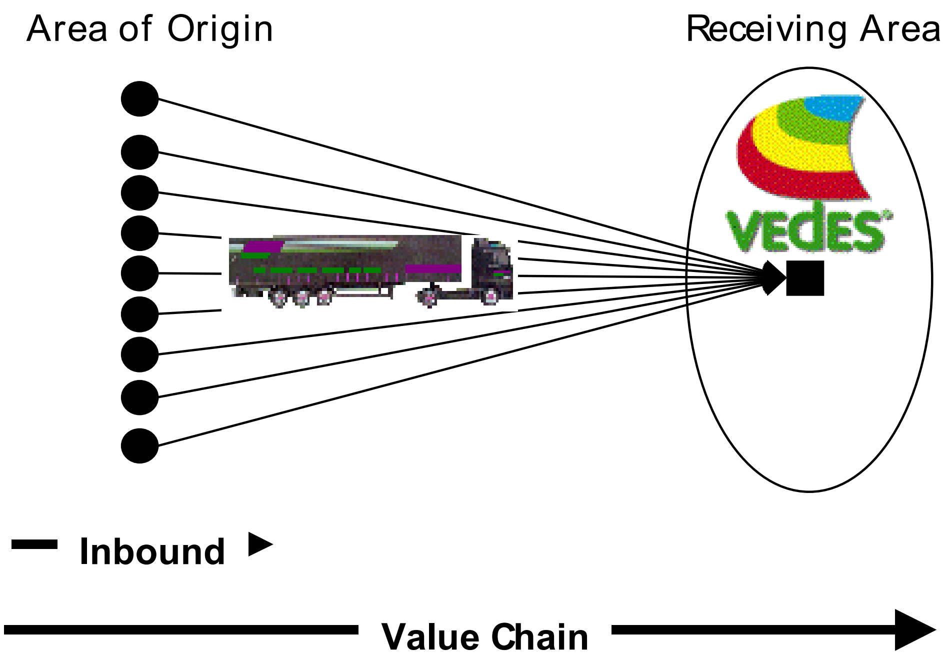


Figure 1:A closer view on the problem of inbound logistics – the VEDES case

4.1.1.2 Demonstrator approach

The subproject “co-operative inbound logistics” aimed at the reduction of inbound orientated long-haul traffic in metropolitan areas by bundling several amounts of small goods flows from different suppliers in defined areas of origin by one GVZ-forwarding agency with the help of the multi-modal functions of the Nuremberg freight centre (GVZ).

The goods are collected with trucks and brought to a consolidation point with the possibility to handle multi-modal freight. Such a place to send and receive bundled freight is typically a multi-modal freight centre (in German: Güterverkehrszentrum, abbreviation GVZ). From there the freight will be delivered to the Nuremberg GVZ from which the further delivery process to VEDES takes place.

The expected results of this approach was a reduction of transport relations and complexity as well as a reduction in negative external effects. The following figure gives an overview of the demonstration approach at the VEDES company:

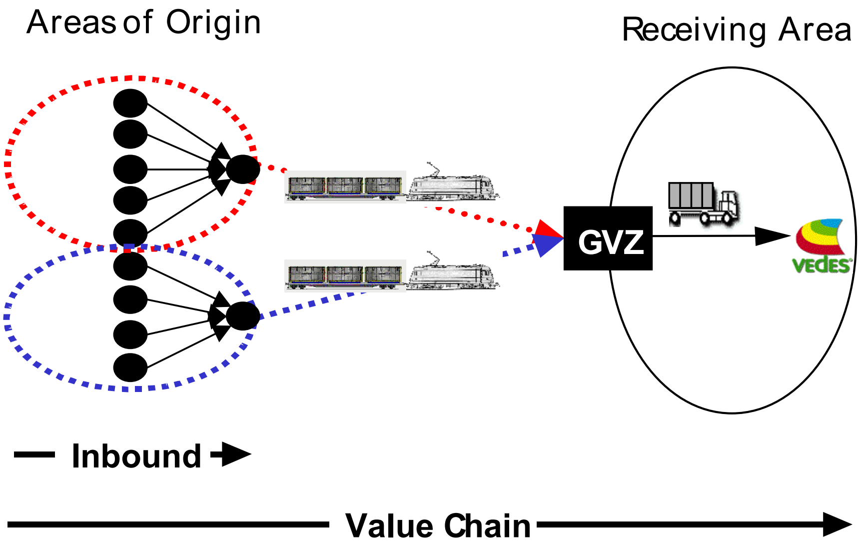


Figure 2:A closer view to the solution for inbound logistics

The demonstration approach started with a simulation of the bundling possibilities. Therefore, a software called NC dis was applied in order to determine the suppliers consolidation points. At the same time forwarding agencies are interviewed to assure that the used data which couldn’t be collected at the VEDES stock receipt like transport tariffs or weight proportions are close to reality.

Closer description of utilised software NC dis[1]

The mentioned software was developed by the NET CONFIGURATION GROUP NUERNBERG. Its originally task is the optimisation of distribution nets. Figure 3 describes the functionality of the software by illustrating the typical distribution freight net.

Different shippers carry their freight to central warehouses. From these central warehouses starts the goods supply to the regional warehouses with usually several contracted transport agencies. The so called pre-run to the central warehouses takes usually place with small delivery vehicles, the main run from the consolidation point to the distribution point (regional warehouses) proceeds with different transport modes (railway, inland navigation, truck).

[1] Net Configuration distribution.

From the distribution points starts the last delivery step to the final clients, again with small delivery vehicles.

The above explained scenario is just significant for the so called piece goods. Parcels will be send by parcel services and truckloads need not to be consolidated, they can be delivered directly, too, like shown in the following figure.

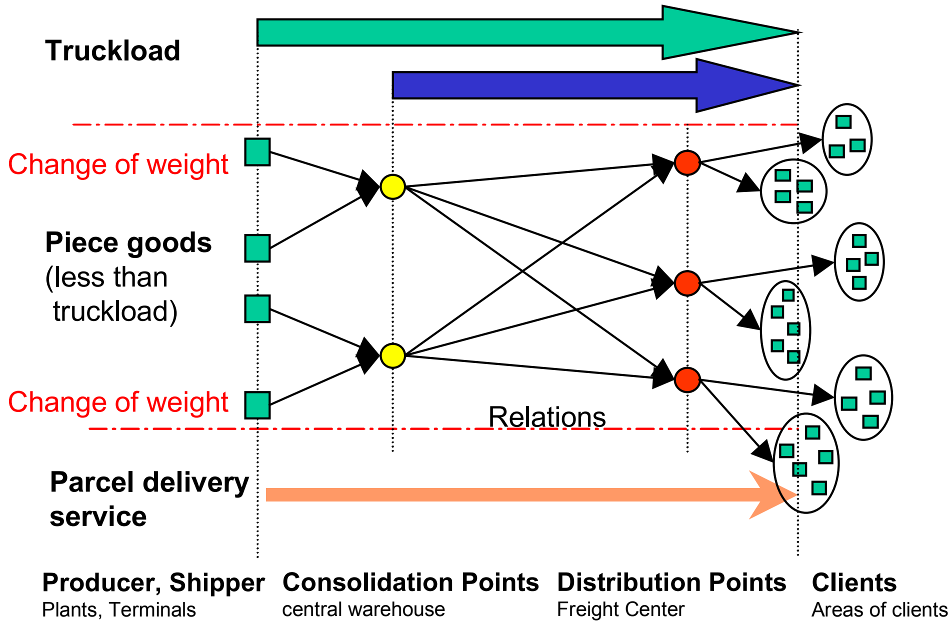


Figure 3:General distribution net

In a next step the optimal number of distribution points was generated. The software calculated a scenario at the optimal cost basis. For a given number of regional warehouses the optimal location for the distribution points were calculated.

The simulation of the inbound transport processes creates the inverse case of the consolidation of goods and can be described as follows:

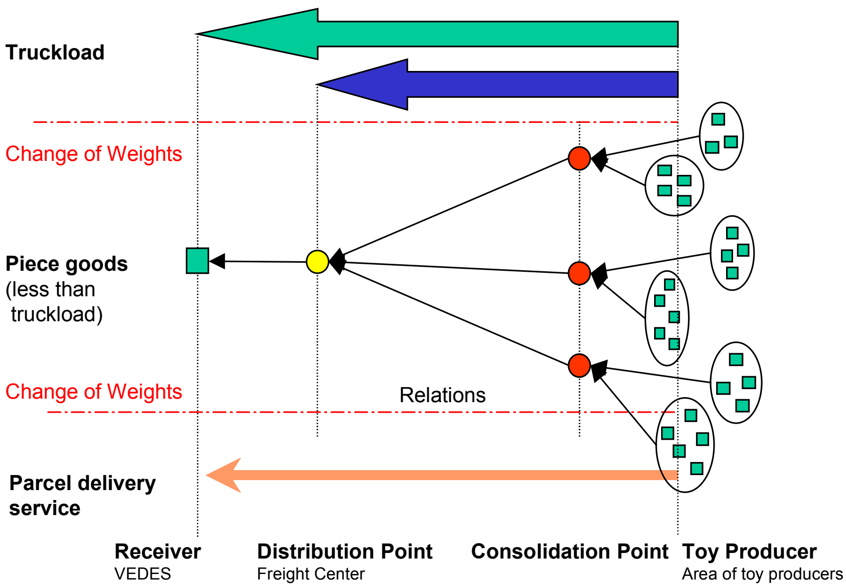


Figure 4:Consoditation net in the VEDES case

Within the simulation carried out in the IDIOMA project VEDES is the only receiver, the only distribution point is the GVZ freight centre Nuremberg.

4.1.1.3 The simulation

The VEDES stock receipt and delivery structure are as follows:

- Altogether 868 toy producer provide VEDES with goods. The big majority of them is located in Germany (80%). The rest is located in Asia (12%) and in other European countries (8%).

- 16446 deliveries were received in the year 1999, half of it by parcel services the other half by transport agencies or company owned vehicles (not owned by the VEDES but the toy producers).

The following figure shows the case of nine consolidation points. The distance from the majority of the toy producers to the consolidation point is that high that possible savings in the main-run cannot even equate costs for a conventional direct truck delivery.

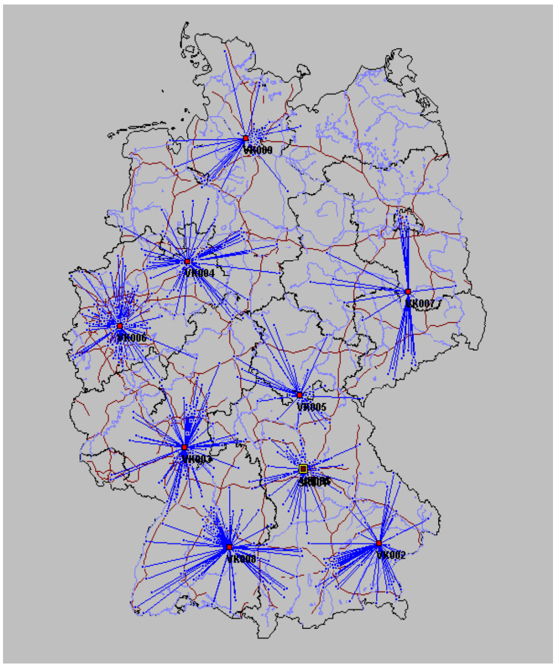


Figure 5:Optimised scenario for 9 consolidation points

In order to come to a commercial viable approach supporting measures had to be applied. By using another functionality of NC dis not only the location but also the amount of yearly deliveries was considered. Combining both, volume of the toy suppliers (size of squares) and the GVZ locations is shown in the figure below.

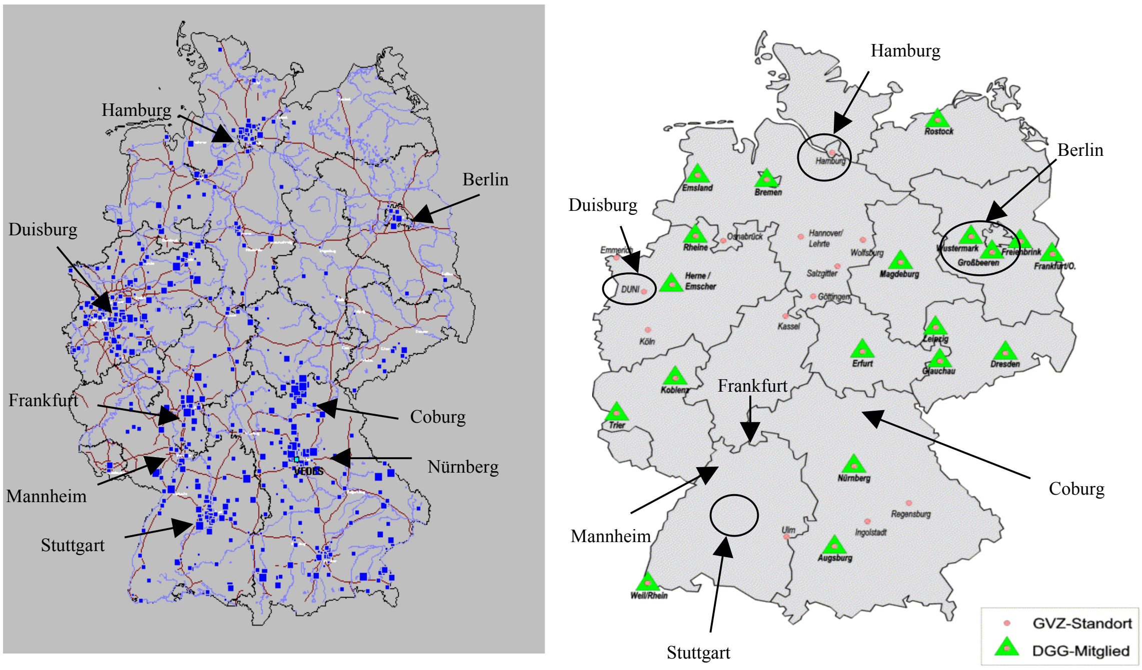


Figure 6:Evaluation of consolidation points and areas with the help of NC dis and the GVZ map

On the left side the NC dis graphics points up areas of interest for consolidated deliveries due to a high frequency of toy producers. On the right hand the GVZs which can be used as bundling points are shown. The next step is to choose areas and the closest GVZ to this area and then find out if and when up to which distance from each possible consolidation point a bundling makes sense. At last the regions around Hamburg, Duisburg, Berlin, Mannheim and Stuttgart were chosen for a deeper analysis.

To find out up to which distances a bundling makes sense four radius with different distances (Zone I = 25 km, Zone II = 50 km, Zone III = 75 km, Zone IV = 100 km) have been drawn around each region. Then with the help of NC dis the current and the planned status for each zone was calculated by using just the toy producers of the appointed zone. This was done for each zone at each consolidation point to find out their concrete saving potential of costs and emissions as shown in the following figure.

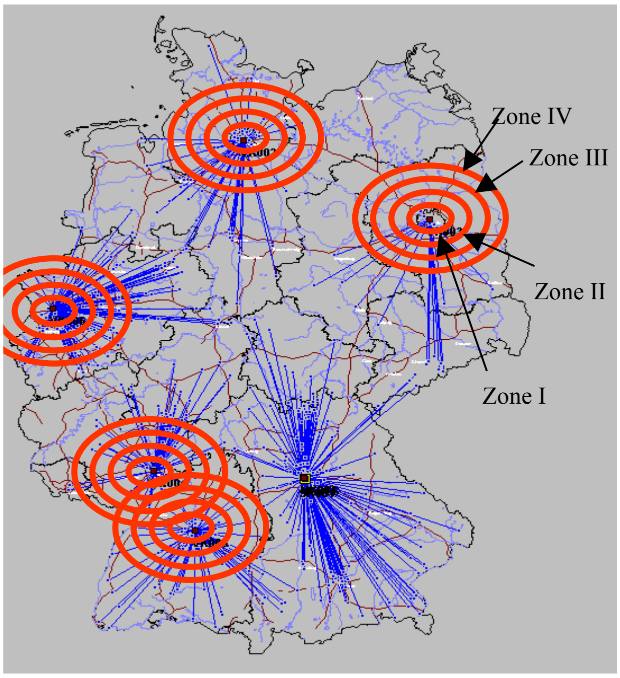


Figure 7:Building of areas around potential consolidation points

4.1.1.4 Results

Besides the region of Stuttgart in no other area cost savings could be evaluated when simulating the consolidation system. And even in the Stuttgart area the savings are very low. The most effective zone is Zone I (where the toy producers are located closest to the GVZ) and even there the annual savings are calculated with about 3000 Euro.

The reasons for this - at the beginning of the analysis rather unexpected result - are too high pre-run costs on the one side and too low savings of main-run costs. In total the approach leads to more km driven than in the pre-IDIOMA status. This can mainly be explained by:

- The locations of the toy producers which are too widespread. There are only very few toy producers immediately close-by the chosen consolidation point.
- The amount of bundled goods is not sufficient to receive high savings on the main-run.

As the locations of the toy producer can´t be influenced and already the consolidation point with the highest potential were chosen modifications are just possible in the type of bundling. Up to now, just an area-based bundling was considered, which means that just the goods of one day are bundled. By introducing a time-based bundling the necessary amount of goods might be possible to reach. But such a close by Just-in-Time delivery is practically hard to achieve. Another very significant problem by analysing the goods volumes is the seasonal fluctuation. In the main periods the necessary good volumes will be reached. But observing the whole year it is not advisable using the consolidation system. Therefore, it has to be stated that the consolidation approach for the regarded toy industry is economically not applicable.

The environmental evaluation show that the number of kilometres driven on road strongly declines, because a high number of tours on the German highways could be saved. This resulted in a reduction of 76% up to 81% of emissions in the main run. In the intermodal case, compared with zero-state, a reduction of 64% CO_2, 95% NMHC, 94% NO_x and 60% reduction of SO_2 was indicated when using the train in stead of truck for main haulage.

In the overall evaluation of the simulation it became clear show that the approach has negative economical effects in most scenarios considered. It became obvious that complex and long pre-haul traffic operations leads to more km driven than in the regular pre-IDIOMA status that overcompensate the reductions achieved in the main haulage. In total neither commercial benefits nor the expected ecological advantages could be verified. Because of the goods' characteristics in the toy industry, consisting of large consignment volumes with light specific weights, no cost reductions could be achieved with a consolidated main rail haulage. Nevertheless, the potential of this approach should be checked for other industrial sections with characteristics that fit better to the requirements of intermodal transport than those of the toy industry.

4.1.2 Innovative containerised load units

In the second sub project on the Nürnberg site small container units (Hellmann-Boxes, 1/3 swap bodies) were demonstrated for parcel delivery. The demonstration was carried out together with DPD (Deutscher Paketdienst) and WISO. By the integration of the new container units in the parcel delivery processes positive environmental effects were one major expectation of the approach. Three small containers – each considered for one delivery tour - were loaded in Nuremberg DPD depot and transported to a regional transfer point located in Neumarkt (50km far from Nürnberg). At the transfer point Neumarkt a fork lifter lifted the container units onto (and off) the delivery vehicles. The delivery vans at Neumarkt operated with CO_2-neutral rape seed oil for propulsion and were therefore free of green house gases neutral. Common practice is to employ 3 delivery vans starting from the Nürnberg depot for this tour.

4.1.2.1 Transport chain and goods flows

Each day about 20.000 parcels directed outbound from various commercial consignor to other national and international geographical destinations are transhipped through the DPD depot Nuremberg (Depot 190 and Depot 191). Each day about 26.000 parcels that are directed inbound to the Nuremberg area for commercial consignees in the depot covered area of nearly 1000km² (Northeast Bavaria).

The following graphic shows the described way conducted by the drivers and (in the small map) the location of the DPD depot 190 delivery area:

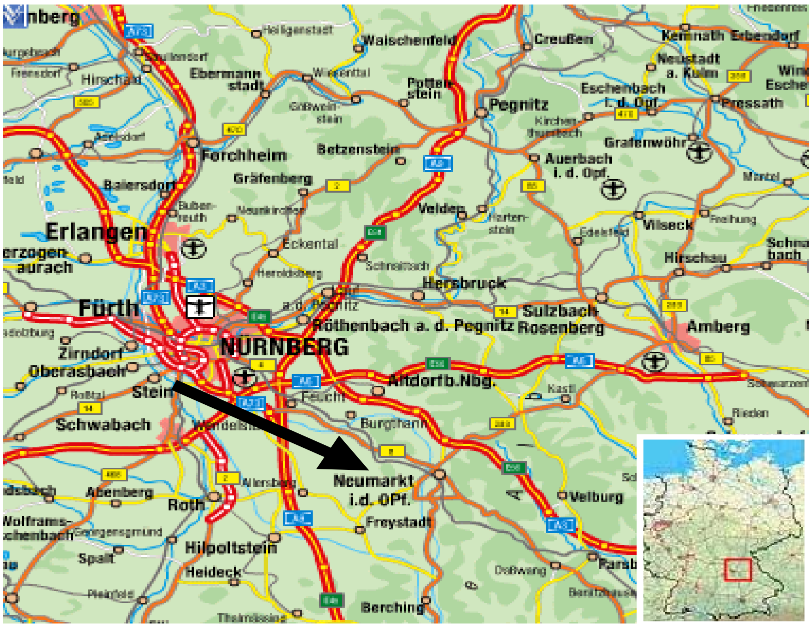


Figure 8:Overview - Way to distribution area and distribution area itself

Summarised each delivery vehicle of the Neumarkt tour of the transport agency conducts a tour of 114km per day (traffic to Neumarkt, delivery traffic in Neumarkt and traffic from the delivery area to Nuremberg). The street attendance time is about 90 minutes on highway and federal routes and 240 min in the delivery area, so 330min in total each day. Per year (with 250 regular working days in the average) each delivery vehicle has a street attendance time of 82.500min or 1.375h or 57 days.

Each delivery vehicle on a tour can take 150 to 180 parcels. During the demonstration period about 450 parcels each day have to be delivered in the Neumarkt inner city and the city near outskirts. As one vehicle usually carries 165 parcels three vehicles were needed to carry out the delivery.

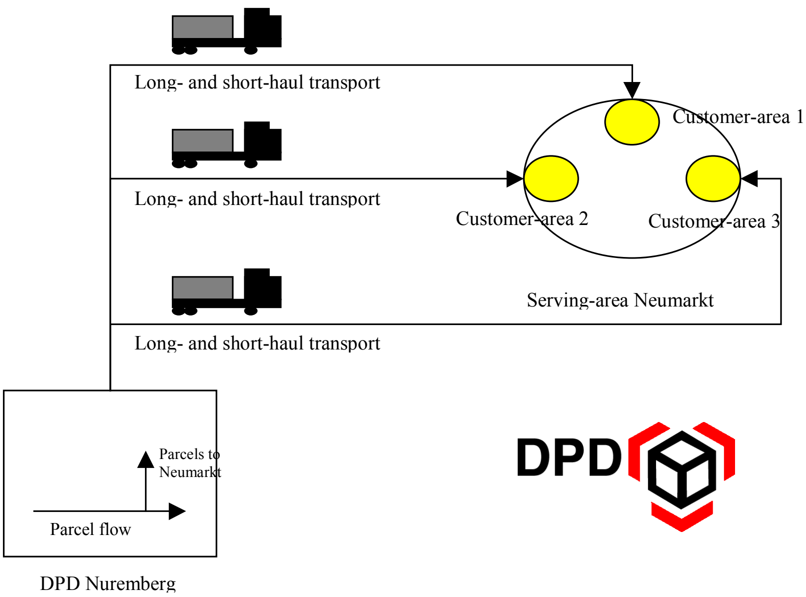


Figure 9:Current Situation at DPD Nuremberg

4.1.2.2 Demonstrator approach

The core of the approach was that only one large transfer vehicle will serve a transfer-point in Neumarkt. It should transport three small container load units, which were moved from this vehicle by forklifts to special short-haul and regenerative propulsed transport vehicles, serving the different areas in the Neumarkt region.

The following figure illustrates this transportation and distribution process:

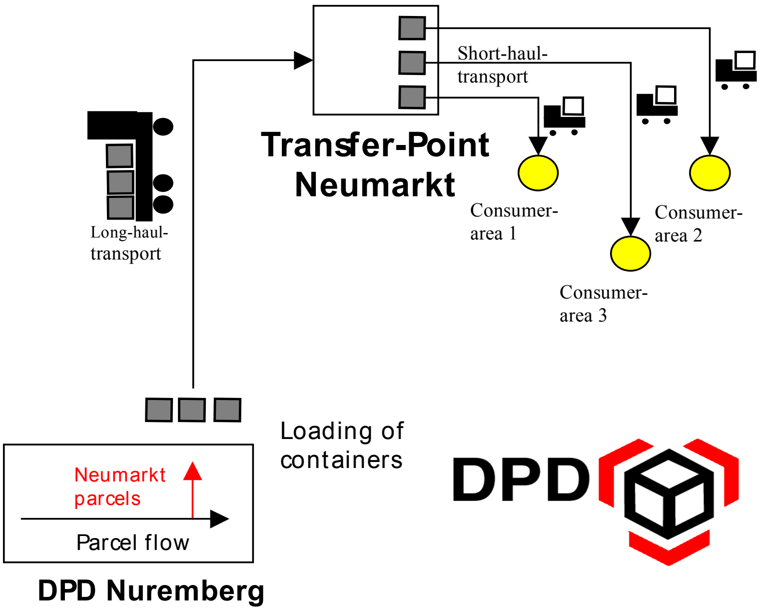


Figure 10: Planned approach for parcel delivery with small container units

By this approach it is intended to reduce negative external effects (noise, air pollution, street attendance time responsible for congestion) and to increase the economic profit of regional transports by „bundling“ several separate smaller loading units on one bigger vehicle and to move them on several smaller vehicles for distribution in the areas of destination.

4.1.2.3 Results of the Demonstrator

No “loading-through” method at the ramp with small containers was possible; operational changes of and at depot ramp were needed

The most relevant change for the transport agency was the modification of the ramp for the Neumarkt-tours in the DPD freight centre. The loading of small containers is limited to one side (from the back) with no “loading through” possibility. This type of construction has to be used because of stability-needs of the containers which are made of light-weight material.

Because of the fact that the three containers are to be fixed side by side on the swap body frame a new transfer mode had to be found. The flat with the three containers could be placed only short-site to the depot ramp and therefore a loading gangway to the containers was needed. For the loading a swap body was used as such a gangway placed side by side with the swap body frame. This solution was a practical approach for the demonstration with a high safety risk in a daily operation.

The following picture shows the operational changes:

Figure 11: DPD Depot with swap body as loading gangway

The next picture is a view from the loading gangway showing the loading processes of the small containers:

Figure 12: Loading process at the DPD depot

The DPD depot is equipped with flexible automatic transportation belt that can be changed easy in length. This transportation belt made it possible to load the swap bodies via the "gangway". Otherwise each parcel had to be picked up and carried onto to the transfer swap-body with the need of high man power (400 to 500 parcels with average weight of 5kg each makes between 2,0 tons and 2,5 tons of short manual transportation in a few hours of the loading procedure by the subcontractors of the transport agency). In our case the transport belt could be extended onto the transfer swap-body so that the picking could be done near the containers loaded.

The following picture gives an image on the length-flexible automatic transportation belt with a view to the transfer swap body:

Figure 13: Automatic transportation belt reaching inside the “loading gangway”

It should be noted that the demonstration approach leads to a total change in the regular operational parcel management where the short haul transport vehicles are usually placed back door-to-ramp so that the load process can be conducted very easy and fast. All the operational problems could not be overcome for transferring the approach in a continuos operation.

Integration of long and short haul traffic with reduction of vehicles needs new logistical process parts and reduces related negative external effects

Because of the use of the application of the swap body frame it was possible to realise a reduction in the amount of used vehicles.

Before the implementation of the demonstration each regional delivery vehicle had to drive the way to the Neumarkt delivery and pick-up area. While the demonstration one large truck was used for the main-run from DPD depot to Neumarkt: Instead of three delivery vans (Mercedes Sprinter) one truck (Mercedes Benz) performs the transportation of 400 to 500 parcels to Neumarkt.

Such a transfer lorry is a new part of the parcel delivery process that is typically never used in DPD organisation that usually employs vans under 7,50 tonnes gross vehicles weight.

The following picture gives an image of the loaded transfer lorry just leaving the transhipment platform:

Figure 14: Transfer lorry loaded with 3 swap-bodies

Necessity of a transfer point and related equipment and process changes

The implementation of this small container solution made an additional transfer point at the pick-up and delivery area necessary. At this transfer point the small delivery vehicles with the environmentally friendly rape seed propulsion and the second units of small containers for the return load are located.

The following picture shows the transfer point in Neumarkt / Mooswiese, about 5km far from the Neumarkt city centre. The three innovative delivery vehicles and the three empty containers from the delivery day before.

Figure 15: Transfer point Mooswiese

Why this transfer point:

(1) In the Neumarkt city centre there is no place to park the environmentally friendly delivery vehicles and to leave the containers over night. All park space in this city is reserved to the inhabitants and customers of the local city retail stores.

(2) Transhipment of the containers from the flat to the delivery vehicles requires for a specialised fork lifter. In the inner city a forklift is not applicable and wanted in such areas. The forklift must be specialised because the weight of one container with a complete load parcel volume and because of the size of the container. Therefore a strong heavy weight forklift is required (risk of overbalancing). Also due to the size of the small containers a special extra-long fork is needed.

The industrial area of Mooswiese was identified as transfer point as it has a good accessibility from the federal route B8 and is just 5km far from the Neumarkt city centre. A possibiolity was given to park the delivery vehicles and exchange containers over night and (most important) a forklift garage was available .

Transfer point of the containers costs time and need skills

After arrival of the long haul regional transfer lorry additional staff for he transhipment is needed. The driver of the transfer truck unlocks the containers on the swap body frame. The forklift raises the container from the flat. Then the full container is transferred to the delivery van that has been prepared by its driver (e.g. unlocking container locks after starting the engine).

The next picture shows this part of the process:

Figure 16: Transferring the small containers from truck to delivery vehicles

Then with the help of the of the driver (and sometimes with the help of the transfer lorry driver) the container is placed directly onto the delivery vehicle

This process part was not easy to handle and took sometimes several attempts until the container could be locked onto the delivery vehicle. This task was always conducted under hard time constrains and the material handling was not always tenderly. Each day the transport agency lost 50min with the planned process in comparison with the regular process with the usually used parcel vans!

Figure 17: Putting the swap-body on the transport

After unloading the full containers the now empty swap body frame on the transfer truck was loaded with the empty containers to secure the next days delivery.

Constraints of the pick-up and delivery process in Neumarkt had to be compensated with experience

The pick-up and delivery process in Neumarkt was conducted without any changes but with use of the environmentally friendly delivery vehicles. As the small containers are equipped with a tambour door need the complete capacity of the small containers could not be used. Therefore, one layer of parcels had be omitted. The width of the tambour door was not to compare with the two wing doors of regular vehicles so the loading and unloading process while pick-up and delivery became less comfortable.

The following pictures show the delivery process in the street area (left) and on places with longer stop possibilities:

Figure 18: On delivery tour in Neumarkt

The result is that the pick-up and delivery process lasted longer than before. This constraint could have been compensated with a very fine tuned loading operation (sorting the parcel according to a tour plan) in the morning that requires high experience of the personal of the transport agency. The customers did not really notice the change in the delivery concept because the parcels are brought mostly into their business rooms or their loading area on the back side of the house.

Also because of the regular appearance of the van (without environmentally friendly notices on the containers) the inhabitants and customers of the retail stores did not make notice of this distribution form.

4.1.2.4 Environmental results

For the rape seed van reduction percentages of the emission factors were derived from data of the research centre for rapeseed propulsion Connemann GmbH & Co. KG in Leer. Thereafter the CO-emission is only 88%, CO_2-emission 0%[2], HC-emission 65%, mKR 50%, NO_x 92% and Particles only 64% of the regular diesel-emission amount. Rapeseed oil contains no benzene or sulphur, reduces the smut-emission and generates from renewable materials.

Due to the use of rape seed oil CO2 emissions in the inner city area could be reduced by 50% in the IDIOMA demonstration case. However, as a heavy truck for the main run was used the overall CO2 balance is almost equal to the pre-IDIOA status where three vans were used which have a lower specific fuel consumption. The following table gives a summary of the pre-IDIOMA- and IDIOMA-case based on one year in kg/year.

Emission	pre-IDIOMA	IDIOMA	Change.	Unit
Benzol	1.07	0.98	**-0.09**	**kg/year**
CH4	1.40	1.45	**+0.04**	**kg/year**
CO	168.94	162.72	**-6.21**	**kg/year**
CO2	18,.780.78	18,687.54	**-93.24**	**kg/year**
HC	21.09	44.43	**+23.34**	**kg/year**
MKr (Diesel)	5,863.31	6,657.71	**+794.41**	**kg/year**
NMHC	19.68	38.23	**+18.54**	**kg/year**
NOx	65.33	137.54	**+72.21**	**kg/year**
Part	5.81	9.19	**+3.38**	**kg/year**
Pb	0.02	0.01	**-0.01**	**kg/year**
SO2	4.43	5.48	**-1.05**	**kg/year**

Positive numbers (in kg/year) mean that a deterioration occurred, negative numbers indicate less pollution in the IDIOMA-case. Because many of the emission factors indicate a small increase/decrease per year, one can conclude that no major ecological effects on emission reduction can be recognised.

Regarding the operational evaluation the demonstration results showed a reduction in street attendance time of 20% compared to the initial situation. This was achieved thanks to combined long haul road traffic with only one big lorry. Nevertheless, this new technology implies the change of many activities traditionally operated with a parcel delivery service, like

[2] There is a closed CO_2-cycle: only that amount of CO_2 is emitted as is taken out from the atmosphere.

changes in internal production processes or the use of a forklift with external personnel for regional transhipment which in the end caused higher costs. The following can be stated for the demonstrator:

- The street attendance time could be reduced by up to 20%.
- Time losses of up to 2 hours a day had to be considered at the DPD depot due to more operational effort needed.
- The higher costs for regional transhipment could not be covered by gains achieved in the main haulage.

It can be concluded that the demonstrated approach has the potential for new distribution concepts for parcel delivery in metropolitan areas. Prerequisite is that the higher transaction costs can be compensated by the gains achieved in fleet management. A follow up approach would need clear productivity gains to become economically viable. Also the environmental performance can be improved. This might be achieved by the creation of different "regional parcel hubs" and by the installation of an integrated overall trip planning application.

4.1.3 Multi-operator tracking and tracing system for co-operative "city logistics" delivery activities

For more than 3 years the Nuremberg „ISOLDE" city-logistics project has gained acceptance with several large parcel and less-than-truckload carrier organisations for consolidated inner-city deliveries and was a blue print example for many other cities in Germany and Europe. Further expansion and acceptance of environmentally friendly and co-operative distribution systems like city logistics needs supporting information and communication processes for an integration of the goods flow. The approach of the third demonstration task at the Nürnberg site was to develop and demonstrate a multi-user tracking and tracing system at ISOLDE city logistics. Central for this task was the development, realisation and demonstration of a co-operative bar-code identification technology using one single mobile scanner unit. The idea was to integrate the final goods delivery carried out by the ISOLDE city logistics operator into the information chain of various forwarding companies. The scanner technology applied is capable of creating a compatibility of the different barcode standards used by the forwarding companies.

4.1.3.1 Demonstrator approach

To integrate the goods flow and the information flow in the ISOLDE city logistics the OHB Teledata scanner software used by the Kühne&Nagel organisation was assessed by the demonstration partners as the most applicable and adaptable. By just using an "overlay" city logistic system the forwarders were not willing to conduct any changes to their actual operating IT-systems.

The working-procedure of the scanner contained a bundle of new operations:

- After the data input from the colli-barcode in the forwarders depot during the ISOLDE pick up tour in the morning, the out scanning of the data (status information) at the consignee takes place during the delivery tour via the ISOLDE city logistic.
- The data transfer from ISOLDE to the forwarders takes place in the afternoon after the completion of the ISOLDE delivery tour.

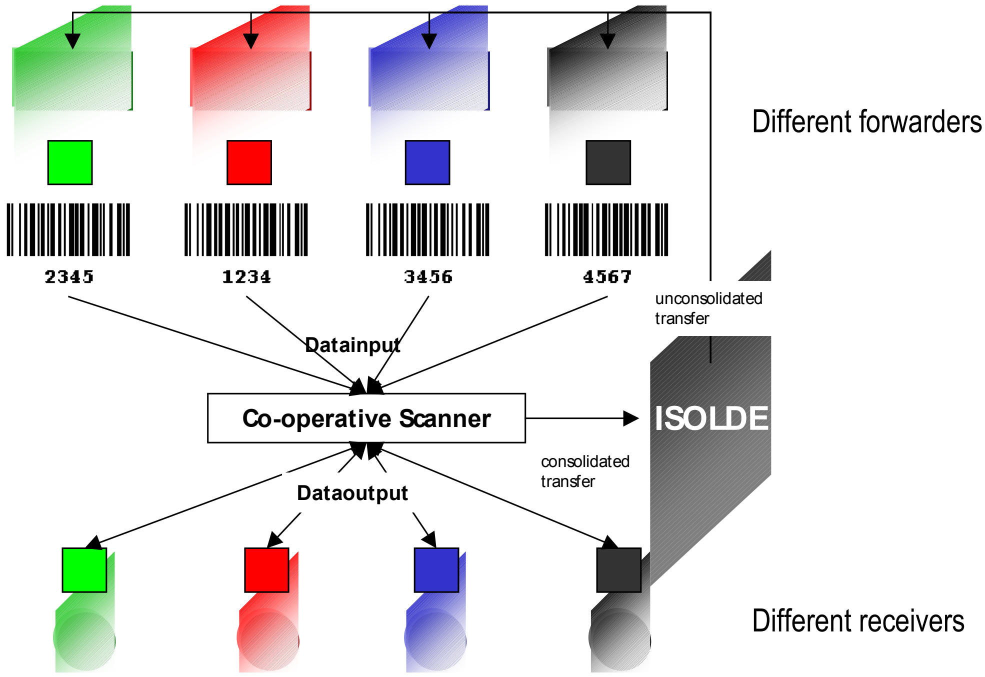


Figure 19: Data transfer within the ISOLD city logistics

The technical layout of the co-operative scanner for ISOLDE is defined with the demonstration partners Symbol as follows:

(1) a PDT 3100 Portable Data Terminal from Symbol

(2) a 8-line display

(3) a 46-alphanumeric and 21 numeric keypad

(4) a co-operative software for multi-forwarder operations

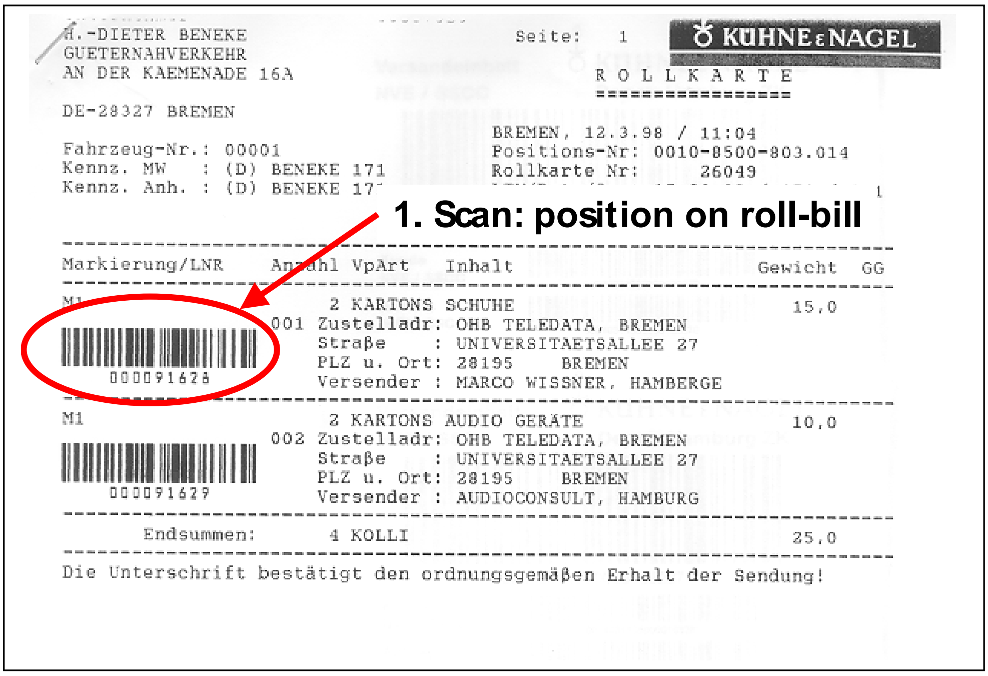
(5) a Cradle for the PDT 3100 to read out data at the ISOLDE-depot with a regular WIN95-system and an e-mail-option.

The scanner can read poor-quality or large symbols, up close or at a distance. It has a high first read rate and accuracy and can scan through plastic and other protecting coatings. The scanner head can rotate and permits left- or right-hand scanning with equal ease.

A detailed view to the scanner with the cradle is provided by the following graphic:

Figure 20: The Symbol scanner

The following graphic summarises the scanning process to be carried out by the ISOLDE delivery tour:


H.-DIETER BENEKE
GUETERNAHVERKEHR
AN DER KAEMENADE 16A

DE-28327 BREMEN

Fahrzeug-Nr.: 00001
Kennz. MW : (D) BENEKE 171
Kennz. Anh. : (D) BENEKE 17

Seite: 1
KÜHNE & NAGEL
R O L L K A R T E

BREMEN, 12.3.98 / 11:04
Positions-Nr: 0010-8500-803.014
Rollkarte Nr: 26049

1. Scan: position on roll-bill

Markierung/LNR	Anzahl VpArt	Inhalt	Gewicht	GG
M1 000091628	2 KARTONS	SCHUHE 001 Zustelladr: OHB TELEDATA, BREMEN Straße : UNIVERSITAETSALLEE 27 PLZ u. Ort: 28195 BREMEN Versender : MARCO WISSNER, HAMBERGE	15,0	
M1 000091629	2 KARTONS	AUDIO GERÄTE 002 Zustelladr: OHB TELEDATA, BREMEN Straße : UNIVERSITAETSALLEE 27 PLZ u. Ort: 28195 BREMEN Versender : AUDIOCONSULT, HAMBURG	10,0	
Endsummen:	4 KOLLI		25,0	

Die Unterschrift bestätigt den ordnungsgemäßen Erhalt der Sendung!

Figure 21: Bar-codes on roll-bill: position on roll-bill

The first scan is the barcode of the position on the roll-bill (here: two single units are to be delivered and combined under the first barcode “000091628”). If the roll-bill does not have a barcode for identification here the number of the bill can be given in manual as option. The second scan is the barcode of the single consignments, here “003340311350000168270” and “ 003340311350000168287”. These labels are fixed at the consignment. Those labels had to be scanned after the delivery to the customer took place.

Figure 22: Bar-code on roll-bill: single units

In order to give the forwarders the possibility to receive the delivery data on collie basis (consisting of more than one consignment) a special software application had to be developed. With the help of the “IDIOMA.Loader” text files in “txt”-format can be generated and listed in a special data path. Each forwarder gets his own txt-file with the following information:

- - number of position of loading list
- - number of shipment(s)
- - date and time of loading
- - time of unloading
- - status information „ok“ or „----“

The last process step is to transfer e-mails to the forwarders to defined persons with the txt-file as attachment. The ISOLDE-terminal will generate individual feed-back for the forwarders by e-mail (on-line on demand).

The following graphic shows the process parts “loading” and “unloading” schematic:

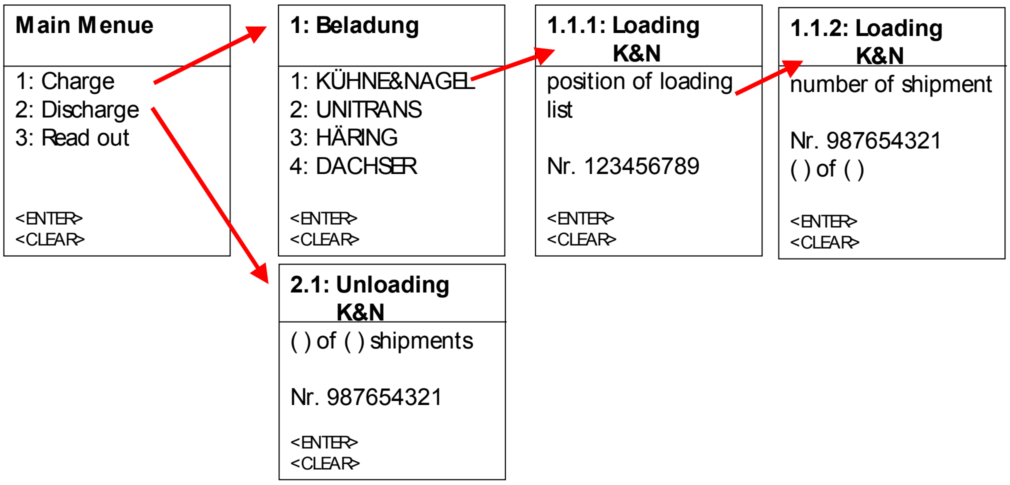


Figure 23: Schematic process of loading and unloading

4.1.3.2 Results of the Demonstrator

Considering that city logistics is no longer high on the agenda the most important results is that neither forwarder will give up their IT-systems for the co-operative scanner. That means that co-operative IT-tools are used parallel to the existing forwarder IT-environment.

Technically the new scanner worked as planned and was identified as a useful tool by the users. The result mask is given in the picture below and is described afterwards:

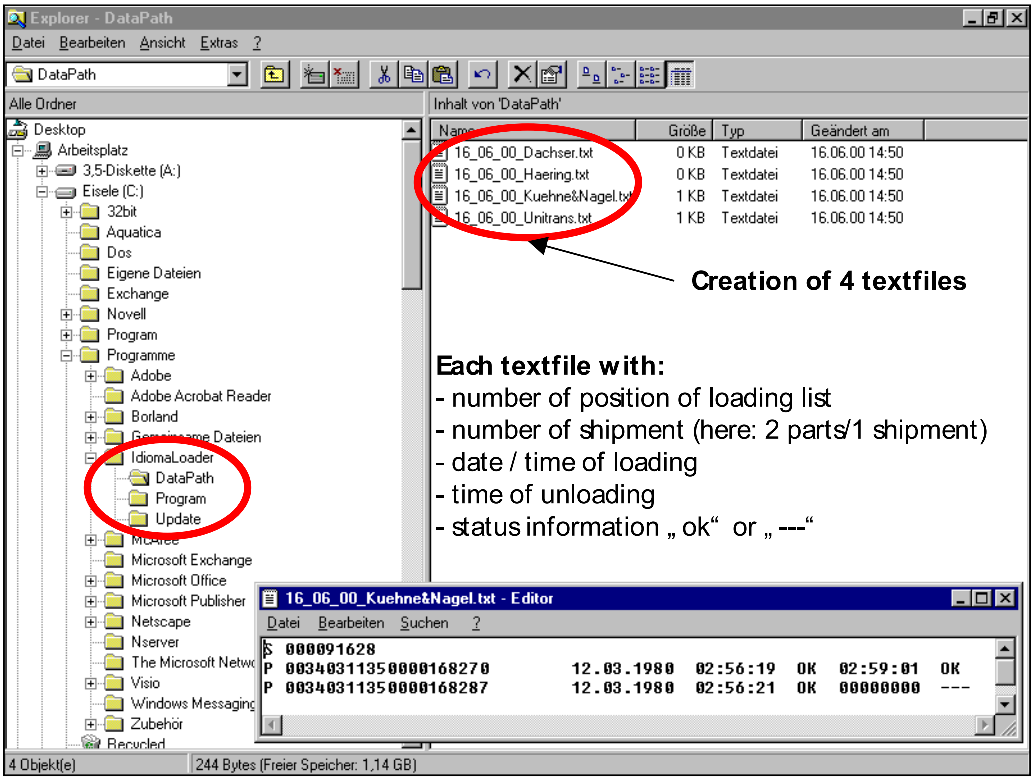


Figure 24: Results - Read out mask

In the IDIOMA Loader there are two relevant program groups: “Program” with the exe-file and the “Datapath” for storing the txt-files after reading out the scanner data.

In this picture the txt-files in the “DataPath” have been generated. One can see e.g. the Kühne & Nagel data with 16_06_00_Kuehne&Nagel.txt created at 16.06.00 at 14.50 p.m.

Opening the text file e.g. in the “Editor” you receive the number of position of loading list (here: “S” for German “Sendung” or position on roll bill), the number of shipment (here “P” for German “Packstück” or single consignment), date and time of loading behind the single parcel unit (here with the wrong date because of a “year 2000”-problem that was fixed by OHB during the operation phase), time of unloading on the same day with “status information ok“ when the delivery and scanning was carried out or “status information ----“ when the scanning was not carried out before reading out the scanner.

The functions of the co-operative scanner can be expanded by add-on equipment and processes as for example:

- Direct on-line transfer of delivery status from the vehicle (without the need of a transformation in the ISOLDE-Depot) to the operator.
- A GPS-supported navigation system to inform the customer about the supposed time of delivery (e.g. city logistics Bremen).

Figure 25: Further “add-on” equipment for co-operative scanner

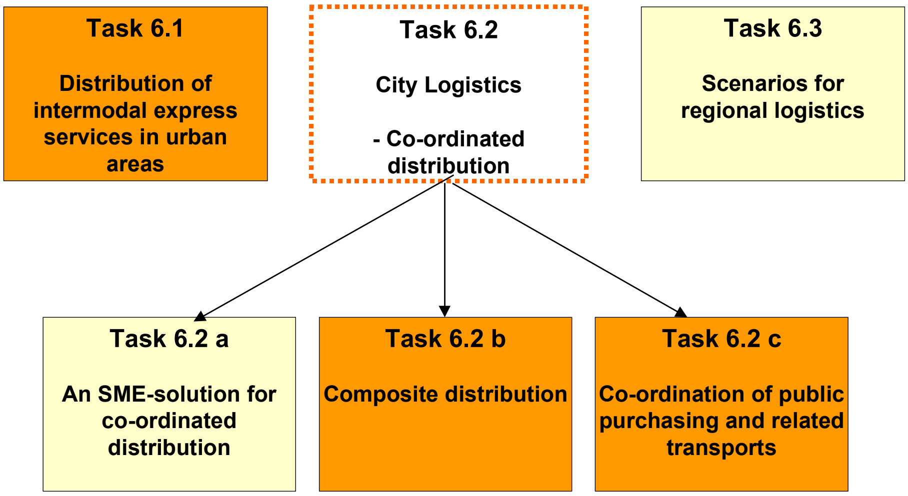
4.2 Validation site Öresund

The EU has designated the Öresund region as a model region for boosting employment. Through a joint environmental programme, the Danish and Swedish governments are seeking to create one of Europe's cleanest metropolitan regions. The EU Interreg II programme is financially supporting this collaboration across Öresund.

The Öresund Bridge, a fixed link between Malmö on the Swedish side and Copenhagen on the Danish side was opened in July 2000. The bridge is one of the prioritised TEN-projects supported by the EU, representing an important link in the completion of the Nordic Triangle. The bridge integrates the Öresund Region with its 3.2 million inhabitants and connects Scandinavia to Continental Europe. The Danish capital Copenhagen dominates the region, with about 1.2 million inhabitants. Malmö is Sweden's third largest city, with about 250,000 inhabitants.

The general objective of the Öresund Test Site was to identify, demonstrate and evaluate ideas and concepts supporting efficient and environmentally adapted city and regional logistics and define how (organisational as well as technical) barriers to change can be removed. The demonstration site was divided into three different tasks:

- Distribution of intermodal express services in urban areas,
- City Logistics – Co-ordinated distribution and
- Scenarios for regional logistics.



The task City Logistics is focusing on co-ordinated distribution from three different perspectives, both technical and organisational. There are demonstration activities in Task 1, 2b and 2c. Task 2a could not be demonstrated due to a lack of interested transport companies.

4.2.1 Distribution of intermodal express services in urban areas

This task was the operation of an intermodal transport chain with an environmentally adapted biogas vehicle for pick-up and deliveries in the East-Sweden region (City of Linköping). The demonstrator handles the transportation of small and medium sized parcels and packages from consignor to consignee. The goods flow can be divided into two parts:

- The pre-/end-phase is handled by Expressbudet i Linköping AB with environmentally friendly distribution vehicles.
- SJ Express operates the long distance transport. The goods are transported with passenger trains where SJ Express has access to special goods compartments.

A typical transport assignment is performed in the following manner:

A customer calls SJ Express or Pedal AB and wants to send a parcel to another city. Pedal will pick up the parcel and take it to the train station where SJ Express takes over the handling. The parcel will be loaded on a scheduled passenger train and taken to the rail station of the destination city. There Pedal picks up the parcel at the train station and delivers it to the consignee. For some consignments, the consignor and consignee do not use Pedal's service but handle the transport to and from the rail terminal by themselves.

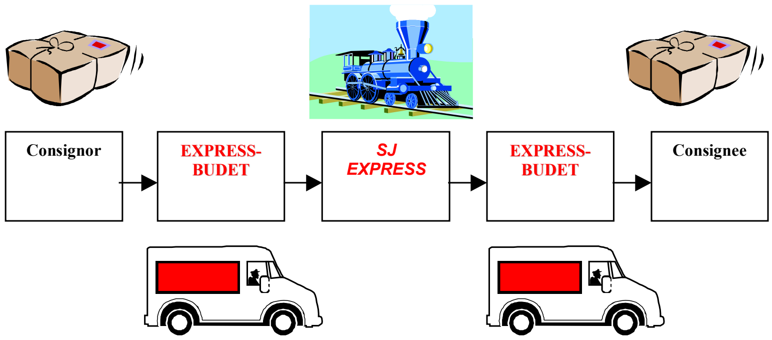


Figure 26: The transport chain in the task "Distribution of intermodal express services in urban areas

During one month SJ Express approximately handles 60 000 parcels, with a total weight of about 1,000 tons. 95% of the parcels are transported by passenger train and 5% by truck.

4.2.1.1 Demonstrator approach

The organisational structure for this task as described in the figure below

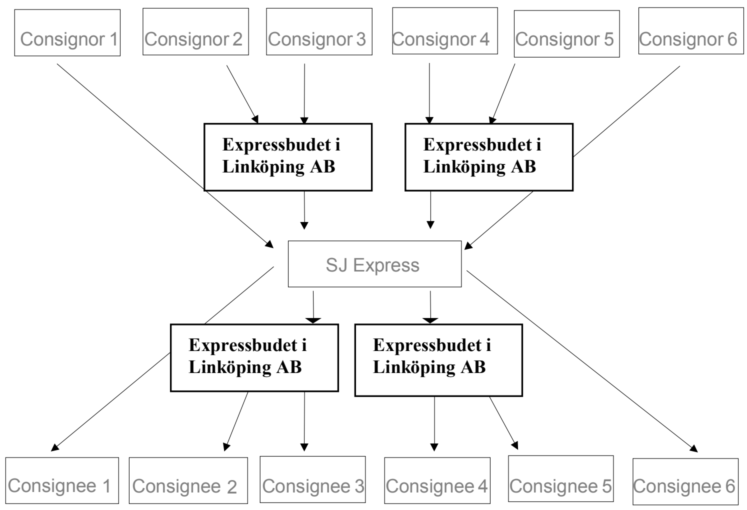


Figure 27: The transport system of SJ Express and partners

Vehicle and transhipment technology

The vehicle that was used for the demonstration as described is a new biogas fuelled van model. Specifications as follows:

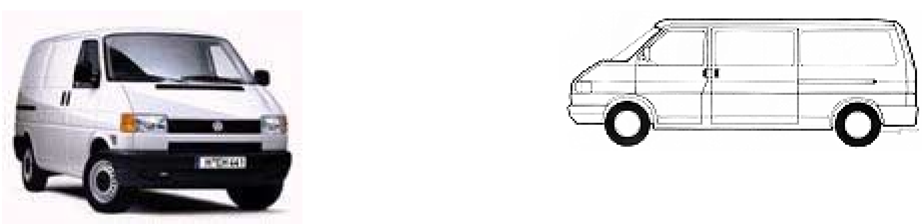


Figure 28: Volkswagen Transporter Van - long wheel base, Model 7DH1R2, 2000-model

The Transporter van has an extra 400 mm in the wheelbase. This boosts the load space length from 2,485 mm to 2,885 mm, giving an increase in load volume from 5.4 m3 to 6.3

m3. The Transporter comes equipped with automatic gearbox, AC, and extra door.

During manufacturing the Transporter was converted to both petrol and biogas propulsion. For this reason it was equipped with 2 biogas tanks. The Transporter was fitted with "Biogas vehicle" streamers.

<u>Rail transport equipment</u>

For the railway transport of express service goods the following train equipment was used:

- Goods wagons for passenger trains, with a maximum speed limit of 160 km/h
- Passenger rail cars with a goods and/or luggage compartment with a maximum speed limit of 160 km/h
- Goods racks in the machine rooms of the high speed trains (X 2000) compartment with a maximum speed limit of 200 km/h
- Rear driving compartment in electric multiple units (X10/X11), also named Pågatåg
- Goods racks in vestibules of diesel multiple units (Y2 – Kustpilen)

Figure 29: Goods wagon for passenger train

Figure 30: Passenger rail car with a goods and/or luggage compartment

This task also dealt with analysing the present methods of using the passenger terminal areas for loading and unloading of goods and on suggestions on how to improve the present situation. The terminal handling study was made on location in Malmö and Helsingborg. The results from this study will however also be applicable in Linköping since the terminal-handling situation is similar there.

4.2.1.2 Demonstration results

The results of the demonstrated combined passenger and goods transport approach show that generally the staff has positive attitudes towards the approach. No significant technical and operational problems were recognised during the demonstration phase. However safety aspects have to be considered when transhipment activities take place on the platform. Economically, the approach of combined freight and passenger transport showed a poor profitability. Main reasons are the much higher investment cost for the biogas van, compared to a regular diesel van, and the lower load capacity in the biogas van, since the biogas tanks are fitted at the rear of the cargo compartment. If the demand for biogas vehicles will increase the purchase price probably will be reduced.

Environmentally, the use of biogas shows clear advantages compared to conventional diesel driven vehicles. In particular the NOX emissions which are responsible for the formation of Ozone are significantly lower when using biogas fuel.

Emission index	NOx	VOC	CO	PM
Biogas 100%	13	100	25	8
Diesel 100%	100	100	100	100
Biogas 50% & petrol 50%	15	130	75	13

Figure 31: Emission index of different propulsion fuels

Technically and operationally, the approach showed no significant limitations. However, a follow up approach should concentrate on a safer interaction between pedestrians and goods handling equipment. This means that new handling equipment for loading and unloading of goods on pallets etc. is needed. Important in this development process is that the new equipment can handle pallets to and from trains from a fixed position on the passenger platform and beside the train.

The road transport company Expressbudet continued to use the biogas vehicle also after the IDIOMA demonstration due to the favourable results from the test period, and since then further biogas vehicles have been ordered. The first was to be delivered in spring 2001. The vision is that 50% of Expressbudet i Linköping AB´s vehicle fleet will be driven by biogas within 10 years.

4.2.2 City Logistics, an SME-solution for co-ordinated distribution

One major problem regarding city logistics today is the trend towards smaller delivery consignments, resulting in an increase in the number of delivery points and thus an increase in the number of kilometres driven. The consequences of this trend are increased levels of emissions and congestion. Studies prove that large economical and environmental gains can be achieved by using co-ordination along the transportation chain, especially in the pre- and end-leg.

Earlier studies done by TFK show that these companies often have an inefficient distribution structure (Sörensen et al, 1997). According to studies done these companies represent 50 % of the goods volume but over 90 % of the deliveries. This transport structure is negative from an economical and environmental perspective but is motivated by the need for customer contact, control of delivery quality and storage space as well as service performed during delivery, etc.

It was initially planned in this task to develop and promote a co-ordinated distribution service to SMEs with distribution activities within the region. On request from the transport company that should operate this service the City commissioned the company GfK Sweden to perform a market analysis regarding views on co-ordinated distribution in central Helsingborg. The survey was made during the autumn of 2000.

However, the very slow process within the city administration concerning how this market study should be financed meant that when the financing problem was solved, the transport company had gone through an internal re-organisation and the focus on environmental work was gone. They were no longer interested in participating in this demonstration task. It was by now too late to find a new partner willing to set up a test within the time plan of the project. The market survey was all the same performed, since the City of Helsingborg still considers the possibilities to find another solution to co-ordinated distribution. Instead of a demonstration a survey on the feasibility for co-ordinated distribution in the City of Helsingborg was carried out.

Three categories of user groups were contacted: suppliers, transport companies and consignees (shops etc). A large selection from each category answered to a phone interview. A smaller number of each category also participated in a personal in-depth interview.

One issue in the in-depth interviews was the respondents opinion regarding two different solutions for co-ordinated distribution, bundling terminal or distribution loop (see figures below).

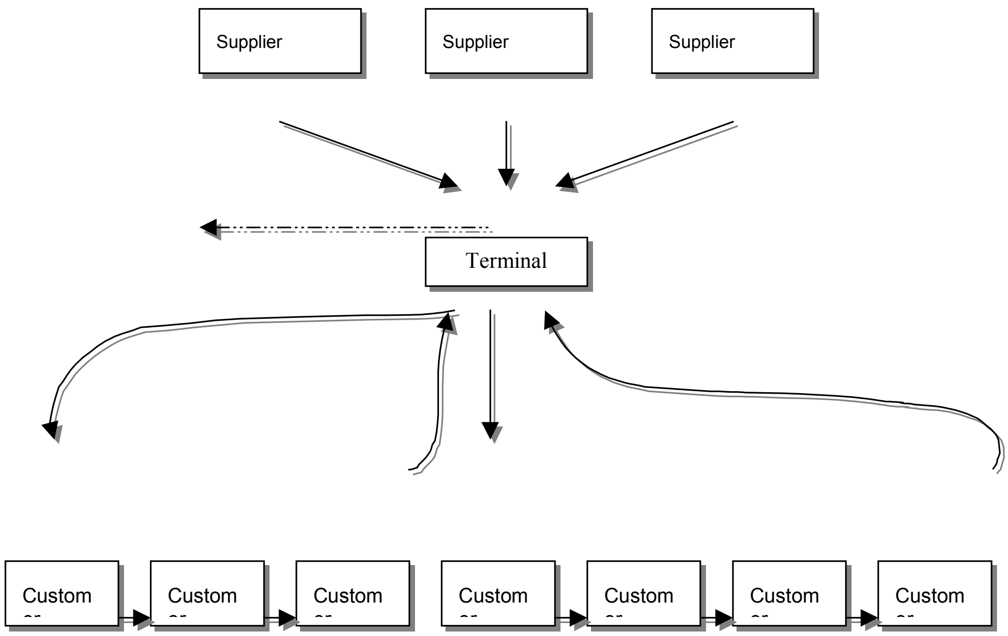


Figure 32: Co-ordinated distribution using a terminal for bundling (Bjurhult, Stansgård, 1999)

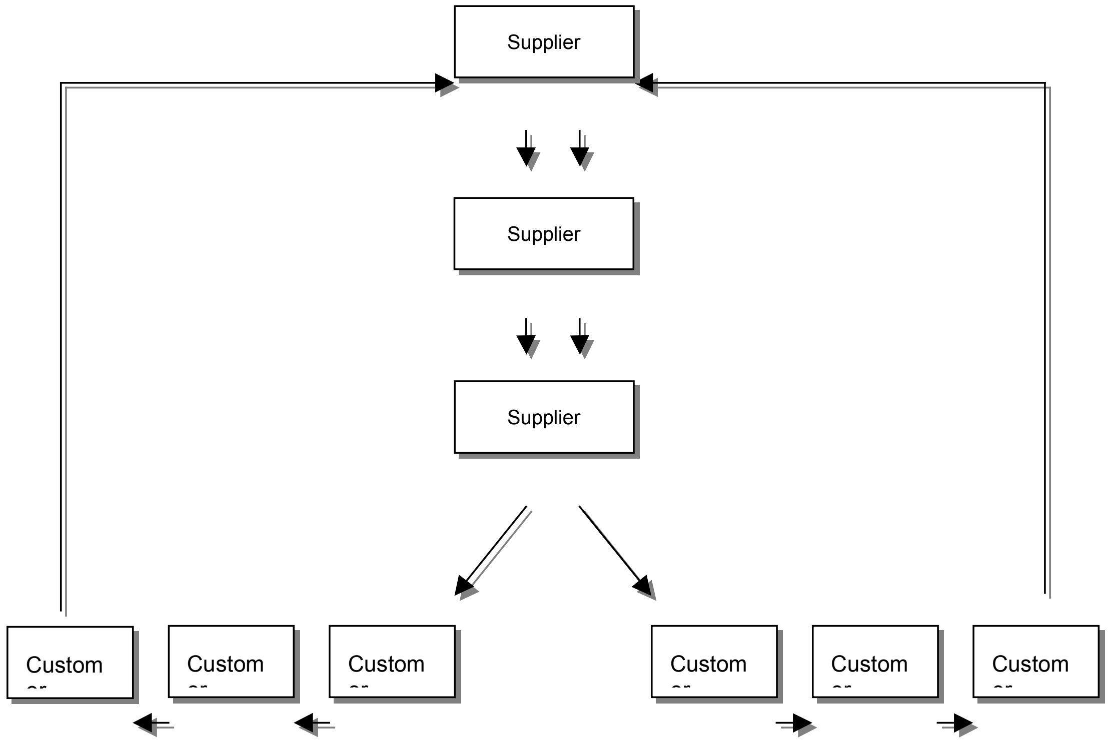


Figure 33: Co-ordination with transport loop (Bjurhult, Stansgård, 1999)

Opinions from suppliers

The most important qualifications for a transport company are punctuality, speed, and flexibility. Environmental work in transport companies is highly regarded.

The suppliers appreciate both co-ordination concepts, but there is no consensus regarding which is the most favourable solution. Co-ordination using a bundling terminal is considered improving the environmental effects, but the additional handling at a terminal could mean increasing transport costs and longer delivery times.

Co-ordination using transport loops is already in use, an advantage is the possibility to get exact information on delivery time. Co-ordination is not always considered to be a good solution, considering the loss of personal service provided by the drivers and the risk of a monopoly situation for the transport companies participation in the co-operation.

Opinions from transport companies

The most important requirements of transport company are as low costs, good service and reliability. Competition advantages are price, high quality, flexibility, and environmentally adapted vehicles as well as other environmental work.

Co-operation between transport companies is regarded as a solution for increased capacity utilisation, but some companies mean that they already have a high load factor in their vehicles.

Most transport companies think that the concept using a common terminal for bundling of consignments is the best alternative, and that it would mean reduced environmental effects in the city (improved loading ratio, less traffic, reduced emissions, less noise).

Participation in a co-ordinated distribution concept is considered as a potential competition advantage. To set up such an approach a co-ordinated concept should be initiated by the city, and there would probably be need for compulsory participation from the transport companies to make it work. To begin with the city must subsidise this transport system.

Future development

The City of Helsingborg has not yet decided on how to proceed to promote a more efficient city distribution. There seems to be a demand from the transport companies for an initiative from the City if a co-ordinated concept should be implemented. The City is however at present reluctant to be involved in an operational role.

Presently, there is a positive attitude towards bundling of goods for distribution in Helsingborg from all parties (suppliers, transport companies, customers and authorities) to be recognised. The problem seems to be that no one is willing to take the lead in a change process since the economic benefits for the different actors in the distribution chain are difficult to assess compared to probable negative effects. Also practical matters such as which terminal should be used for bundling is an obstacle. The transport companies are not interested to let a competitor handle all terminal activities.

From a commercial point of view there is an uncertainty if a co-operation between several major transport operators in the region is in line with the regulations regarding free competition, or if it would become a monopoly.

4.2.3 Composite distribution

This conceptual test demonstrated a co-ordinated composite distribution, for goods with specific temperature requirements. Two companies constitute the core partners, but the solution will be open for further actors.

Frigoscandia is one of Sweden's largest transport provider of temperature-controlled logistics services. They handle the whole chain through the transport from warehouse to the end customer. Frigoscandia could be described as fairly typical compared to other providers of temperature-controlled logistics services. They represent the hub between the transport company and the transport buyer. So their main function is to co-ordinate all the customers needs and plan it so that it correlates with the transport company's resources. The vehicle, equipped with the specially designed IDIOMA refrigerator cabinet, was tested in a goods distribution system in Stockholm to one of the major customers, Burger King.

Based on the results from the user requirement survey and other considerations Frigo-scandia Distribution, Frigoscandia Logistics and TFK set up the requirements and design for the composite distribution vehicle. The partners also specified the distri-bution concept. Consideration has been taken to the requirements of a constant tem-perature, because of hygiene aspects, throughout the whole supply chain, including moving, storing, handling and reloading the goods. Due to the re-organisation of partners the planned development of an extranet solution is no longer needed.

4.2.3.1 Demonstration approach and technical layout

The Burger King-flow was chosen for the demonstration because of the mixed assortment of goods within different temperature zones, the quick turnover of products and company's high demands on an unbroken temperature chain from producer to consumer. Further the demonstration took place in the Stockholm region. This region was best suited because of the comparatively large number of Burger King restaurants (19). Each restaurant received supply every second day in a cyclic pattern.

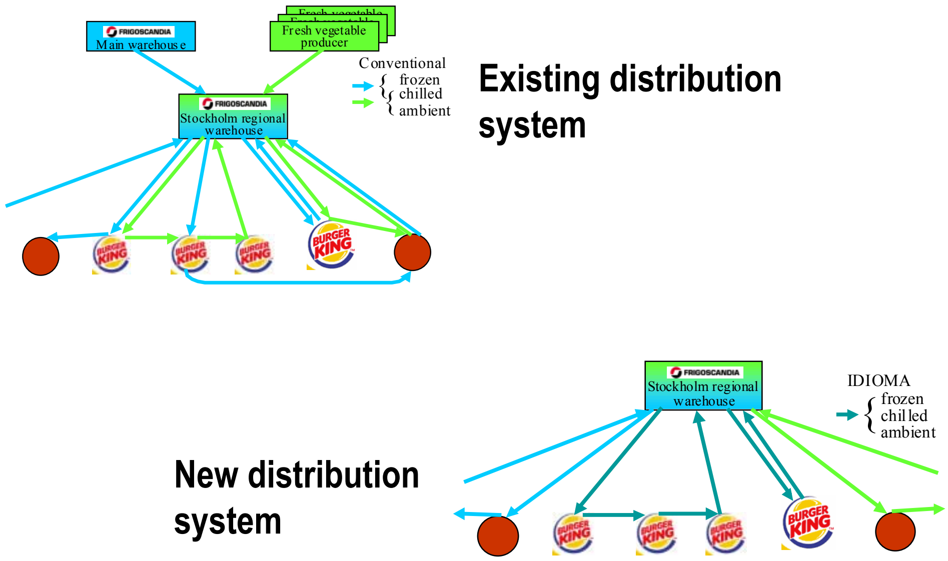


Figure 34: New distribution pattern due to the multi-temperature vehicle

The technology used and tested within this sub-project was a multi-temperature vehicle enabling the simultaneous distribution of goods with three or more types of different temperature requirements. The technology itself is already known, utilising cooling unit, isolating panels in a sandwich construction, possibly combined with thermo-covers.

Figure 35: The refrigerated compartment is built on a Mercedes Benz Atego chassis

Technical characteristics

Trailer/box figures:

- max. load volume: 18 pallets (max 18 pallet positions)
- max. load weight: about 7 tonnes
- floor level: 1 350 mm

Cool unit figures:

- type: ThermoKing type RD TLE 50 incl three steam units
- fuel type: diesel and electrical power
- energy consumption: 2,7 – 3 liter per hour. 4,32 watts per hour
- noise levels: Main surrounding level 46 dB(A). Max level 82,5 dB(A) at distance of 7 m
- emissions: PM 0,26; CO_2 2,06; NO_x 1,04 and HC 0,04 g/h
- location of the unit, sensors, air channels, control unit: The control device is located beside the TLE3 unit (see figure below).
- type of control: Control panel for the whole refrigerator system including a remote control unit in the drivers cabinet. Temperature log system (AccuTrack) with built-in printer.
- others: energy curtain at rear end powered by electricity

The use of multi-temperature vehicles is widespread through the transportation industry, although there are none or very few vehicles that handle more than two, fully controlled temperature zones. If one vehicle (without a trailer) can be equipped to handle more than two temperature zones the following can be achieved:

- a possibility to use this vehicle for co-ordinating inner-urban distribution of temperature sensitive goods
- lowering the amount of warehouse stock/inventory at the RDC
- improved quality of transported goods

The design

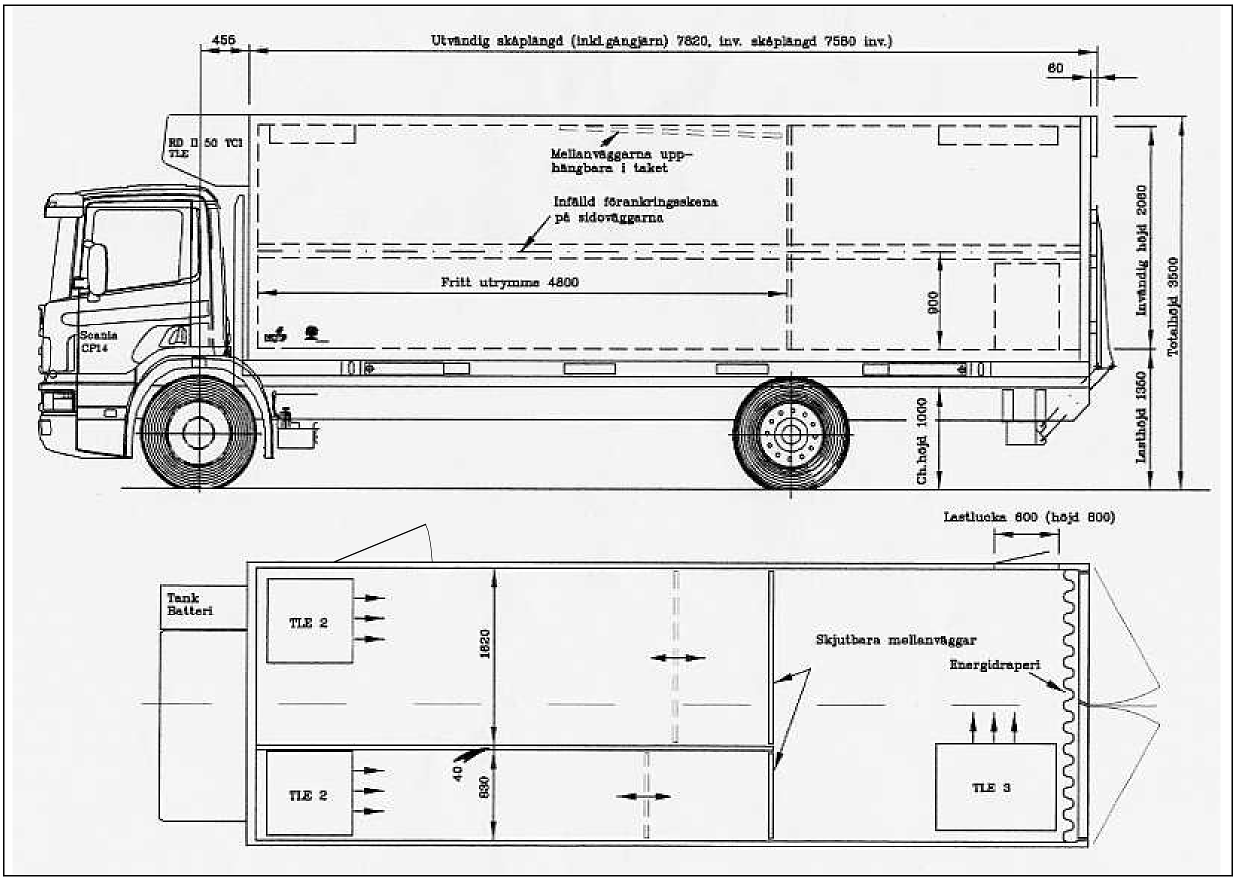


Figure 36: The design of the multi-temperature vehicle.

The design of the multi-temperature vehicle is illustrated in the figure above. The top sketch shows the unit from aside. The lower sketch shows the cabinet from above. Slight changes have been made regarding the size of the different zones and the location of the sliding walls. The presented solution facilitate the handling of the goods for the driver, especially pallets, compared to earlier proposals.

4.2.3.2 Demonstrator results

With regard to performance the following can be noted

- Loading times were considerably longer for the first two weeks (evaluated period) with the new IDIOMA-vehicle compared to a conventional vehicle. This difference is most probably a consequence of the driver's unfamiliarity with the new box.

- For the outgoing IDIOMA-vehicle (from terminal) the loading degree was in average 80% compared to a theoretical maximum capacity of 18 pallets. Empty driving i.e. driving without load is equal between the compared vehicles (7 %).

- During the demonstration period the special qualifications of the IDIOMA vehicle (three temperature zones) were only utilised to a small extent. This illustrates the difficulties in establishing an optimum goods flow from the start.

- The driven distance is considerably less per day for the IDIOMA vehicle (40 km compared to 158 km for the reference vehicle). The number of stops is also reduced but to a smaller extent. This demonstrates the advantages of the IDIOMA vehicle, namely that with the three different temperature compartments it is able to concentrate the deliveries to fewer consignees, thereby reducing fuel consumption and emissions.

The main environmental effects are related to a shorter driven distance with the IDIOMA vehicle in comparison with the conventional vehicle. For the emission calculations it was decided not to use figures from the demonstration period since they were not considered to be representative of a well-operating logistic flow with the new vehicle. The following results (emissions in kg/year) were obtained:

Emission factor	Conventional vehicle			IDIOMA vehicle		
Unit	vehicle	cooling equipm.	Total	vehicle	cooling equipm	Total
NO_x	290	44	334	264	51	315
VOC	24	5	28	21	5	27
CO	42	10	52	38	12	50
PM	5	3	7	4	3	7

Although the cooling machinery is somewhat more energy consuming due to another compartment and temperature zone, the total effects are still in favour for the IDIOMA vehicle. Except for PM-emissions the IDIOMA-vehicle produces about 5-6 % less emissions than the conventional vehicle.

4.2.4 Co-ordination of public purchasing and related transports

This task demonstrated organisational concepts for co-ordinated distribution for public purchasing in Malmö. A concept for freight flows to be included in the demonstration of the co-ordinated distribution system was chosen. The concept excluded food deliveries/groceries and concentrated on non-temperature regulated goods. The product types were office products, health and care products as well as cleaning and chemical products.

The City of Malmö has 258,000 inhabitants, and is Sweden's third largest municipality in terms of population. Due to its size the city municipality is a major purchaser in the region. In a democratic reform in 1996 the city was divided into ten city districts. The goods flows studied in this task are those within the city district Kirseberg in the north-eastern part of Malmö.

The city district Kirseberg is the second smallest in terms of population and has 13,000 inhabitants, which represents 5% of the total population in Malmö. The city district of Kirseberg includes all sorts of activities decentralised down to district level such as childcare, compulsory education, medical care, etc.

Public purchasing traditionally includes the distribution service. The city therefore has no influence on how the purchased products are being transported. A minor quantity of the goods supply is bought directly in regular stores, for instance by small childcare units. All units are requested to use the contracted suppliers but there is no control in this matter.

User Groups and involved Partners

The user groups within this task are the following:

- The City of Malmö
- The City Council of Kirseberg
- Posten (Sweden Post) - transport operator
- Lyreco – supplier
- Skåne Förrådet – supplier
- Papperskedjan – supplier

Representatives from three organisational levels in the city administration are involved: the Department of Public Works, the Central Purchasing Department and the department responsible for local purchasing at the city council.

The communication channels with suppliers will mainly go through the Central Purchase Department and City District.

Transport concept

The city districts all have an extensive responsibility for public purchasing. Because of the time and resources restrictions we considered it necessary to delimit the extent of transport flow for co-ordination. In discussions with the Division of Public Works we decided to choose one of the ten city districts as area for co-ordination. We used the following selection criteria:

- Limited total transport flow – one of the smaller city districts
- Diversity of consignees and activities included in the city district – schools, childcare centres, medical care centres of different size
- Interest in transport and environmental improvement activities - already initiate projects and ideas
- Spatial limited area

With reference to these criteria, the Kirseberg city district was chosen. Contacts were then taken with their local transport and purchasing department.

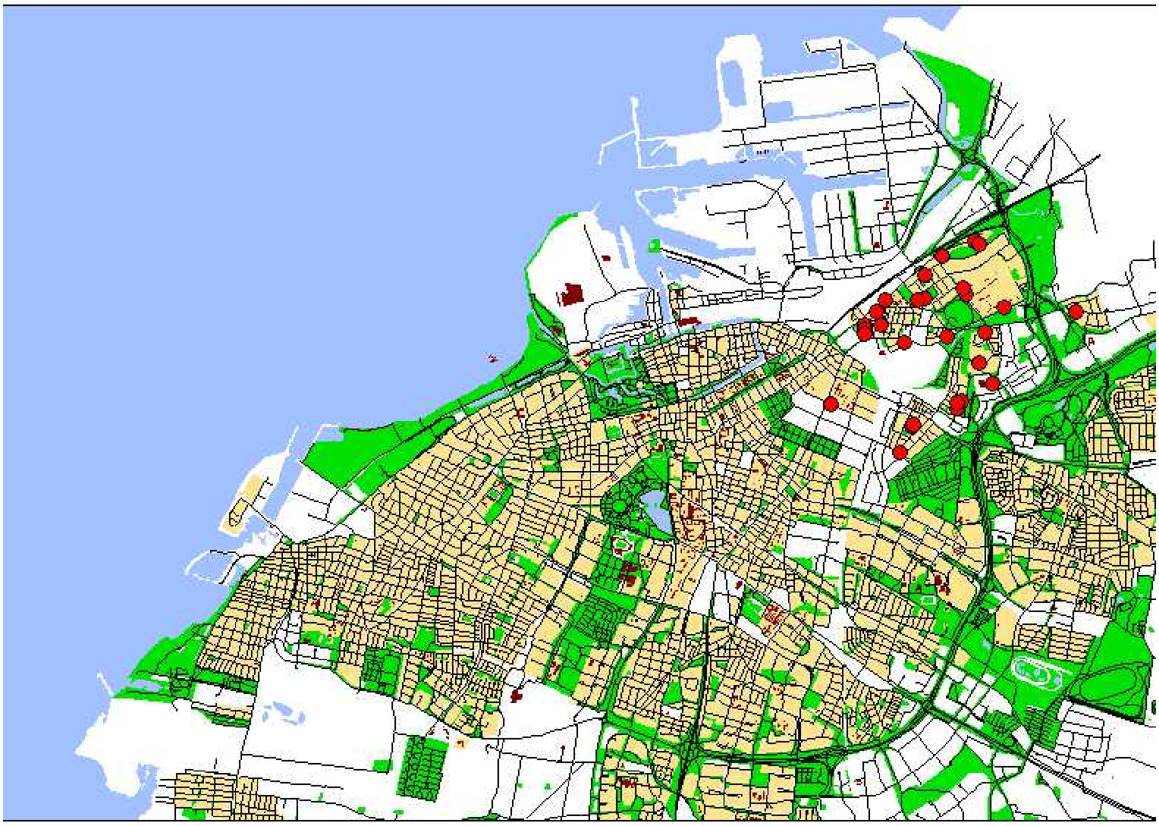


Figure 37: The City of Malmö with municipal customers in the City district of Kirseberg marked as dots

A survey for all activities in Kirseberg was performed. The main results were that the current numbers of activities were 40 and the current numbers of suppliers were 43. There was a great diversity of suppliers. The eight main suppliers were chosen for an extent survey. The goals were to establish delivery patterns, goods volumes, delivery days and delivery forms.

With the results from the two surveys a main concept for which freight flows that would be included in the demonstration of the co-ordinated distribution system were chosen. The concept excluded food deliveries/groceries and concentrated at non-temperature regulated goods. Due to the decision three main suppliers were chosen to be involved in the project. They were representing three different product types and three different geographic locations. The product types are office products, health and care products and cleaning and chemical products. The locations are local, regional and national for the different suppliers. They are also using different concepts of forwarding their goods: own forwarder, only one external forwarder or many different external forwarders.

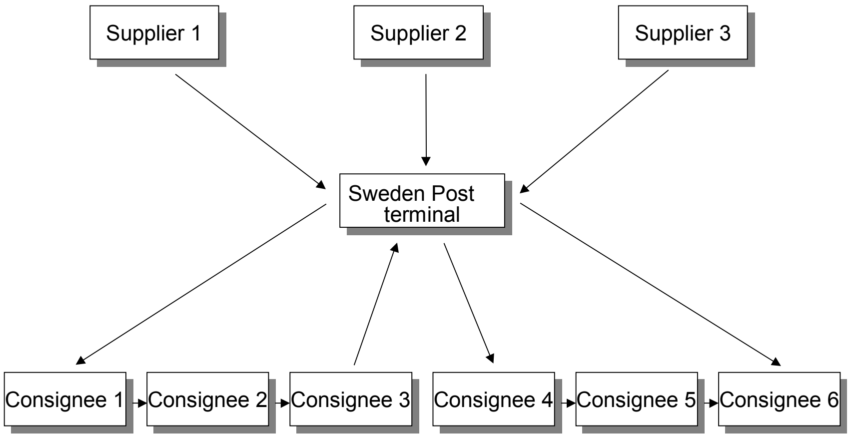


Figure 38: The co-ordinated transport concept implemented in Kirseberg

All the goods of these three suppliers are delivered to one terminal for cross docking and co-ordinated distribution to the end consumers. To get a company with terminal, cross docking and forwarder experience a public purchase were made. For public administrations this is a strictly regulated process. Out of four pre-chosen companies three companies returned tender. The winning company was Posten (Sweden Post).

The actual transports began on the 1st of March 2001. Regular vehicles (already in operation) and transhipment technologies were used. If the system is successfully implemented, more city districts may use the concept or be integrated in a common transport system. In Malmö the planning for the future has already begun. A couple of new suppliers are supposed to join the project before the summer 2001. In the autumn 2001 one or maybe two new city districts will be additionally involved in the project.

4.2.5 Scenarios for regional logistics

In this task the effects on the regional logistics caused by the construction of the new rail and road Öresund fixed link were evaluated. Scenarios were developed on how the fixed link would impact on the regional logistics structure. It was also studied how different companies within the region handle the change process to best adapt to the new conditions.

Since the bridge integrates two markets and gives new logistics opportunities, many companies are forced to change and improve in order to stay competitive. This in fact increases their ability to overcome the barriers and adopt new ideas and concepts. Consequently, the possibilities of initialising new concepts and achieving interesting experiences are very good in the Öresund region.

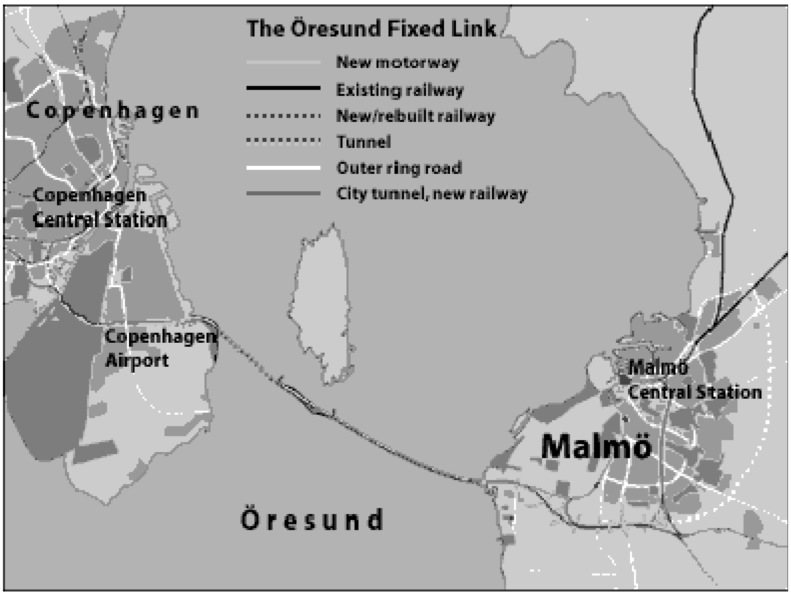


Figure 39: Location of the fixed link between Malmö and Copenhagen

The study provided a first analysis of the effects on the regional logistics due to the new rail and road Öresund fixed link, however, six months is a very short period for location effects to be shown and companies are not always very willing to expose their strategies.

4.2.5.1 Impact analysis

Since of July 1st 2000 there has been a fixed link between Malmö and Copenhagen. The Öresund bridge shortens the time of travel between Malmö and Copenhagen and ties together a region of about 3.5 million inhabitants, which forms quite an important region in Scandinavia.

For many players within the area of transportation and logistics the presence of the Öresund bridge will change the conditions. Furthermore, the Öresund link will be even more important after it has been extended by another fixed link over the Fehmarn Belt.

After the bridge has been in operation for six months it has been established that travel by rail has exceeded the predictions by 40%, whereas the road traffic was lower than predicted. Only 9,250 road vehicles per day have passed the bridge, which is 2,600 less then predicted. The development of the goods flows agreed fairly well with the predictions.

According to the Port of Helsingborg the total volume of private cars on the ferry between Helsingborg and Helsingör has decreased by 22-25%, which is less than the 30% reduction that was feared. The volume of trucks has only decreased by 10-15%. Regarding the direct transports to mainland Europe, the Port of Trelleborg has noticed an increase of the truck volume of about 14% since the beginning of the year. The rail volume has decreased, but it has more or less to do with new logistics concepts than with any influence of the new bridge. One example is Stora Enso Baseport concept.

When the Great Belt link was opened several companies in Denmark adapted their distribution systems. Earlier they had distribution centres with large warehouses on Jutland as well as on Zealand. In recent years a number of companies has located their central warehouses close to the bridge.

The Öresund Chamber of Industry and Commerce points out various relocations and new locations on both sides of the sound. Accordingly, the manufacturer of china and crystal, Royal Scandinavia, has located their central distribution warehouse to Malmö. Daimler Chrysler has moved their common Scandinavian business units such as head office, central warehouse, distribution and training centre, to the Öresund region, where they have their largest market.

Other effects of the changed logistics are that the restaurant chain McDonald's nowadays gets all their hamburger buns from the bakery Sjöholms Bröd in Malmö. The new link was of decisive importance for finding the right logistics concepts. The pharmaceutical group of companies, Novo Nordisk Farmaka, has located their national warehouse at the sales department in Malmö, which offers synergy effects. In the field for food, the company MD Foods in Denmark and the company Arla in Sweden have merged and will be marketed in the Öresund region under the name of Arla Foods.

Changes have taken place in the shipping business as well. The Ports of Copenhagen and Malmö has merged in order to handle the international competition in a better way. In the aviation business you can recognise the fact that there are a competition as well as co-operation between the airports Kastrup and Sturup. So far Sturup has functioned as a port of relief for Kastrup for the charter traffic as well as for the freight traffic. An important change is that the company TNT, the worldwide parcel delivery company, has chosen to move their Nordic hub to Sturup to cover the whole of the Öresund region. Low price charter Ryan Air has been operating Sturup-London since July 2000 and has had 75,000 passengers, 43% from the UK of which 70% had Copenhagen as destination.

The potential for co-operation in the region by ways of city logistics and common distribution centres is enormous. The examples above show that there are changes going on, but compared to what has happened in connection with the bridge over the Great Belt, the effects on the logistics are still limited. There are some examples with transportation companies that transport goods between Malmö and Copenhagen via Helsingborg-Helsingör. The reason, which is often mentioned for these limited effects on the logistics, is the price for using the bridge and the lack of integration between the regions.

The level of the charge for crossing the bridge or whether or not the toll should exist is being debated intensely in the region. The advocates for a lower charge claim that the bridge was built to stimulate the integration and growth in the region, which has been prevented by the high cost. A concept is that of the "Managers' Bridge". Calculations made by the Öresund Chamber of Industry and Commerce show that a person, who is living in Sweden and starts to work in Denmark has to get a marginal increase of income of about 7,600 SEK to cover the net cost for commuting.

In the autumn, there was a considerable decrease of the bridge toll for commuters, who paid the bridge toll automatically with the so-called *brobizz*. This decrease, that was nearly half of the charge, meant 18,000 new subscribers but no increase of the car traffic worth mentioning. The arguments, which have been heard against a decrease of the bridge toll, are the environment and the financing. However, in Denmark this issue is especially delicate as a toll is also imposed on the bridge over the Great Belt.

According to the estimates made by Merita Nordbanken an integrated Öresund region may lead to an increased gross national product of 4% or 35 billion crowns when the economy gathers momentum.

Even if you don't have to pay any cost at all to use the bridge you must have a need for travelling between Malmö and Copenhagen. This requires integration between the two cities in the form of work commuting, common education and culture. When the bridge over the Great Belt was opened all transportation forecasts were immediately fulfilled. From the integration point of view this was a completely different situation. This bridge tied together two regions within the same country. The Danes on one side of the bridge had relatives on the other side of the bridge, and for companies they often had their suppliers on the other side. These regions were already integrated, which was a strong basis for the traffic. Another important fact is that integration takes a longer time if two nations with different laws and regulations are to be integrated.

The results show that the goods flows within the region will increase considerably with an improved infrastructure both as a consequence of the increased commuting but also due to an increased availability with shorter lead times etc. The transit traffic will continue to go via Helsingborg-Helsingör and Trelleborg-Travemünde. There won't be any important effects on this structure by the bridge if the toll is not changed or not until the Fehmarn Belt-link is ready.

4.2.6 Conclusions from the Öresund site

The Öresund site demonstrated different environmentally friendly and co-operative approaches on city distribution incorporating private as well as private public partnerships. On the basis of the results and experiences gained on the site the following conclusions can be made:

Different actors in the transport chain, both transport companies and authorities, are active in solving city transport problems. In Sweden, environmental aspects in the transport sector were primarily initiated on demand from consignors, and the major forwarding companies served as good examples for the smaller transport companies. Environmental work is considered as being an important aspect for the competitiveness of companies.

Within IDOMA Öresund co-operated with partners from both the public and private sector and they used both technical and organisational methods to find solutions for a more efficient distribution.

The experiences of "IDIOMA – Öresund" indicate that regarding technical methods the private sector is rather confident in finding suitable solutions for their own purposes. When it comes to organisational aspects involving the restructuring of transport systems, where several actors are influenced, the change process is more difficult. The tasks where IDIOMA aimed at implementing more efficient solutions by bundling the goods before city distribution show that some kind of public commitment is an advantage. One reason for this is that the transport companies are reluctant to co-operate with each other when the financial gain is uncertain.

From an overall perspective the work was successful since it has resulted in the initiation of three different demonstrations among which two operations will be continued after the IDIOMA project: the new vehicles (Task 1 "biogas vehicle" and Task 2b "multi-temperature vehicle") and the new transport structure (Task 2c "co-ordinated distribution in Malmö"). The experiences from the demonstrations can also be of interest for implementation in other companies and cities as many of these actors face the same problems and are looking for solutions for a more efficient goods distribution.

4.3 Validation site Ile de France

IDIOMA Ile de France was a demonstration involving the partners NOVATRANS, the French operator for combined rail road transport, and two road hauliers using a new technique for improved communication in combined transport to and from the Paris area: ROUCH Intermodal and TAB (Transports Automobiles Brunier).

The project and its geographical scope are presented graphically in figure 41.

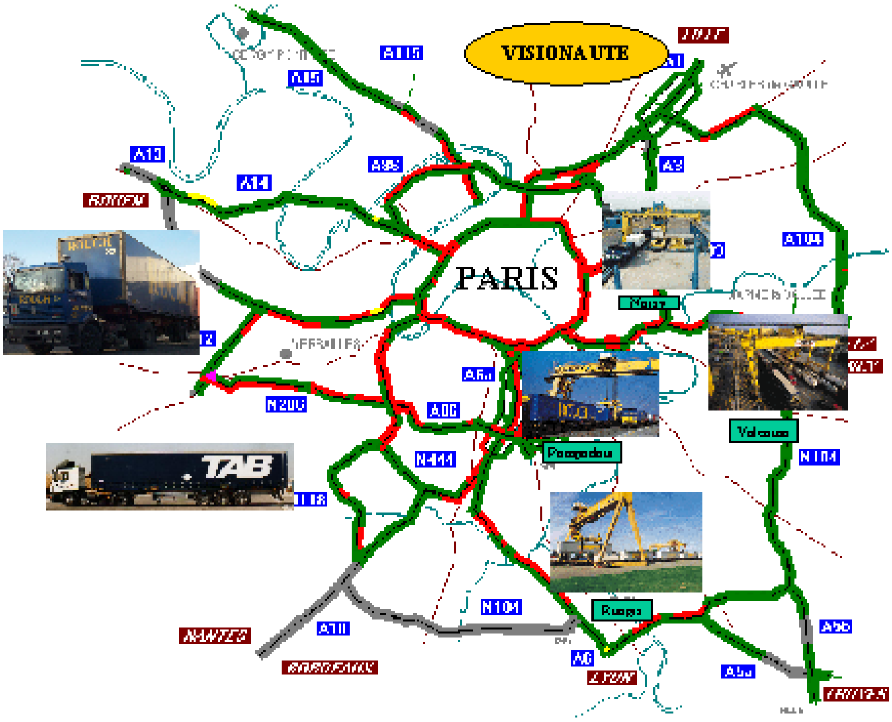


Figure 40: The Ile-the-France site

4.3.1 Description and results of the Paris / Ile de France demonstrator

The aim of the IDIOMA Ile the France project was to enhance, precise and secure the exchanges of data between all actors in the envisaged combined transport chain. The introduction of traffic data provides a possibility to optimise transport by the visualisation of the position of trucks and knowledge about expected arrival times. The scope was to allow the transport company to re-route a vehicle in case of traffic jam and for combined transport terminal operators to optimise the whole terminal operation, to enhance the adherence to train schedules and to improve the occupancy rate of wagons. The project has been structured in such a way that each partner has a key role to play for the success of the implementation.

The IDIOMA sub-project at the Paris/Ile de France validation site therefore represented a further step in an information exchange process between two types of partners in the combined transport chain. Several techniques were implemented in order to optimise the movement of mainly trucks (primary or terminal trip) to and from the Ile the France terminals. The technical components that were used are:

- a highly advanced traffic information system,
- a tracking system,
- a mobile data transmission system and
- road trucks equipped with on-board computers.

By implementing all these technical components the communication flow between the intermodal transport terminal and the transportation companies could be improved thereby optimising the intermodal transport chain (traffic jams could e.g. be avoided by suggesting alternative routes).

The demonstration concept consisted of three approaches:

- to equip vehicles at TAB and ROUCH with on board computers and satellite navigation systems
- to exchange information among the road transport companies and the combined transport terminals;
- to integrate real time traffic data information into the transport planning processes.

For the demonstration 10 vehicles (5 at each haulier) were equipped with full satellite solutions of Euteltracs Alcatel. At the end of the demonstration, TAB replaced Euteltracs solution by Transics solution, which is based on a GSM communication device associated with a GPS navigation system.

Euteltracts full satellite solution

Comrising and Transics solution (GPS and GSM)

In an optimum configuration – which could not be fully realised in the project lifetime - a telematic link between TAB and ROUCH on the one side and NOVATRANS on the other side would be established. The core functionality of this link would be to allow and provide driver related information (from TAB and Rouch) directly and automatically to NOVATRANS. Relevant information would then be:

- the identification of the swap body to be brought along at the combined transport terminal (CTT),
- the expected arrival time at the CTT.

In the IDIOMA demonstrator the realised road carriers can inform the CTT operator in real time during the trip about the position and the status of the vehicle that is taking a swap body to the train. Among the road transport companies and the CTT a particular message, the ”report of pick up operation” message was exchanged that includes:

- the identification number of swap bodies,
- a precise time of departure of the vehicle taking a swap body to the CTT,
- an expected arrival time at the CTT evaluated by the driver.

The integration of real time traffic data information was ensured by the Visionaute system. Visionaute is a service provided by the Mediamobile traffic data operator, giving access by Internet to the traffic status in the Ile de France region. It is also possible to calculate an alternative route to improve the trip time of a vehicle.

Figure 41: The VISONAUTE system

There are complex requirements of goods transport operators in the Ile de France region, like specific regulations for trucks or the availability of a dedicated map that identifies combined transport terminals which were presently not provided by the Visionaute system. As it turned out that the development and integration of such a system would not be possible within the frame of the IDIOMA project, the following approach was chosen:

- Screens linked to Visionaute by Internet were installed at the gate of the 4 CTT in the Paris region to allow drivers to be informed on the status of the traffic on the road they wanted to take. This also allowed an evaluation of the trip time on the main routes of the Ile de France.

- The same information was also accessible from the home base of TAB and ROUCH to allow an evaluation on the trip time of the vehicles of which they had the position and thus to inform the CTT operators about the expected arrival time and/or delays; this allows the train to start on schedule and insured a high occupancy rate of wagons.

4.3.2 Demonstrator results

The IDIOMA Paris / Ile the France demonstrator brought out several positive results. One of the most important gains that could be achieved in the project was a substantial reduction (or even elimination) of risks of mistakes or misunderstandings resulting from voice communication. Data communication brought about far less disputes resulting from misunderstandings. Unnecessary activities could therefore be avoided.

Another important benefit that result from the introduction of the information system was a substantial decrease in waiting times. Drivers and vehicles were capable of travelling more ‘profitable’ kilometres or carrying out more activities during the same period of time as they constantly were provided with the most up-to-date information on congestion, waiting times, etc. This gave them the privileged opportunity to act accordingly. Complementary to this it became easier to manage the driver employment considering a fleet of 50 vehicles.

It has been confirmed that a 'critical mass' exists in the ratio between vehicles equipped and all vehicles managed. If this ratio drops below a certain level, the users consider application of the system as a 'marginal' action preventing them from carrying out their work efficiently. It was calculated that this ratio lies somewhere between 1/3 and ½ of the total number of vehicles.

The second important output of IDIOMA Ile de France was the analysis of the benefits expected from an efficient system of traffic data and the way to exploit these data. Within the project the time savings for a fleet of 50 vehicles using the information service were measured. Two scenarios were tested based on the following assumptions:

Assuming that the complete fleet of TAB and ROUCH (50 vehicles) in the Ile de France region were integrated into the demonstrator approach the following reduction can be calculated:

Number of delays lasting more than 2 hours	- 50 %
Number of delays of 1 to 2 hours	- 30 %
Number of delays lasting less than 1 hour	- 30 %

Under the same assumption the late arrival can be reduced as follows:

Arrival after the appointment time at the customer	- 40 %
Arrival after the train deadline time	- 50 %

Overall, the demonstration results show considerable benefits in terms of the following gains:

- A more reliable transport planning;
- An improved communication between driver and dispatcher;
- Less unproductive vehicle hours due to re-routing possibilities;
- Increase in dispatching productivity;
- Work process optimisation due to data integration.

Quantifying these benefits into monetary terms a cost benefit analysis was carried out to calculate the pay back time of the whole investment costs in the telematic applications and devices. According to this analysis a pay back time of less than 14 months was calculated.

4.4 Validation site Randstad

The Randstad agglomeration consists of four of the biggest Dutch cities (Utrecht, The Hague, Rotterdam and Amsterdam) and many smaller cities and regions in between. Congestion is a major problem, causing economic and ecological damage. Especially, the supply of products to cities, is getting worse and worse. As a result of increasing replenishment times and decreasing order quantities it becomes harder to organise distribution processes in an efficient way. Many logistics services providers therefore have to deal with decreasing average truck loads or less than truck load shipments. Especially the so called "white spots" (distribution areas that contain only limited numbers of clients and which are – most of the time – not located in the vicinity of services providers) are causing problems.

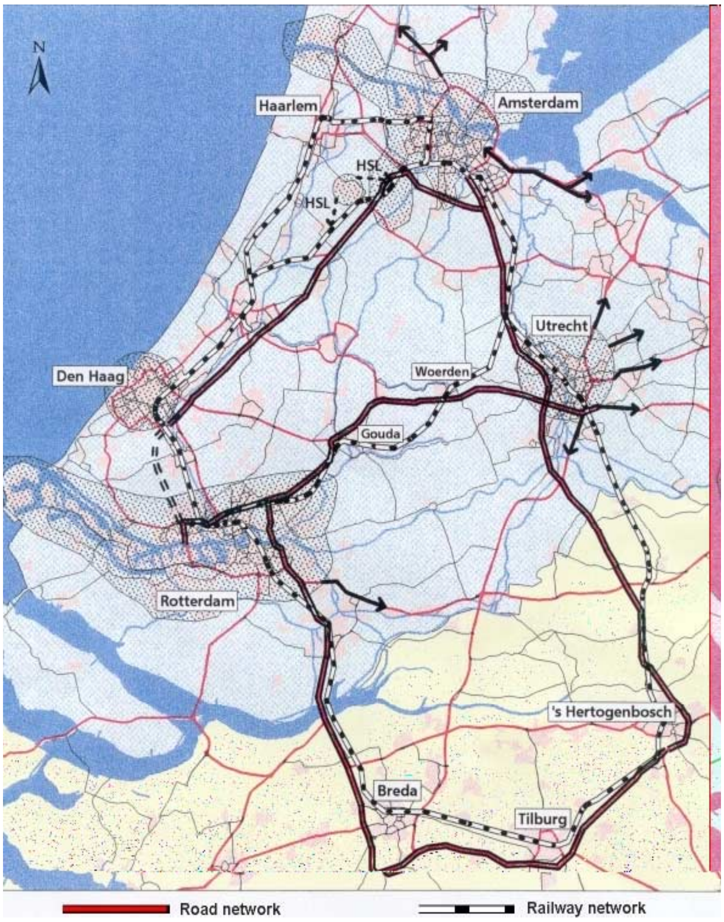


Figure 42: The Randstad validation site

As not all the services providers have the same white spots, it was decided to create a co-operative system that will be able to provide a solution for both the white spots and the increasing number of LTL – shipments. The Flownet system consists of several regional distribution centres in which the LTL – shipments are bundled into full truck load shipments (FTL). In every region a regional specialist will be selected that is able to distribute efficiently in areas which are white spots to others. The distribution centres function both as regional collection and as regional distribution points. LTL – shipments are combined and bundled in the region of origin and distributed collectively to the region of distribution. The regional distributor can integrate the provided goods in its own distribution operation. As a result the number of drops per shipment or the distance between the drops can be reduced substantially. An information system was developed in order to optimise the bundled goods flows between the network distribution centres (network optimisation). When enough volume is provided, a neutral operator will be used that will be held responsible solely for the network shipments e.g. in the form of line-shipments. As a result a continuous flow will be created which led to the name Flownet.

The Randstad validation site included the demonstration of a single node and the simulation of a complete network approach of the Flownet concept.

4.4.1 The single node demonstration project

Within the single node demonstration project the benefits of the combination of LTL shipments with a destination in Rotterdam, Leiden and The Hague were demonstrated. Five logistics service providers were involved in the project. One of them was selected as the common carrier. Its major role was to bundle and distribute the LTL – shipments provided by the others. The single node demonstration project can be presented graphically as follows:

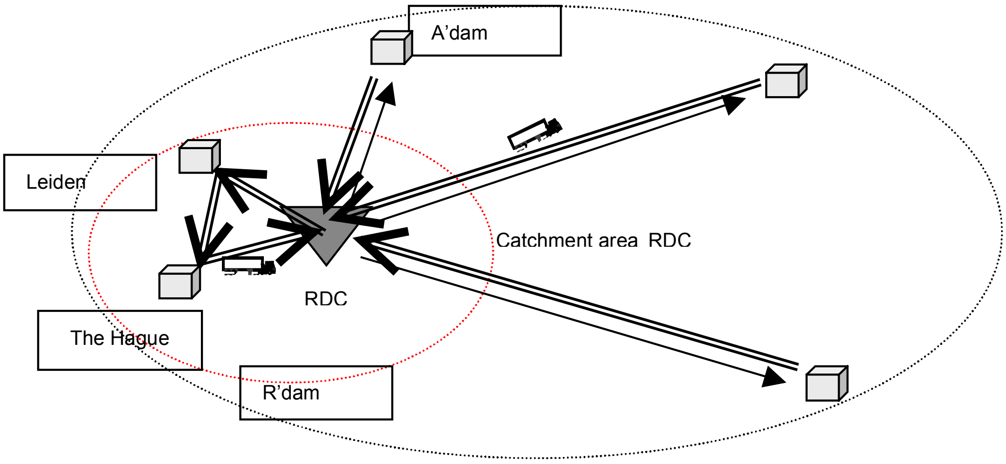


Figure 43: The Randstad single node demonstrator approach

During a period of two weeks the shipments of these parties were consolidated and distributed. The results during these two weeks looked promising. Both financial as well as societal benefits could be obtained.

Social benefits	**Two week period**
Effect emission of CO2 (kg)	(-) 1938
Effect emission of NOx (kg)	(-) 28
Effect emission of CO (kg)	(-) 7
Effect emission of HC (kg)	(-) 5
Effect emission of particles (kg)	(-) 0.8
Effect emission of SO2 (kg)	(-) 0.4
Effect on energy consumption (L)	(-) 683
Employment effect (euro)	(+) 1731
Business effects	
Cash flow	(+) 726

The single node demonstration project can be regarded as a great success. A rather substantial improvement in the distribution of LTL-shipments (and therefore a reduction in the number of kilometres driven) was realised. The only drawback was that the participants already decided after a period of two weeks of demonstration to terminate their relation with the common carrier chosen. The common carrier proved not to be fully equipped for IST tasks. Therefore much more time had to be invested in the operations to be carried out. As a result the common carrier claimed an increase in the pallet price to be paid for its consolidation and distribution services. The common carrier was especially disappointed that the other participant only provided relative small shipments (2 to 3 pallets per drop instead of the expected average of 4 to 5 pallets per drop). None of the other parties was however willing to pay a higher price. They argued that these problems would fade away as both the common carrier as well as suppliers of load got more experience and trust with and in the service. It proved however to be impossible to select a new common carrier and prepare for a new demonstrator still within the timeframe of the IDIOMA project. It was therefore decided only to present and evaluate the two weeks of demonstration mentioned.

4.4.2 The Flownet simulation project

A comprehensive simulation of the complete Flownet system took place on the basis of a newly developed web-based network optimisation system. 9 market parties were selected to participate in this simulation. Several scenarios were tested in order to get a thorough understanding of the viability and the sensitivity of the system. Variations were made e.g. in the number of distribution centres and the total volume provided. The system tested can be presented graphically as follows:

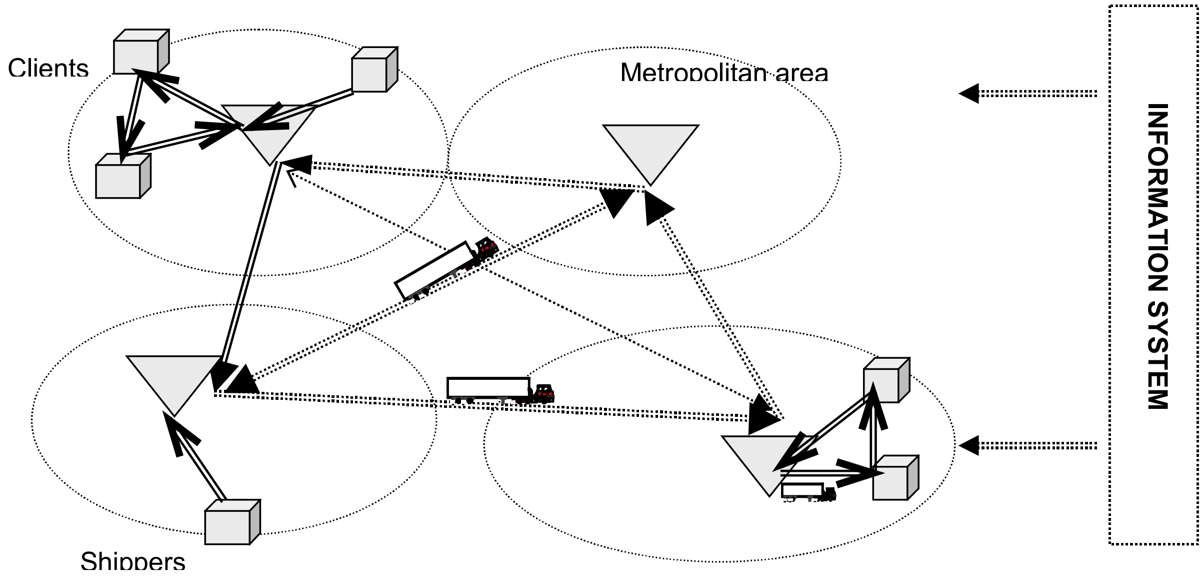


Figure 44: Example for the Flownet system

The system was tested for a period of 8 weeks. A potential analysis was also part of the simulation. Based on the currently existing potential (number of LTL-shipments in the Randstad area) results were extrapolated for the coming years.

In more detail the simulation included the assessment of different scenarios of the Flownet system. The IT company EDS was selected to develop the necessary information system. As a formal partner of ILOG, EDS suggested to use the ILOG Dispatcher optimisation tool. Some additional knowledge could be obtained from the EC Esprit project GREEN TRIP (Global, Reactive, Efficient and Environment Friendly Transportation Logistics; http://www.cs.strath.ac.uk/research/GreenTrip).

Besides the possibility to run an integrated planning in a real life environment, the planning tool also had to provide the possibility to run several simulations. By executing several simulations, a profound indication of the potential of the concept would be given, thus creating more enthusiasm for the concept.

The basic operations of the information system are presented below:

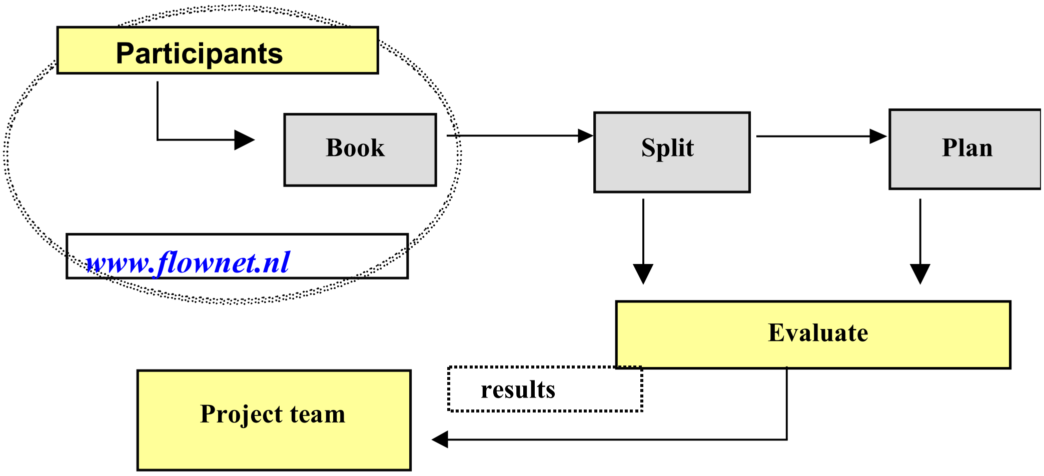


Figure 45: The Flownet simulation modell

Provided with the information required (like for example goods flows, region(s) of origin and destination etc.), the tool was able to simulate the system's performance. Different scenarios were prepared and simulated, like:

- a dense network (7 warehouses) as well as a less dense one (5 warehouses);
- a high frequency network as well as a less frequent one;
- a high volume network as well as a low volume one.

The simulation project ran in parallel with the demonstration project. It however contained all relevant aspects of the Flownet system and used the first prototype of the IT-tool developed. Nine market parties were selected in order to carry out the simulation. These parties provided a selection of their LTL-shipments every week. Based on this selection, the performances of the Flownet system were calculated. Also some variants or scenarios were tested. Variations were made in the number of distribution centres, the lead times of the system and the volume provided.

The results of the potential analysis for the following 3 years are presented in table 2. This table shows the development of the system up to a total of 700.000 shipments. The estimation of this potential was based on a total number of 20 interviews with both transportation companies, shippers and retailers. Only the results for the network presented above (total number of 5 distribution centres) were integrated in the table.

Number of shipments	**Year 1**	**Year 2**	**Year 3**
	241.436	477.568	696.436
Social benefits (cumulated)			
Effect emission of CO2 (kg)	(-) 267.056	(-) 1.288.847	(-) 2.344.745
Effect emission of NOx (kg)	(-) 3.919	(-) 18.913	(-) 34.408
Effect emission of CO (kg)	(-) 941	(-) 4.539	(-) 8.258
Effect emission of HC (kg)	(-) 656	(-) 3.164	(-) 5.756
Effect emission of particles (kg)	(-) 105	(-) 509	(-) 926
Effect emission of SO2 (kg)	(-) 57	(-) 275	(-) 500
Effect on energy consumption (L)	(-) 94.054	(-) 453.916	(-) 825.791

Employment effect (euro)	(+) 330.000	(+) 660.000	(+) 990.000
Business effects (per year)			
Cash flow	(-) 3.477.594	(-) 2.490.321	(+) 1.150.853

This table shows that ***the Flownet concept can be considered as a green concept with strong societal benefits. The business effects were less positive.*** It can be derived from the table that it would take about 3 years to make the system economically viable. Especially the investment costs – e.g. for the IT-system needed – proved to be substantial. ***Nevertheless, substantial improvements in the rate of return can be made.*** Therefore a larger number of shipments should be collected from the beginning or a better balance between the number of distribution centres and the total volume provided needs to be found. Five DC's for a total number of 241.436 shipments proved to be too much. Also a further increase in the efficiency of the system can be realised. So far only the goods flows on the network were optimised. But also the pre- and end haulage from and to the network DCs could be optimised. In a full-operating Flownet system, regional distributors will be responsible for the optimisation of both the regional collection and distribution. A group of logistics services providers was therefore approached in order to calculate the system performances for the pre- and end haulage. As these calculations were based on their current performances, it can be expected that these costs can turn out lower in a real life situation. The integration of new (extra) shipments within their own operation (the consequence of Flownet) will lead to a reduction of the number of drops per truck as well as the inter-drop distance). Flownet might therefore lead to a substantial reduction in the distribution costs. In the simulation these benefits were not calculated as this required the subsequent planning of the pre- and endhaulage. In the next phase of the project such planning will be crucial.

Therefore, a further development of the Flownet system seems to be justified for both governmental bodies as well as market parties. Particularly, a further development of the information system and the establishment of concrete pilots in specific market segments need to be strived for. At this very moment the Physical Distribution Group of the Dutch Association of Logistics Services Providers (TLN) is actively preparing a Flownet for the Dutch Grocery market called Foodnet.

4.5 Validation site Zürich

The conurbation of Zurich is the most important metropolitan area within the urban network of Switzerland with about 1.1 million inhabitants and 60.000 employees. Zurich is the economic capital of Switzerland with high importance in the banking and insurance sector and services for industrial production as well.

According to goods transport, the Zurich area is strongly connected to other Swiss cities and with cities in the European Union. Concerning intermodal transport Zurich is connected to Rotterdam and Antwerpen by direct shuttle trains. The container terminal Zurich plays an important role as an interface between the shuttle trains and regular inland trains.

Figure 46: Overview of the conurbation of the Zurich validation site

Intermodal transport has in Switzerland a long tradition. It is an important part of the Swiss freight transport policy on national and regional level. On national level, combined transport is supported to reduce the shift from rail to road transport and to reduce the negative effects of implementing the 40 tons weight limit for heavy goods vehicles. Different activities are in discussion and partly in realisation as for example the reduction of rail transport costs, a Swiss internal combined transport concept, subsidies for terminals and for track prices, implementation of the Heavy Vehicles Fee (HVF, introduced at the beginning of January 2001, seems to have positive effects on the use of rail and intermodal freight transport) etc.

On regional and local level, the canton and the town of Zurich initiated and supported different activities and projects to reach a more sustainable goods transport in the Zurich area. These activities and projects included concepts for combined transport, site evaluation for terminals, supporting measures for rail transport, use of private locations as transhipment points, strategies and activities in urban goods transport, co-operation/city logistics, compact city terminals, low emission lorries etc. The canton and town council supported pilot projects corresponding to their goods transport policy.

Within the IDIOMA-project at the validation site Zurich, three sub-projects have been carried out and demonstrated relating to intermodal and pick-up and delivery transport. Within these three sub-projects 12 Swiss partners (transport companies, system suppliers, universities, authorities and consultants) have been involved. Within Sub-project 1 “Innovative Combibox-System for intermodal logistics“ and Sub-project 2 “Innovative horizontal transhipment equipment (RTS-500 Furmia)” demonstrations were carried out, within Sub-project 3 “System integration between ACTS and conventional intermodal transport technologies“ no real demonstration took place but running pilot projects have been assessed and case studies have been carried out.

4.5.1 Innovative Combibox-System for intermodal logistics

Within Sub-project 1 ‘Innovative Combibox-System for intermodal logistics’, the use of a small container system (including telematics applications) for consumer goods within the transport chains (between Rothenburg and Zurich, 60 km) of the PISTOR-company was demonstrated. The demonstration included as main innovations small containers (Combiboxes for 4 pallets), a low floor city lorry, a swap body frame for 4 Combiboxes, a horizontal transhipment equipment and telematics applications incl. tracking and tracing techniques.

4.5.1.1 Demonstrator approach

During the demonstration a truck (monomodal case) brought a trailer with a special swap body frame and 4 Combiboxes (loaded with goods for restaurants and bakeries) from Rothenburg to the transhipment area nearby the city centre of Zurich. There the horizontal transhipment equipment transhipped the Combiboxes from the trailer to the city lorry which finally distributed the goods in the city centre of Zurich.

The transhipment rail/road (intermodal case) and the telematics applications could not be demonstrated within a real transport chain but the equipment was tested.

Figure 47: Combibox – uni-modal, intermodal and Telematics Applications Equipment

The following cases were demonstrated and evaluated:

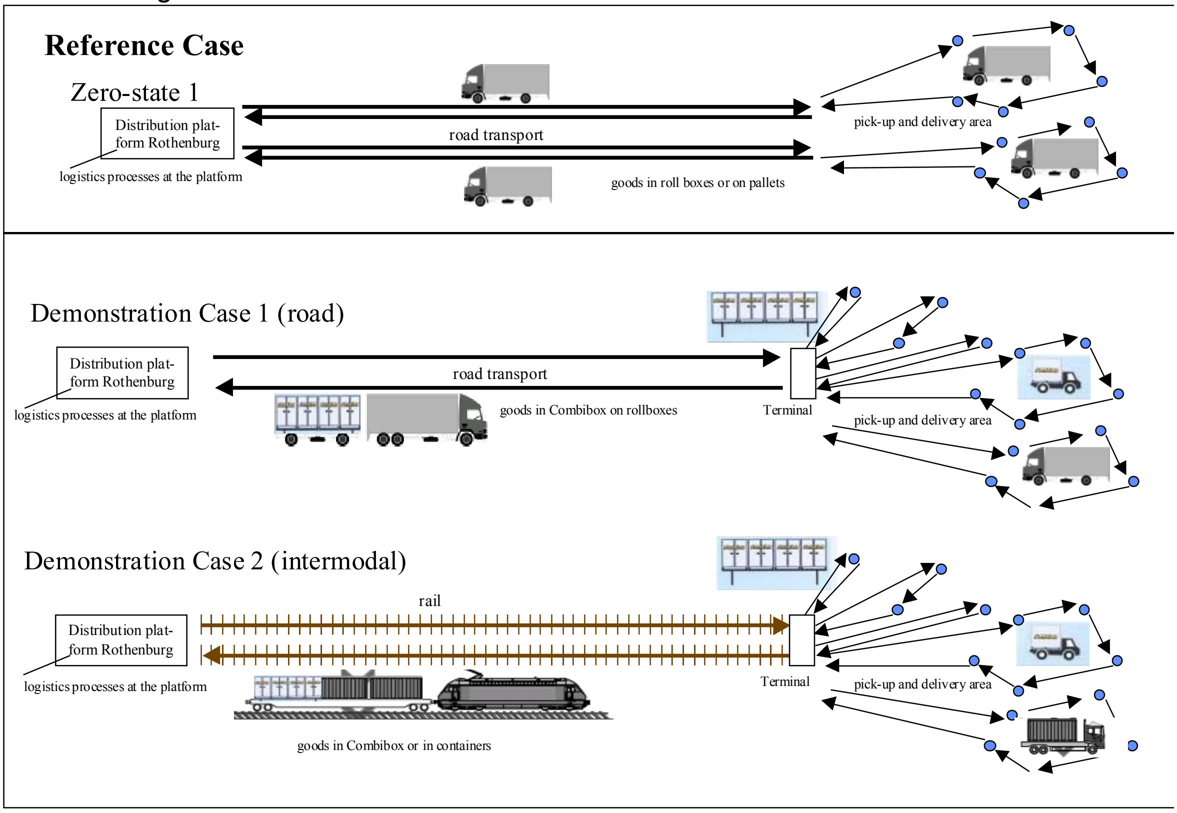


Figure 48: Combibox-System evaluated cases

The Zero state case consisted of road transport between the delivery platform Rothenburg and the delivery area in Zurich including the distribution process. The two vehicles had a load weight of about 4 to 5 tons each and 14 to 18 delivery points in the city-centre of Zurich.

Within the Demonstration case 1 (road) the two trucks are replaced by one truck and one trailer (incl. swap body with 4 Combiboxes). From the transhipment point (at Engrosmarkt Zurich) the truck and the city lorry went on delivery tour. The transhipment of the small containers was done by horizontal transhipment equipment or forklift. The demonstration case 1 (road) with horizontal transhipment equipment was fully demonstrated in January 2001.

Within the Demonstration case 2 (intermodal) a conventional swap body and the new swap body with 4 Combiboxes were transported by rail between Rothenburg and the transhipment point in Zurich. From the transhipment point (at Güterbahnhof Zurich) the truck and the city lorry went on delivery tour. The transhipment of the small containers was done by horizontal transhipment equipment (or forklift) and the transhipment of the conventional swap body is done by a reach stacker. The demonstration case 2 (intermodal) was only partly demonstrated in February 2001.

The equipment for tracking and tracing was developed and installed simultaneously to all other equipment but it could only partly be used during the demonstration due to compatibility problems with existing systems and technical failures but some tests were done.

4.5.1.2 Demonstrator results

The fist part of the validation and evaluation focused on the technical feasibility of the equipment and showed that the system elements (city lorry, transhipment equipment, and swap body frame) functioned generally but are not ready for the market yet. The equipment and the telematics application equipment have to be improved. Many technical and conceptual problems still have to be solved like the optimisation of the width, the ground clearance and the loading and unloading process of the city lorry, the steering/control and size of the horizontal transhipment equipment or the compliance of standards of the swap body frame.

The second part of the validation and evaluation included the assessment of the economical effects for the case that the Combibox-System is used within a company like PISTOR. For the individual situation of PISTOR and today's framework conditions the analysis shows that the Combibox-System leads to higher costs than in the zero state case by road. The costs per net ton are for the road case (with Combibox) about 17 to 25% higher and for the intermodal case (with Combibox) 28 to 35% higher. Considering the low market prices for road transport and the market prices for rail transport the differences are in reality even higher.

In several scenarios also the implementation of the HVF was regarded but it became clear that the influence is modest because of the relative low mileage in the main haul and especially in the distribution. The saved costs are already compensated by the higher distribution costs by the city lorry with Combibox (high vehicle and personnel costs) and additional costs for transhipment have to be paid. If better framework conditions like e.g. longer distances, higher delivery point density or cheaper transhipment costs can be set the intermodal case (with Combibox) is getting competitive compared to road transport.

Also the effect of the telematics application was regarded and it can be concluded that with regard to the transport and logistics structure of PISTOR and the existing framework conditions the costs for implementation and running of a telematics application system would be higher than the benefits. But if costs for equipment and communication can be decreased and if a higher service level for the whole transport (including e.g. tracking and tracing, shorter delivery windows, more just-in-time-transports, automatic access control, monitoring) is needed such a telematics application system would be an appropriate solution.

The environmental effects are as follows:

- The Combibox-System used in pure road transport chains compared to conventional road transport leads to a decrease of road mileage of about 25%, a decrease of 20 to 30% concerning the emissions (except CO: increase of 250%) and a decrease in energy consumption of 26%. That means that the external costs (emissions and accidents) are reduced by 17%.

- If the Combibox-System is used in intermodal transport chains there is a decrease of road mileage of about 65%, a decrease of 25 to 55% concerning NOx, HC and CO2, no change concerning particles, an increase of 220% concerning CO and a decrease in energy consumption of 39%. The external costs are reduced by 31%.

The above described results reflect the special circumstances within the Sub-project 1 "Innovative Combibox-System for intermodal logistics" and should not be generalised or directly transmitted to any other case!

4.5.2 Innovative horizontal transhipment equipment

Neuweiler AG (System supplier) and Guha AG (Engineering company) developed in co-operation with MIKON (Hungary) an innovative horizontal transhipment equipment 'RTS-500 Furmia' especially for medium and small intermodal terminals. The equipment should be able to handle all kind of ISO containers and swap bodies and should easy to be handled. Furthermore it should not require big restructuring work on the rail infrastructure and it should be able to be used even under the overhead conductor.

4.5.2.1 Demonstrator approach

Within Sub-project 2 'Innovative horizontal transhipment equipment' the use of this new horizontal transhipment equipment RTS-500 Furmia for the horizontal transhipment of containers and swap bodies below overhead conductor was tested on a small intermodal terminal. The demonstration took place at the public goods station in Dietikon. The swap bodies were transported under real market conditions between Dietikon and Geneva (275 km) within a new intermodal service concept of the SBB (Swiss federal railway company).

Figure 49: Horizontal transhipment equipment Furmia RTS 500

The following cases were demonstrated and evaluated within this sub-project:

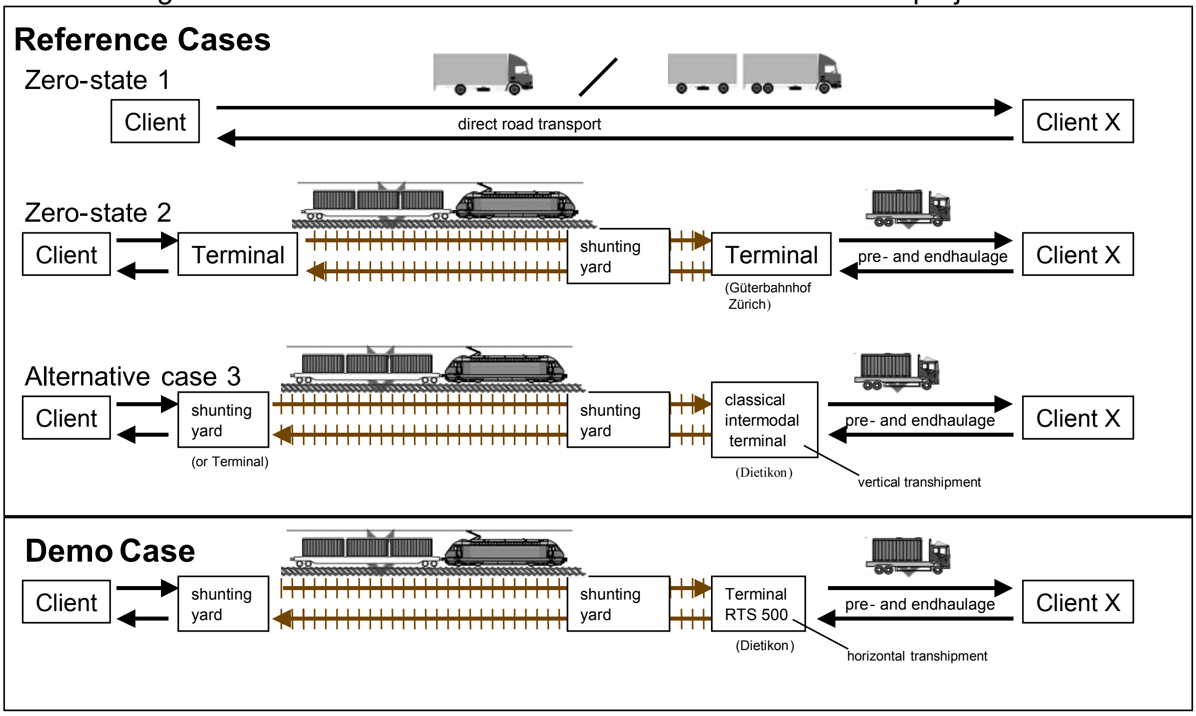


Figure 50: Evaluated cases

The Zero-state case 1 consists of road transport between the clients. In our case between the distribution platforms of the Planzer AG in Dietikon and Geneva. The final delivery of the goods was not regarded.

The Zero-state case 2 and the Alternative case 3 consist of intermodal transport based on a conventional terminal (Güterbahnhof Zurich) which leads to longer pre- and end-haulage distances and/or on a small terminal (Ortsgüteranlage) both with conventional terminal infrastructure (e.g. reach stacker or gantry crane).

The Demonstration case consists of intermodal transport based on small or medium terminals (Ortsgüteranlage) with innovative transhipment technology.

4.5.2.2 Demonstrator results

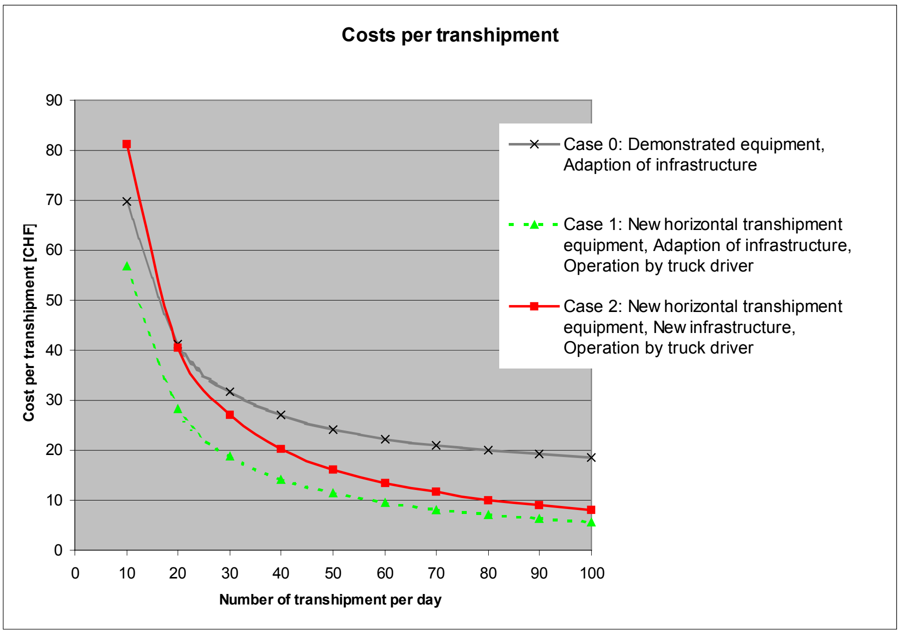
The demonstration in Dietikon showed that the horizontal transhipment equipment generally functions, but a commercial application is not viable yet. The main reasons are the too long transhipment times, the limited convenience in manual operation and insufficient reliability. The transhipment equipment is relatively easy to handle as far as the automatic operation mode works but if a container shows too big deviations of standards the hand operation mode has to be used. This mode needs a lot of training and experience and operation by the truck driver is not possible.

In general the intermodal transport service which was offered by the SBB (Swiss federal railway company) and which included the transhipment with the RTS-500 Furmia was only accepted by potential clients as long as also the terminal operation was changed (especially demand for longer opening times).

The validation and evaluation included also a cost analysis of the used equipment which showed that an improved horizontal transhipment equipment can be operated cost-covering if the transhipment process can be handled by the truck driver and ideally existing infrastructure can be used:

At a price of 25 CHF per transhipment at least 32 transhipments per day have to be realised to reach break even (case 2 with new infrastructure). For case 1 with existing infrastructure at a price of 25 CHF are only 22 to 23 transhipments a day are necessary to reach break even. Therefore, from the viewpoint of economy it is very important to use existing infrastructure as far as possible.

The comparison of different transhipment technologies (new horizontal transhipment equipment, gantry crane, reach stacker and forklift) showed that for a terminal with small and medium volumes below 100 transhipments a day, the horizontal transhipment technology is more economical than vertical transhipment technologies.



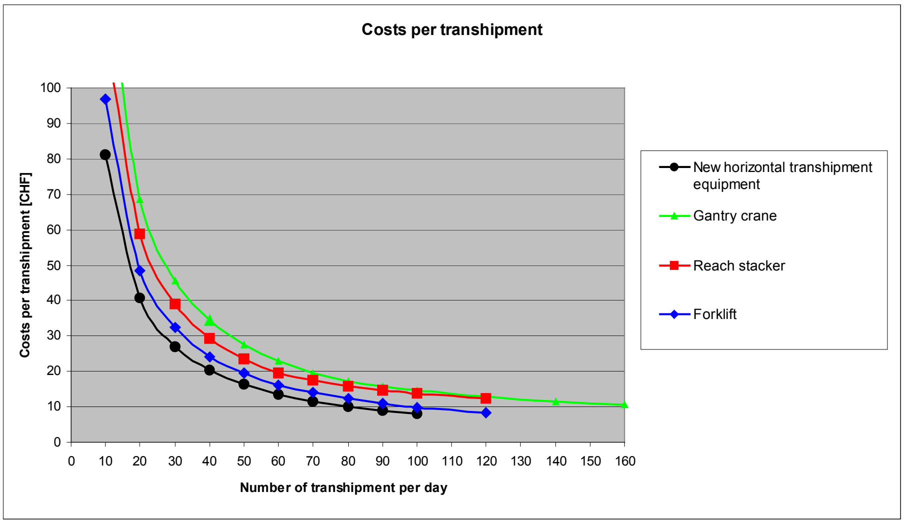


Figure 51: Costs per transhipment

The next step of analysis regarded the whole transport chain between Dietikon and Geneva (about 250 to 300 km) considering also the influence of the Heavy Vehicles Fee.

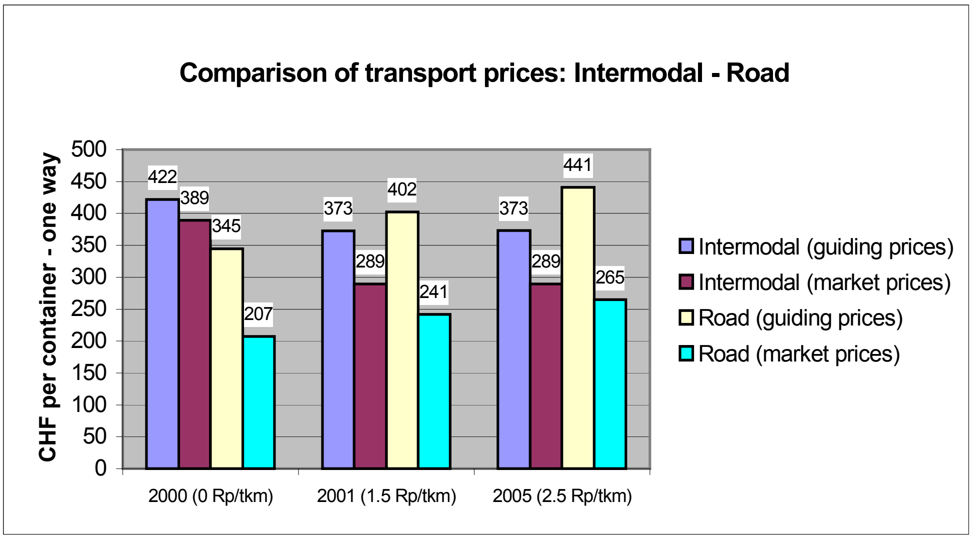


Figure 52: Comparison of transport prices

The comparison of the market prices shows that intermodal transport market prices are always more expensive (between 90% in the case 2000 and 10% in the case 2005) than road transport market prices. If open rail access was implemented the real prices would be situated between the above shown guiding prices and market prices. That means that intermodal transport will get more competitive in future but nowadays market prices on road are too low to give intermodal transport a real chance.

The analysis of the environmental and social impacts was finally done in two different ways (with and without considering global energy consumption, that means e.g. also production of vehicles, infrastructure, etc). In general combined transport is regarded as more sustainable in terms of emissions and energy use but by doing estimations on demonstrator basis the following results turned out:

- The first more global estimation is based on the number of containers transported during the demonstration (8 swap bodies per day and direction, 275 km). The results show that intermodal transport causes approx. 70% more emissions than road transport and the energy consumption lies even 118% higher (double the energy consumption of road transport). These results are quite surprising and are due to the excellent capacity utilisation on the road and the rather low capacity utilisation on the rail main-haulage.

- The second estimation with focus on operation is also based on the number of containers transported during the demonstration (8 swap bodies per day and direction, 275 km). For the transport chain Dietikon-Geneva the road mileage could be reduced by 550,000 km a year or 275 km per transported swap body. This reduction of mileage leads to a significant reduction of energy consumption and external costs.

The above described results reflect the special circumstances within the Sub-project 2 “Innovative horizontal transhipment equipment (RTS-500 Furmia)“ and should not be generalised or directly transmitted to any other case!

4.5.3 System integration between ACTS and conventional intermodal transport technologies

Within Sub-project 3 ‘System integration between ACTS and conventional intermodal transport technologies’ no real demonstration took place. The use of the roll-on/roll-off technology within bulk and consumer goods transport chains and the combination of roll-on/roll-off-system with features for delivery transport (vehicle with lifting platforms and special containers) was regarded in detail within the following examples:

<u>Coca-Cola</u>

12 new ACTS-containers are used since December 1998 for intermodal transports of Coca-Cola between Dietlikon (Zurich), Bollingen (Bern) und Bussigny (Vaud). The distance Dietlikon – Bussigny is about 240 km and between Bollingen and Bussigny about 120 km.

<u>Waste transport in the Canton of Thurgau</u>

The system is used since 1997 within waste transport chains in the canton of Thurgau (short and medium distances of about 30 to 70 km). 7 vehicles with ACTS containers are in operation, the whole transport chain was optimised.

<u>MIGROS</u>

In the year 2000 special ACTS-containers were tested for the intermodal transport of consumer goods between Neuendorf (Aargau) and Crissier (Vaud) (approx. 160 km).

Figure 53: The ACTS System – Coca-Cola, waste transport and MIGROS

4.5.3.1 Results

In a first step of the validation and evaluation of the state of the art and existing pilot projects in Switzerland the following aspects were looked at:

- The assessment of the infrastructure needed and the user acceptance showed that in general ACTS has low requirements for infrastructure and the transhipment process can be handled by the truck driver. The high density of transhipment possibilities (existing public goods stations) in Switzerland leads to short pre- and end-haulage distances on the road. Therefore the infrastructure and operation costs can be kept low. Furthermore all over Switzerland, suitable trucks with the necessary transhipment facilities are available.

- The ACTS-equipment is functional and usable in daily use for intermodal bulk transport and also partly for intermodal part load transport. The weight of the transhipment equipment on the truck reduces the pay load, which can be relevant for heavy bulk transport. ACTS containers can be put on the ground without any problems. This handling is also possible for part loads if the loads are fixed by special fixing features.
- The ACTS AG is responsible for the organisation of the whole transport chain and the management of the containers (one stop shop). This makes the planning and organisation very efficient and guarantees a high level of service for the clients (comparable to road transport). The mixed ownership of ACTS AG (railway company, trucking companies) is positive for the acceptance of the system and guarantees a good co-operation.

The results of the regarded examples show that intermodal waste transport and consumer goods transport (part and full load) using ACTS are economically viable. ACTS used e.g. in intermodal waste logistics chains can reduce costs up to 5 and 15% depending on the local conditions. But if framework conditions are not suitable (bad location of transhipment points, long turn around times for rail wagons) only pure road transport in combination with ACTS equipment is competitive.

- The second step of the validation and evaluation included five different fictitious transport chains and different scenarios (with/without HVF) in order to compare road and intermodal transport costs. The following findings can be outlined:
- Below 100 km intermodal transport using ACTS is only competitive compared to road transport under special framework conditions (e.g. waste logistics, high volumes on block trains).
- Between 100 and 200 km intermodal transport using ACTS can be competitive compared to road transport depending on the productivity gains due to the productivity gains of the weight limit for road transport (from 28 to 40 t) and the length of the pre- and end-haulage.
- Over 200 km intermodal transport using ACTS is usually independent of the Heavy Vehicles Fee cheaper than road transport. But the HVF improves the competitiveness.

In general the Heavy Vehicles Fee increases the competitiveness of intermodal transport, especially if the pre- and end-haulage is short (reimbursement is higher than the HVF prices) and the productivity gains of the weight limit increase for road transport (from 28 to 40 t) is low.

Furthermore a potential analysis of the potential for ACTS within Swiss internal traffic was carried out that estimated a potential to be shifted from road to intermodal transport with ACTS of about 3 to 5 mio. tons a year and for the time horizon 2015 a potential of about 10 mio. tons due to an increase of freight transport and an improvement of the intermodal system (distances less than 25 kilometres are not regarded). That would be a remarkable increase of factor 7.5 to 12.5 (year 1996) or factor 25 (year 2015).

Finally also the environmental and social impacts were analysed with regard to the five different cases (different distances and kind of goods) and weight limits (2000/28t, 2001/34t and 2005/40t).

- Within Case 1 (0-25 km, Waste) the energy use of intermodal transport using ACTS is about 8% lower than road transport. The reduction of social costs is estimated between 30 and 35%.

- Within Case 2 (25-50 km, agricultural products) the energy use of intermodal transport using ACTS is about 30% lower than in road transport. The reduction of social costs is estimated between 35 and 50%.
- Within Case 3 (50-100 km, food products) the energy use of intermodal transport using ACTS is only in scenario 2001 (34t) 20% lower than road transport. Within other scenarios intermodal transport using ACTS is 1 – 8% higher. The reason for this is the relatively high use of capacity for trucks. The reduction of social costs is estimated between 30 and 45%.
- Within Case 4 (100-200 km, chemistry products) the energy use of intermodal transport using ACTS is only in scenario 2001 (34t) 20% lower than road transport. Within other scenarios intermodal transport using ACTS is 5 – 20% higher. The reason for this is the relatively high use of capacity for trucks. The reduction of social costs is estimated between 30 and 50%.
- Within Case 5 (>200 km, waste/paper) the energy use of intermodal transport using ACTS is also about equal to road transport resp. in scenario 2000 (28t) about 30% higher. The reduction of social costs is estimated between 30 and 35%.

The ACTS-System leads not to a significant reduction concerning energy consumption. Depending on the transport chains and conditions an increase is possible.

The above described results reflect the special circumstances within the Sub-project 3 “System integration between ACTS and conventional intermodal transport technologies“ and should not be generalised or directly transmitted to any other case

5 IDIOMA follower cities

Within the IDIOMA project the so called “Follower Cities” represent one group of users who benefit from the experiences made within the IDIOMA project. The dissemination of the specific approaches and experiences of the IDIOMA demonstrators towards this group was an important element of the project. Experiences shall be shared with follower users in order to avoid problems, which have already emerged at IDIOMA demonstrators. The lessons learned within IDIOMA shall help “Follower Cities” to improve their own pre- and end-haulage distribution processes and with it to develop attractive competitive intermodal transport solutions.

Within the Follower City activities, solutions, developed and tested in Nuremberg, Öresund, Paris, Zurich and in the Randstad region should be evaluated regarding transferability to other regions. The experiences made should also help the Follower Cities of Budapest, Bratislava, Milan and Cologne to design innovative “tailor-made” logistical concepts for their region. Depending on the respective general conditions some of the solutions did match, others did not and have to be adjusted in case of implementation.

Both, the IDIOMA project as a whole and every single Follower City will benefit from the exchange of information and experiences:

- IDIOMA aims to widen the scope of scenarios, including the original IDIOMA demonstration sites as well as the follower cities in order to prove the sustainability of the concepts;
- The Follower Cities in turn will benefit from the experiences made regarding the prevention of redundancies and unsuccessful projects as well as the assessment of different potential logistical solutions.

Regarding the pre- and end-haulage of intermodal transport activites in urban areas, especially the availability of necessary infrastructure and the general regional political conditions play an important role for the implementation of future logistical concepts derived from IDIOMA demonstration sites. Furthermore, the Follower Cities activities also provided references and complementing ideas to the IDIOMA demonstration tasks which resulted in first raw concepts of potential future demonstration projects.

The following figure gives an overview on the relations between the Follower Cities and the IDIOMA Demonstration sites. From an overall point of view the first and most general conclusion is that there is a strong interest in the solutions found within the scope of IDIOMA. This does not seem to be very much astonishing because the problems the Follower Cities have to face were also part of the IDIOMA sites.

Relations to IDIOMA demonstration sites				
	Budapest	Bratislava	Milan	Cologne
Nuremberg	**x**	**x**		**x**
Task 5.1		x		
Task 5.2		x		x
Task 5.3	x	x		
Öresund	**x**	**x**		
Task 6.1		x		
Task 6.2	x	x		
Task 6.3		x		
Paris		**x**	**x**	**x**
Randstad	**x**	**x**	**x**	
Zurich	**x**	**x**	**x**	**x**
Task 9.1		x		x
Task 9.2	x		x	x
Task 9.3				x

Figure 54: Comprising presentation of interfaces

Budapest and Bratislava state to learn from the experiences made across all sites, whereas Milan and Cologne will primarily focus on the solutions derived from Paris and Zurich site. These rather technical solutions seem to be easier to transfer to other sites independent from the respective general conditions. Nevertheless the table must be interpreted from different horizons. In the case of Budapest and Bratislava all experiences made across all IDIOMA sites have been assessed as useful in that sense, that even solutions which does not seem to be transferable, could be valuable in order to avoid negative experiences already made within IDIOMA. In the case of Milan and Cologne only solutions which seem to be suitable for their specific situation have been listed.

All in all there is a strong nation-wide interest in promoting intermodal transports and co-ordinated distribution within urban areas but the implementation and execution of successful intermodal transport systems as well as co-operative distribution concepts require more. “Intermodal transport takes place in the heads of the parties involved” seems to be a fitting statement in this respect. Apart from technical requirements especially organisational aspects like the co-operation among different partners is of great importance. In this respect the organisational obstacles which had to be faced across all sites and tasks could be of even more value for the Follower Cities than the development of successful technical solutions.

In any case the experiences, negative as well as positive, made within IDIOMA will be helpful for related projects in organisational and technical respect.

6 IDIOMA overall results and conclusions

IDIOMA made once more obvious that new initiatives in urban areas distribution are needed especially in the pre and end haulage of intermodal transport chains. IDIOMA demonstrated a variety of different approaches of new technology and distribution concepts integrating – as far as possible – intermodal transport.

Most significant IDOMA results are

- Regional or local bundling projects in urban freight transport as demonstrated in Nuremberg, Randstad, Öresund and Zürich, were only partially successful. IDIOMA proved that on the one side a reduction of emissions can be achieved, especially when regarding intermodal transport chains. On the other side, it turns out that such approaches are extremely difficult to implement in the current transport business environment.

- City/Small container concepts can significantly reduce environmental impacts of freight transport. However the concepts demonstrated in IDIOMA met with technical problems and were therefore not commercially viable. It can be stated that the technical problems can be solved, but the economic perspective is still uncertain. To become economically viable city container concepts will either require large investments in infrastructure and equipment or entirely different transport patterns. Without such efforts small containers will play a marginal role in city distribution.

- The integration of traffic information turns out to have a striking impact on the efficiency and competitiveness of the goods distribution system in urban areas. The approaches demonstrated in IDIOMA showed that a substantial part of the delays in intermodal transport can be eliminated if high quality (reliable, detailed and up-to-date) traffic information is available in time.

- For the horizontal transhipment system RTS-500 Furmia as demonstrated in IDIOMA, it has to be stated that it is presently not commercially viable and can not be marketed yet. The main reason is that it is at present still costly and difficult to work with for the terminal personnel. However when properly adapted and integrated in the terminal infrastructure it may very well become operationally feasible in the future. A next generation of this kind of equipment is demonstrated in the INHOTRA. Two major trends are influencing the market prospects for the horizontal transhipment system. On the one side the system has to compete with similar, other transhipment systems and other innovations to make small volume terminals more profitable. On the other side the current terminal building plans in various EU member states include the building of a number of small terminals and these plans will of course enhance the chances of the transhipment system.

- The ACTS system proved already its capability for short distance rail transport, mainly for bulk goods. From IDIOMA it is concluded that there are no real technical barriers to apply the system also in non-bulk transport chains in urban and regional distribution. However this expansion of markets will impose additional, higher requirements to the logistic organisation of transport companies. They are currently not accustomed with these requirements. So instead of a technical challenge it was found that the real challenge is of an organisational nature.

- On city level a significant reduction of emission level has been observed in IDIOMA due to the use of alternative fuels. However, it should be noted that in a global view the use of alternative fuels might well be negative if one takes the generation of these fuel types into account. The basic economic problem with the use of alternative fuels in freight transport is that one has to compete in a commercial environment with other products having an already present massive fuel supply infrastructure and very efficient supply chains. In IDIOMA it became clear that a kind of temporary market protection for alternative fuels will be indispensable to migrate to large scale introduction. However, under the current conditions there is a clear limitation of this solution on local and regional transport in a commercially protected environment.

- The advantages of integrated transport of passengers and freight to urban areas are fast access to city centres and high priority transport. However the type of cargo is limited in size and the transhipment of cargo is not ideal and even clumsy when this has to take place on passenger platforms. The main problems turned out to be of a commercial nature (poor profitability) and difficulties with the internal organisation. Given the expected developments in urban freight transport, it seems that there might be indeed scope to renew interest in integrated passenger-freight transport. E.g. taxis could play a role in home shopping deliveries.

In summary it can be concluded that IDIOMA covered a broad range of facets of alternative approaches on urban goods transport having all positive impact on the environmental performance. To adopt such concepts the commercial performance is the crucial factor for the market players in urban transport. Regarding IDIOMA from this view some demonstrators passed these barrier's and will be continued even after the end of the project. After all, the majority of the demonstrated approaches can not be marketed yet. Due to the introduction of the Heavy Vehicles Fee (HVF) in Switzerland in the end of the IDIOMA project it was possible to show – as one of the first project – the influence of this fee on intermodal transport and in particular on urban transport. Considering the introduction of such charges also in other European countries in the near future the relevance that there is a need to develop and to employ improved concepts on the pre and end leg of intermodal transport chains becomes obvious. Best practices are one thing that is needed, new kind of transport and logistic organisation – including Public Private Partnerships (PPP) - is the other prerequisite to reach such an adoption. In this context more field trials applying innovative technologies and concepts would certainly contribute to more sustainable urban goods flows.

7 IDIOMA recommendations

The IDIOMA project demonstrated several different approaches and concepts aiming to improve the distribution of goods within metropolitan areas and between intermodal terminals/freight centres and metropolitan areas. Especially looking at:

- the more efficient operation of freight centres by optimising the information flows to ease the transhipment of freight between the available modes and means of transport and the use of multimodal chains;

- the integration of small and medium sized enterprises (SMEs) and their specific requirements in freight centres and transhipment point concepts to push their active participation in offering intermodal transport services and;

- the optimum organisation and the integration of telematics in the distribution process before or after a long haulage intermodal transport leg to achieve sustainable freight flows in urban areas and to reduce the environmental impact.

From the previous chapters it became once more clear that new initiatives in urban areas distribution are needed especially in the pre and end haulage of intermodal transport chains. IDIOMA demonstrated that good practices and possibilities to be followed in the distribution of goods within metropolitan areas and between intermodal freight centres and metropolitan areas exists. The findings and conclusions derived within IDIOMA refer to:

- The regional or local bundling of urban freight transport, using common carriers or co-operative distribution concepts;

- New loading units in urban (intermodal) transport;

- Improving technical, operational and commercial aspects of the information exchange in intermodal transport by means of innovative ICT-applications;

- Innovative transhipment systems in intermodal transport;

- Use of alternative fuels and energy sources in urban freight vehicles.

Clearly, not all IDIOMA innovations had already reached the level of technical and commercial maturity that is required for an introduction on the market. This is due to the fact that IDIOMA also demonstrated some innovations that were newly developed applications. Generally, it can be stated that for almost all IDIOMA demonstrators a reduction of emission level could be evaluated. On the other side for almost all demonstrations the financial and economic performance was unsatisfactory.

Regional or local bundling projects in urban freight transport as demonstrated in Nuremberg, Randstad, Öresund and Zürich, were evaluated only partially successful. IDIOMA proved that on the one side a reduction of emissions can be achieved, especially when regarding intermodal transport chains. On the other side, it turns out that such approaches are extremely difficult to be implemented in the current transport business environment. Generally it was experienced that city logistics looses awareness in urban freight policy. Especially, the problems in the commercial performance of city logistic projects are the reason for a reconsideration of the commitment of cities in such projects. It is recommended that the commercialisation of city logistics and city logistics companies should be further supported. The focus should thereby be on the development of logistical solutions and to increase logistical expertise in urban goods transport. Therefore, training and education of transport operators in order to increase the knowledge and expertise on best practices in co-operation and consolidation of goods and transport processes but also on the functions and operations of freight centres are recommended measures. Further research is recommended especially related to

- The promotion and assessment of information systems and interfaces in metropolitan transports

- The development of efficient structures for bundling and commercial co-operation of transport operators in metropolitan areas

- The development of intermodal freight transport structures in urban areas. Especially it is to ensure that city logistics and co-operation of city distribution are not complicated by competitive regulations etc.

City/Small container concepts can significantly reduce environmental impacts of freight transport. However the concepts demonstrated in IDIOMA met with technical problems and were therefore not commercially viable. It can be stated that the technical problems can be solved, but the economic perspective is still uncertain. To become economically viable city container concepts will either require large investments in infrastructure and equipment or entirely different transport patterns. Without such efforts small containers will play a marginal role in city distribution. To promote small containers standardisation work is recommended. This includes an overall approach regarding the standardisation of the small containers, the handling and carrying of intermodal equipment as well as the processes of and facilities provided in freight centres. To support this work further demonstration projects especially on urban container units and pools are recommended.

The integration of information be it traffic information or transport related information turns out to have a striking impact on the efficiency and competitiveness of the goods distribution system in urban areas. The approaches demonstrated in IDIOMA showed that a substantial part of the delays in intermodal transport can be eliminated if high quality (reliable, detailed and up-to-date) traffic information is available in time. Therefore, integrated telematics applications and approaches are key for the success of intermodal concepts in urban areas. The IDIOMA demonstrators in Paris and Randstad showed the key role of information and communication technology to plan, operate and monitor intermodal services in urban areas. Further research is recommended, especially in the share and usage of information along the transport chain but also along the supply chain to improve intermodal services in urban areas. To support this further research and demonstration projects are needed.

For the horizontal transhipment system RTS-500 Furmia as demonstrated in IDIOMA, it has to be stated that it is presently not commercially viable and can not be marketed yet. The main reason is that it is at present still costly and difficult to work with for the terminal personnel. However when properly adapted and integrated in the terminal infrastructure it may very well become operationally feasible in the future. Two major trends are influencing the market prospects for the horizontal transhipment system. On the one side the system has to compete with similar, other transhipment systems and other innovations to make small volume terminals more profitable. On the other side the current terminal building plans in various EU member states include the building of a number of small terminals and these plans will of course enhance the chances of the transhipment system. Further research on the technical and operational refinement are recommended. As the success of intermodal services in urban areas is strongly influenced first of all by the costs but also by the location of terminals, an overall strategy for intermodal transport terminals on European level integrating large hub terminal with small regional and urban terminals is needed.

On city level a significant reduction of emission level has been observed in IDIOMA due to the use of alternative fuels. However, it should be noted that in a global view the use of alternative fuels might well be negative if one takes the generation of these fuel types into account. The basic economic problem with the use of alternative fuels in freight transport is that one has to compete in a commercial environment with other products having an already present massive fuel supply infrastructure and very efficient supply chains. In IDIOMA it became clear that a kind of temporary market protection for alternative fuels will be indispensable to migrate to large scale introduction. However, under the current conditions there is a clear limitation of this solution on local and regional transport in a commercially protected environment. It is recommended that urban policy strategies should be aware of the possibilities and limitations of the employment of alternative fuels. Due to the positive environmental effects such a strategy should support the introduction of alternative fuels in urban areas.

From the IDIOMA follower cities activities it can be concluded that there is a strong interest in the solutions found within the scope of IDIOMA. Especially, in the case of Budapest and Bratislava all experiences made across all IDIOMA sites have been assessed as useful in that sense, that even those solutions which does not seem to be transferable, could be valuable in order to avoid negative experiences already made within IDIOMA. The best practices and expertise transfer especially into the new applicant countries is a major aspect recommended. This should include that these countries should have the possibility to scan the existing expertise and knowledge on urban goods transport promising solutions (best practices) for their cities/countries in order to promote the adjustment process in the new applicant countries.