New technologies increase efficiency in intermodal transport

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Conference paper STRC 2004

STRC 4rd Swiss Transport Research Conference

Monte Verità / Ascona, March 25-26, 2004

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Abstract

Freight transport is a key topic in the national and European policy. Transfer freight transport from road to rail is one of the the objective of transport policy in europe. Intermodal transport is a key strategy for meeting this goal, but only in particular situations. On one hand intermodal transport improves efficiency since over long distances trains can move large amounts of freight with a single locomotive driver and relatively low energy consumption. On the other hand there is a reduction in efficiency because two transhipments are needed to bring the freight from the short distance transport system (i.e. trucks) to the long distance transport system and back. Intermodal transport only succeed when the specific costs are lower and service quality is higher than conventional road transport.

Over the last several years the IVT has participated in several European projects designed to investigate new methods for increasing the efficiency of intermodal transport. Some of them will be described: InHoTra and COST 339 / EUROCONT.

InHoTra

The goal of the InHoTra project was to develop, construct and test new transhipment machines. In the last 2 years 3 different machines were builds (in Switzerland, Austria and Hungary). These machines can tranship boxes (containers and swap bodies) in the horizontal direction under the rail catenary. With this feature makes it possible to develop new terminal layouts and new services (e.g. liner trains).

COST 339

The market of partial loadings is growing faster than the other markets in freight transport. Modern logistic solutions in this market include less rail transport, but more effort in assembling, handling, sorting and distribution. The mostly used trandport mode are trucks. The idea of COST 339 was to develop new loading units which can be used for partial loadings and fit to common equipmnet and vehicles in intermodal transport.

In COST 339 the requirements of smaller boxes for intermodal transport were developed in a

top-down- and bottom-up-methodology.

EUROCONT

In EUROCONT, a r&d-project still in preparation, the aim is to design, build and test containers in real demonstration projects including the results and requirements of COST 339. In the end of the project a european standard for small boxes will be elaborated.

Keywords

Intermodal transport – efficiency - freight - InHoTra - horizontal transhipment – terminal - liner train – NETHS – A-IUT – RTS - simulation - COST339 - EUROCONT - partial load – swap body – pallets - small box

1. Introduction

Political, technical and economic changes induced a heavily increasing freight transport in Europe. The positive effects of the international and interregional exchange of goods can be felt in several ways: new products, new markets, new business relations, etc..

At the same time the negative effects (ecological and social problems with noise, pollution, accidents) of freight transport are likewise increasing. The majority of negative effects are caused by the freight transport with trucks on the roads. In the opinion of the policy and the public the ecological and social benefits of rail transport seem to be evident. The transfer of freight transport from road to rail is a frequently published target of European, national and regional policy.

The traditional way of handling the goods in railway system is obviously no efficient and economic solution. The intermodal transport can be a promising solution, because in the intermodal transport the advantages of both transport-systems (road and rail) can be united.

On one hand intermodal transport improves efficiency since over long distances trains can move large amounts of freight with a single locomotive driver and relatively low energy consumption. On the other hand there is a reduction in efficiency because two transhipments are needed to bring the freight from the short distance transport system (i.e. trucks) to the long distance transport system and back. Intermodal transport only succeed when the specific costs are lower and service quality is higher than conventional road transport.

In the intermodal transport more players are involved as in pure road or rail transport. The key for a successful intermodal transport service is to coordinate the players and the interfaces:

Sender - Road - terminal - rail - terminal - road - receiver

The interfaces influence the costs and the quality and resulting from this the price and the market share of the intermodal transport service.

Objective of policy

Sustainable economy and transport: increasing the positive effects and decreasing the negative ecological, economical and social effects.

Strategy of policy

Increasing of the market share of the intermodal transport

Objective of the two projects InHoTra and COST 339/EUROCONT

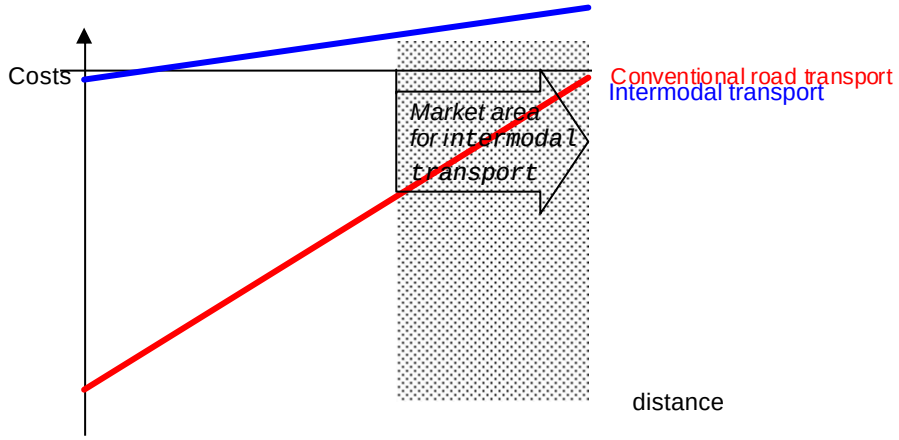
Increasing the market share of intermodal transport by increasing the efficiency of the intermodal transport with new technologies.

2. InHoTra
Interoperable intermodal horizontal transhipment

2.1 Terminal size - terminal costs – market share

The existing intermodal transport services are mainly direct trains between greater industrial areas and / or sea ports. The main reason for this fact is the cost- and production structure of existing intermodal transport services.

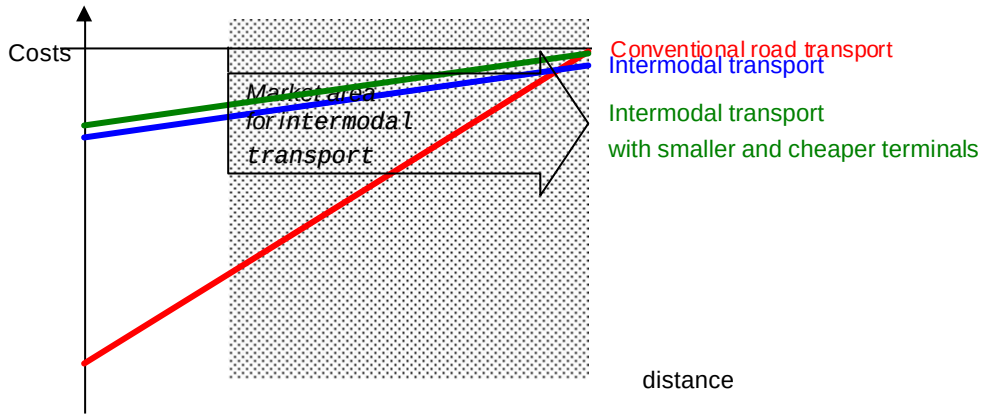
Figure 1 Market area for the intermodal transport



The costs of intermodal transport are influenced of the costs for road and rail transport but also by the costs for transhipment, storage and the administration / organisation of the transport chain. As shown schematically in figure 1 the market area for the intermodal transport is the long distance transport.

If it is possible to reduce the fix-costs (especially for transhipment and terminals) the total costs of the intermodal transport will be reduced and as consequence the market areas and the market share for the intermodal transport will increase (see figure 2).

Figure 2 Market area for the intermodal transport with small and cheap terminals

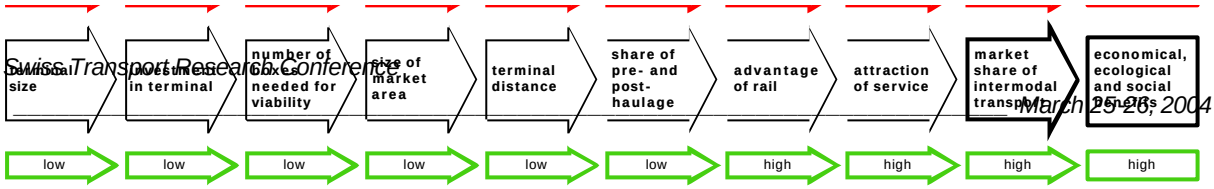


The business idea of InHoTra is to open new market areas for the intermodal transport in:

- middle distance market and
- regions with lower volume

The dependences between the terminal size and the market share (as well as the benefits) of the intermodal transport are pictured as following. The qualitative influences are marked with the direction of the arrows.

Figure 3 Market area for the intermodal transport with small and cheap terminals



In the opinion of the author the crucial point is the share of the pre- and post-haulage in the whole transport chain. As shorter the share (and the absolute distance) of the road transport (pre- and post-haulage) as bigger is the advantage of the rail in cost and quality and equally the bigger is the chance for the intermodal transport in competition to the pure road transport. A short share (and distance) of the pre- and post-haulage of the whole transport distance can only be realized with short distances between terminals. It is also evident, that there is an economic minimum limit for the terminal distance because of the speed, the cost and the attraction of the rail operation. A terminal every 10 km is surely not useful. It is also not thinkable to transfer the current system with shuttle trains between big terminals for the connection of small terminals.

2.2 New market areas – new types of services

It is evident, that for the acquisition of new markets and new clients not only new or additional terminals are necessary, but even new services and new types of terminals.

Reasonable overall systems of road, rail and terminal operation were developed with the experience of former projects in the field of intermodal transport, analyze of existing transport chains and services and observations of plausibility.

Basically two fields of new services were supposed:

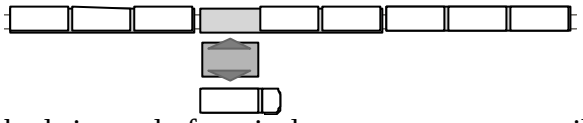
- High-quality-service with a high system-speed
- Low-cost-service with cheap and small terminal in areas with lower freight demand

The High-quality-service offers a service with several departures a day. The economic idea is, that short loading and unloading time means a low cycle-time and reduces the invest in boxes, vehicles, locomotives and personal. The clients profit by short waiting time and short distance to the terminals. The low-cost-service means access to intermodal transport for regions with

lower freight demand. This kind of service can be offered by economic production with low invest in infrastructure and equipment as well as low staff. In addition the feeding of an existing intermodal service with freight acquired by small terminals in new regions increase the economics of the bigger existing system. So for a final economic evaluation also the effects on the existing systems have to be calculated and respected.

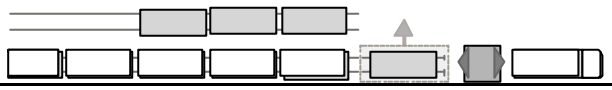
2.3 New types of services – new types of terminals

To suppose ideal equipment and layout for terminals in new services in a first step the dependences between transhipment system, equipment and rail operation had to be shown. To make requirements to the constructors of the new horizontal transhipment machines it was to

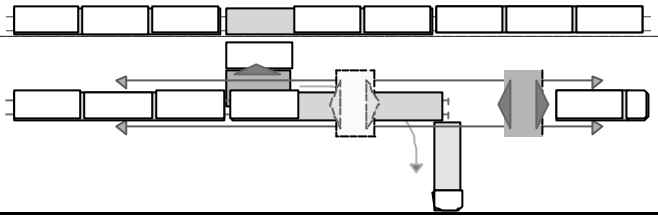


clear, which other methods instead of vertical movements are possible (table 1).

Table 1 classes of transhipment



Class I	
Class II	
Class III	
Class IV	



Class V	
Class VI	
Class VII	

These 7 classes of transhipment are the different ways to move a loading unit from one vehicle to another. It is evident, that there are differences in technology, automation, needed staff, infrastructure, costs and time.

The combination of rail operating forms and terminal case gave 18 useful and realistic cases. In the following table 2 the possibilities, the reliability and the necessity of operational details are listed.

Table 2 definition of terminal classes

Type of trains		Size of the terminal																				Junction (without transhipment)
		x	l	m	s	v	x	l	m	s	v	x	l	m	s	v	x	l	m	s	v	
Direct trains																						
Shuttle trains	L		2	1	1							T	T	T			T	T	T			
	P		4	3	3							T	T	T			T	T	T			
Block trains	L		6	5	5							S	S	S			S	S	S			
	P																					
Feeder systems																						
Feeder trains	L			2/6	1/5	1/5						TS	TS	TS			TS	TS	TS			16
	P			4	3	3						TS*	TS*	TS*			TS*	TS*	TS*			17
Train coupling & sharing	L				1/5	1/5																16
	P				3	3																17
Pick-up trains	L			2/6	1/5	1/5				7	7	TS	TS	TS			TS	TS	TS			
	P			4	3	3				8	8	TS*	TS*	TS*			TS*	TS*	TS*			
Pseudo liner trains	L				1/5	1/5				7	7											
	P				3	3				8	8											
Liner trains																						
Liner train 1	L			2	1	1			10	9	9	T	T	T			T	T	T			
	P			4	3	3			10	9	9	T	T	T			T	T	T			
Liner train 2	L			2	1	1			12	11	11	T	T	T			T	T	T			
	P			4	3	3			12	11	11	T	T	T			T	T	T			
Circle train	L								10	9	9	T	T	T			T	T	T			
	P											T	T	T			T	T	T			
Hub and spoke systems																						
Transhipment hub	L	Spokes consist of the other forms										X	X	13			X	X	14			Spokes consist of the other forms
	P											X	X	13			X	X	14			
Shunting hub	L											X	X	X			15	15	15			
	P																					
Full load traffic																						
Full load traffic	W				18	18																

L Train pulled by locomotive
P Push - pull trains
W single wagons in full load traff
x Mega terminal (>1'200 ITU/d)
l Large terminal (480 - 1'200 ITU/d)
m Medium terminal (120 - 480 ITU/d)
s Small terminal (<120 ITU/d)
v Mini terminal (<40 ITU/d)

Horizontal transhipment is possible
No transhipment is necessary
X Horizontal transhipment is hardly practicable
T: Transhipment hub
S: Shunting hub
S*: The shunting hub does make sense only when wagon groups are shunted
1-18 Classes of terminals

+!	+!	*	*	+!	+!	*	*	*	*	*	*	*	*	e	*	*	*	Loop line for the locomotive
+	+	+	+	+	+	+	+	+	+	+	+	*	+	+	*	*	+	Waiting area for road vehicles
*	+!	*	+!	*	+!	*	*	*	*	+!	*	+!	+!	+!	3)	*	*	*	More than one track for the transhipment
*	*	*	*	+!	+!	*	*	*	*	*	*	*	*	*	+!	*	*	*	Depot for railway wagons
*	*	*	*	+!	+!	*	*	*	*	*	*	*	*	e	+	*		Sorting sidings
*	*	*	*	+!	+!	-	-	*	*	*	*	*	*	e	*	*	+!	Shunting locomotive
*	*	*	*	*	*	+	+!	+!	+!	+!	+!	+!	+!	*	*	*	*	On a secondary track with direct access and exit
+!	+!	+!	+!	+!	+!	+!	+!	n	n	n	n	n	n	*	*	*	y	The whole train (or wagon group) has to be unloaded
y	y	y	y	y	y	y	y	y	y	n	n	y	y	n	*	*	n	The ITUs are loaded and unloaded at the same time
n	n	n	n	n	n	n	n	n	n	y	y	n	n	y	*	*	y	The ITUs are loaded or unloaded at the same time
-!	-!	-!	-!	+!	+!	-!	-!	-!	-!	-!	-!	-!	-!	+!	*	*	+!	Shunting
+	+	+	+	+	+	e	e	-!	-!	-!	-!	-	-	e	-!	-!	e	Long stopping time of the rail wagons
4)	4)	*	*	+!	+!	4)	*	*	*	*	*	*	*	+!	4)	4)	+!	Break trial
						+!	+!								+!	+!	*	Fast coupling and uncoupling of the wagon groups
						+!	+!								+!	+!		The last wagons were uncoupled and rest where they are
*	*	*	*	*	*	*	*	+	+	+	+	*	*	*	*	*		The ITUs that have to be transhiped have to be close together
																		Transhipment
+!	+!	1)	1)	+!	+!	+!	+!	+!	+!	+!	+!	+!	+!	+!			+!	Every wagon has to be reached for the handling
-	-	(-)	(-)	*	-	-	X	-	-	-	-	-!	-!	-			-!	Wagons can be displaced step by step
+!	+!	+!	+!	+!	+!	*?	*?	+	+	+	+	+!	+!	+			*	Parallel use of several transhipment units
+	+	+	+	+	+	+!	+!	+	+	+	+	*	+!	+			+	Transhipment directly to the road vehicle
+	+	+	+	+	+	*	*	+	+	+	+	+	+	+			+	Short time buffer
*	*	*	*	*	*	*	*	*	*	*	*	+!	+!	*			*	Storage for ITU
+!	+!	+!	+!	+!	+!	*	*	+!	+!	+!	+!	+!	+!	+			*	fast transhipment
+!	+!	+!	+!	+!	+!	*	*	+!	+!	+!	+!	+!	+!	+			+	Short distances to move with the ITU
+	+	+	+	+	+	+	+	+!	+!	+!	+!	+	+	+!			+	From the side of the railway wagon
-	-	-	-	X	X	-!	-!	-!	-!	-!	-!	-!	-!	-!			-	From the back of the railway wagon (over the buffer)
-	-	-	-	2)	2)	-!	-	-	-	-	-	-	-	-			-	Fix
+	+	+	+	+	+	+	+	+	+	+	+	+!	+!	+			+	Guideway
-	-	-	-	-	-	-	-	-	-	-	-	-!	-!	-			X	Free mouvable
X	X	X	X	X	X	X	X	X	X	X	X	-	-	X			X	Integrated in the transport vehicles
+!	+!	+	+	+!	+!	+!	+!	+!	+!	+!	+!	+!	+!	*			+	Transhipment under the catenary

+!	required	e	existent	1)	If there is enough time, the train can be displaced step by step
+	advantage	t	non-existent	2)	Possible when system serves from the back and the system can move the wagons
*	not needed	X	possible	3)	Loading and unloading are situated in different tracks
-	disadvantage	O	impossible	4)	Partial break trial is sufficient
-!	must not	y	yes	5)	When system can move the rail wagons
l	like without _f	n	no		

One basic part of InHoTra was to show the technical, operational and economical dependences between the system-elements rail, road and terminal. The requirements of the different terminals to the railway operation and to the transhipment behaviour are shown in table 3. The table can be read in two directions:

- which terminals need which kind of railway operation and / or transhipment;
- which terminal is possible for a defined railway operation or transhipment system.

Table 3 requirements of the terminal classes

In table 4 is shown, which class of transhipment can be used in which class of terminal. It can be seen, that the class IV – the system with a machine in the middle between road and rail system – can be used in nearly every kind of terminal. The reliability depends on the number of boxes and the requirements on the capacity.

Table 4 combinations of terminals and transhipment

	Classes of Transhipment						
	I	II	III	IV	V	VI	VII
1		/		X		X	/
2		/		X		X	/
3	/			X		X	/
4				X		X	/
5		X		X		X	/
6		X		X		X	/
7			X	X		X	X
8	/		X	X		X	X
9	X			X		X	/
10	X			X		X	/
11				X		X	/
12				X		X	/
13				X			
14				X			
15				X		X	X
16							
17							
18	/	/	X	X	/	X	X

X : possible combination
/ : restrictive possible combination

2.3.1 Example for a new service with new terminals and new equipment: the liner train

One kind of new service in intermodal transport is the liner train. The idea is to transfer quality and production schemes from passenger to freight transport:

- No shunting, no coupling of wagons or wagon groups
- In stations only the passengers, not the vehicles are changing trains
- Regular interval timetable
- Several departures a day
- Short and fixed stopping time in the stations
- Optimized and economic use and cycle of vehicles

The increasing speed of transport in liner train systems is a result of the reduced waiting time of the boxes in the terminals because of the interval timetable system with several departures a day.

For the liner train – and also for other kind of new services - new types of terminals (design, equipment and even operation) are needed.

Liner train systems include 3 types of terminals:

- End terminal
- Intermediate terminal
- Connection terminal (connection between two lines / other intermodal services)

2.4 New types of terminals - new types of transhipment equipment

The existing terminals for intermodal transport can be divided in 3 different types:

- Big terminals with cranes
- Medium terminals with movable equipment (reach stacker, fork lifter, etc.)
- Specialized terminal for single clients with special boxes or requirements (food, chemical, etc.)

The terminals for the new services have to be different, because the operation of rail and also of road transport is different. The decision, which kind of equipment should be used in a terminal depends on several terminal-specific facts:

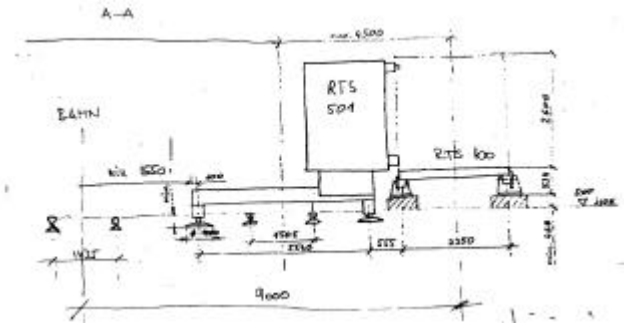
- Types of boxes
- Size and geometry of the area
- Number of boxes per day
- Time to load and unload
- Storage (number of boxes, height, …)
- Railway operation (complete train on one track, wagon groups or single wagons)

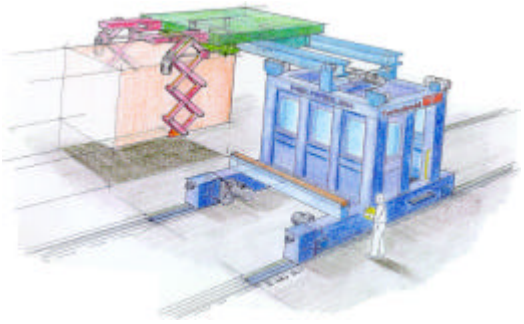
In terminals for the liner train systems there is the need to load and unload the boxes in a short and exactly defined time slot (defined by the regular interval timetable).

2.5 Requirements for new equipment

The wide preparation work in the field of operation / terminal / transhipment (see chapter 2.1 – 2.4) gave fundamental requirements for the horizontal transhipment systems:

- Operation under the catenary
- Easy to use (self-service terminal)
- Automatically
- Modular system
- fast
- economic (cheaper as cranes, low infrastructure invest)

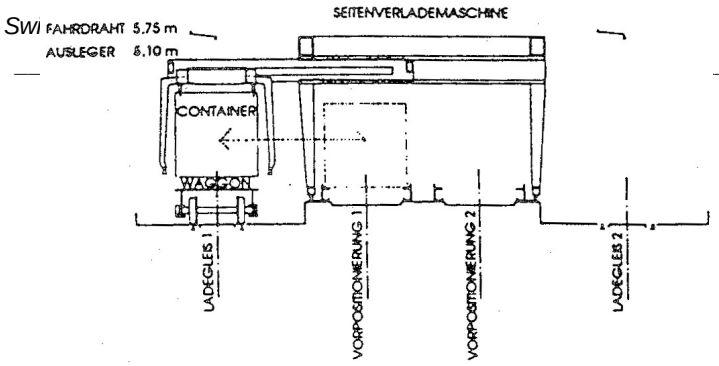


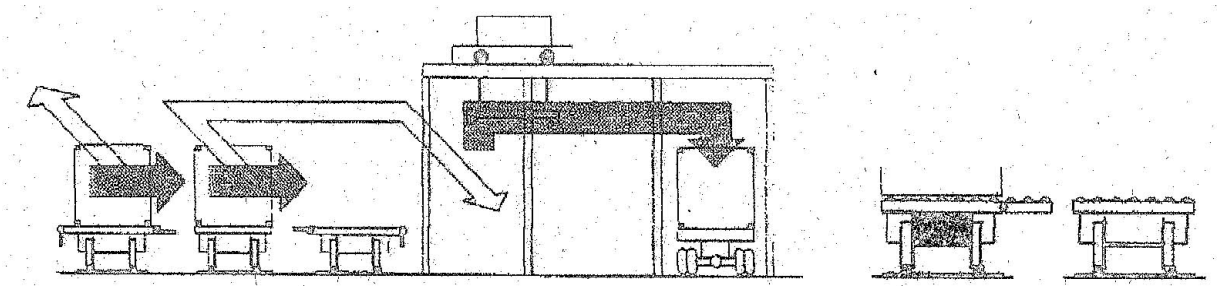


2.6 3 solutions

The industrial partner in the InHoTra consortium developed in a first step several ideas for horizontal transhipment systems:

Figure 4 ideas

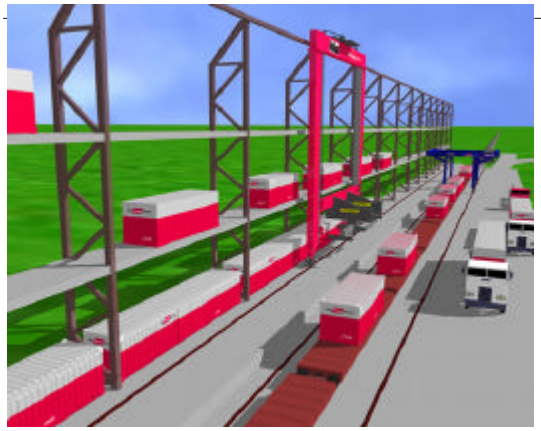




Three of theses ideas came to realisation. It is remarkable, that all realized ideas handle with existing boxes, road vehicles and rail vehicles. This is probably a hint on the reasons why many other new ideas and developments don't get into commercial and successful use.

2.6.1 A-IUT

The A-IUT is a concept developed for connection terminals (e.g. in the crossing station of 2 liner trains). In these kind of terminals the incoming trains should be unloaded and reloaded in



a very short time (ca. 1 h) to get low travel time and a high system speed. The idea to reduce the loading and unloading time was to separate the functions of the crane in two machines:

- The loading unit (blue) and
- The storage system (red).

Figure 5 The A-IUT in a draft

Draft: Rail Cargo Austria

Figure 6 The A-IUT prototype in reality

-26, 2004

Photo: Rail Cargo Austria

After the arrival of the train the loading system (blue) unloads all boxes of the train and puts the boxes just beside the train on the preparation line. The storage system (red) takes the boxes as fast as possible and puts the boxes on a high storage (prototype: 2 levels, planned: 3 levels). After unloading the train the storage systems takes the new boxes for the departing train (brought by other trains or trucks) out of the storage puts them on the preparation line. The loading system loads the boxes on the train.

The A-IUT is no origin horizontal system, but it is an economic and needed part for a successful system of intermodal service. Because of the widely distributed demand of freight transport successful intermodal services have to build up networks. In these networks the knots have to be designed and operated. A-IUT is a system for a economic operation of the connection terminals in these liner knots.

2.6.2 NETHS

The Neuweiler Tuchschmid Horizontal transhipment System is a typical horizontal transhipment system. The system contents 2 units. On the top of each of the units is a movable table on which the equipment for lifting and gripping is installed.

Figure 7 NETHS in an overview

Photo: Neuweiler

The NETHS runs in a 4,25m wide track, which is designed that a normal gauge track can be situated in the middle. ISO-Containers are handled from the top at the upper corner fittings. Swap bodies are gripped on their bottom with scissors-arms.

Figure 8 NETHS with swap body (left) and ISO-Container (right)

Photos: Neuweiler

The NETHS can run in a manual, semi-automatic and automatic mode.

The extensive tests /3 days in July 2003) showed, that the semiautomatic mode is very useful for unloading (gripping) the boxes. It runs reliable and precise. To automate the loading process is still a supervisor necessary. Here the (semi-) automatic mode can only support the operator, but can't substitute the operator.

2.6.3 RTS

The RTS is a product family with several machine parts:

- RTS 100 sorting field
- RTS 200 container pilling and lifting machine
- RTS 300 universal reloader for Container (prototype exists)
- RTS 500 universal reloader for Container and swap bodies (in construction)
- RTS 600 universal reloader for Container and swap bodies (planned)

Figure 9 RTS 500

Figure 10 RTS 100

Photo: Bosch Rexroth Group

Figure 11 RTS 300

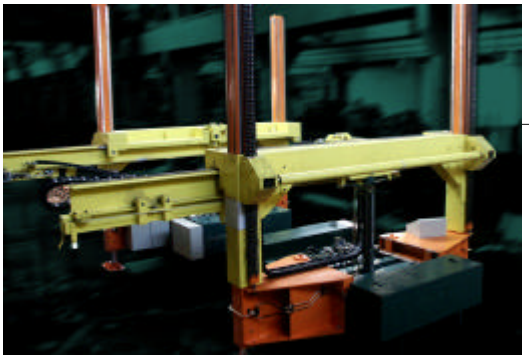


Photo: Bosch Rexroth Group

In the InHoTra-project the RTS 300 was constructed and evaluated. The Constructors (Bosch Rexroth, MIKON and KORAX, both Hungary) developed also other equipment and machines. They made their own market analyse and saw chances for automated systems in which containers and swap bodies can be loaded and stored with a high quality and high security (theft, damage, etc.).

The RTS 500 grips the ISO-Container at the side-corner-fittings. Because of the hydraulic powered system a very exactly measurement of the corner fittings is necessary.

The RTS 300, which was in autumn 2003 under construction can handle with ISO-Containers as well as with Class A and C swap bodies.

2.7 evaluation

The evaluation of the machines contents three parts

- Questionnaire
- Testing and measurements
- Simulation

2.7.1 questionnaire

Based on the experiences of the preparation work (see chapter 2.1 – 2.4) a wide questionnaire was developed. The constructors have to answer about 400 questions to the technique, the economic, but especially on the operation. There were also questions about the safety system and the needed personal.

2.7.2 testing and measurements

In summer 2003 all 3 systems were wide tested. The tests were filmed on video to keep the results and to make the analysis separately and even transparent.

Because of the different state of developement of the machines every machine had to make an individual test program. The aim was to show the possibilities, the work and the needed time for typical handlings.

With the NETHS 40ft, 20ft and swapbodies are transferred between rail, road, floor and legs (swapbody).

In the A-IUT –system only the (red) storage system exists. It was possible to see the handling (time and procedure) with 40ft, 20ft and swapbodies.

The RTS 300 handled with a 20 ft ISO Container. The sorting field RTS 100 was still under construction in the same testing area just beside the RTS 300. The RTS 500 was still under construction, but the evaluation group could get some impressions of the machine.

The NETHS is the only of the 3 machines which is in commercial use. It is situated in the area of the construction company Tuchschmid AG, Frauenfeld. It can be seen in the testing period, that the development of the NETHS is very well advanced. The other two systems (RTS and A-IUT) are still in the prototype-phase and it was seen, that there is still some amelioration-work to do.

2.7.3 Simulation

As shown before the system of terminal, operation and equipment is very complex. So it is not sufficient to compare the machine s/ systems only by comparing the costs or the needed time for transhipment. The aim of the evaluation was to find out, which machine / systems is the most practicable in which case. It is evident that the costs for investment and operation and also the transhipment time have to be integrated in the evaluation, but not as single numbers, but as part of the whole view.

To show the best working field of every machine terminal simulations were done. In these simulations every machine was integrated in different terminal situations.

One of the results of the preparation work and observations to the terminal / operation / equipment-combination (see chapter 2.1 – 2.4) was to create typical terminal cases for the evaluation. Already in the tests was seen, that every machine needs a specific terminal layout and operation form.

Figure 12 example for loading / unloading scheme of a short liner train

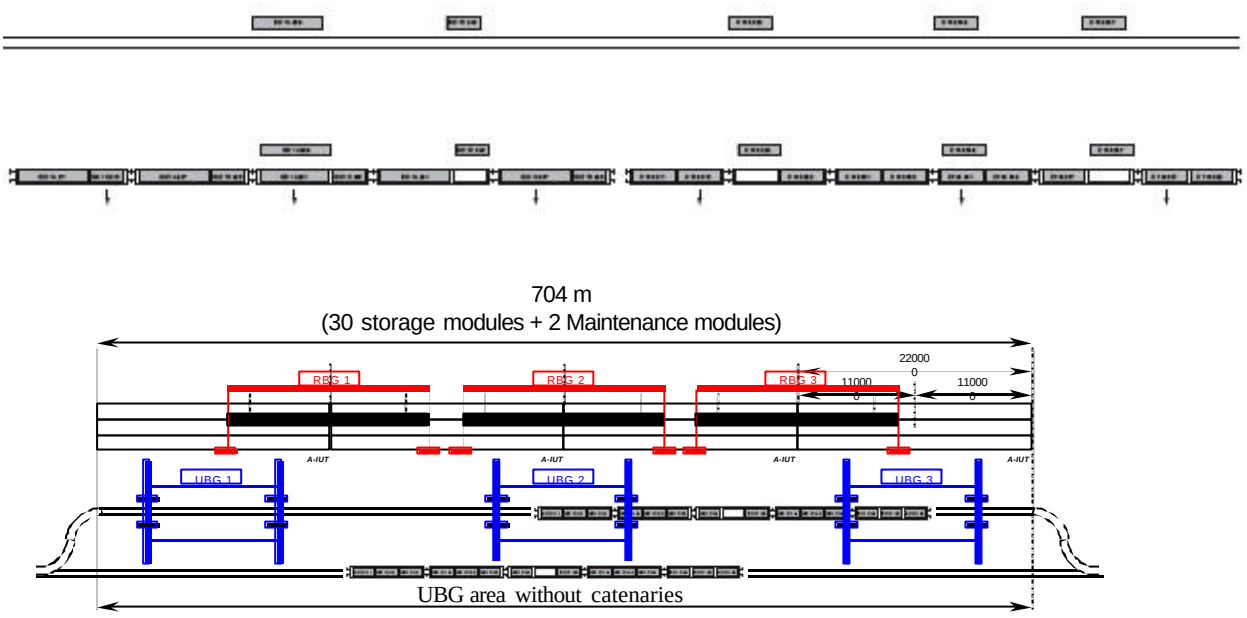


Figure 13 example for a terminal in the simulation

2.8 conclusions / results

An advantage of the smaller systems NETHS and RTS will be that they can be adapted easily to an increasing market. If there is a need to shorten the stop-time of the trains or to accelerate

the handling it is possible to take more machines on the existing track in the existing terminal area.

Because of the modular system there is automatically a back-up-system. When one machine fails the other machines can go on working, but with less performance of the whole terminal.

To build up an additional terminal into an existing network the 2 small systems (NETHS and RTS) are an economic, fast and easily realizable solution with low start-invest and good possibilities to fit to the needed capacity because of the modular system

Problematic will be the start-up phase of new services because for a whole service or network a lot of invest in locomotives, rail vehicles (even road vehicles), terminal infrastructure, equipment and administration will be necessary.

2.9 Reasons for increasing efficiency with horizontal transhipment

New services with optimized cycle of vehicles and loading units give a high system speed and a high specific performance (load-tons / vehicle and year) and low investment-costs per transported ton.

More goods / new markets for existing services by connecting areas with lower demand on freight transport in existing services with economic an cheap small terminals

The level of equipment goes parallel to the level of demand: caused by the modular systems it is possible to plan and realize the needed capacity in every terminal. So there won't be any over capacities. In cases of too much capacity (too much machines) it is possible to remove some machines to another terminal.

Because of the transhipment under the catenary there is no need to have infrastructure, locos and staff for shunting.

The machines are powered by electricity and they are not very high (NETHS and RTS). There is also no need for diesel powered shunting locos. So the noise pollution and spreading is not

very high. A use even in cities or in areas with houses around is possible. There is no need for noise protection caused by the terminal.

For small terminals areas or tracks in stations or industrial areas which are actually not in use can be used.

3. COST 339 / EUROCONT

3.1 background

A key objective of European transport policy is the substitution of the fast growing freight transport on road with a better use of existing railway network and fluvial and short sea shipping. Substitution of road transport by rail and ship means more intermodal transport chains. Following this, all shortcomings of the intermodal transport must be removed. One lack is missing standardisation of intermodal transport units like stackable swap bodies class A for an economical transhipment. Further are missing boxes smaller than class C swap bodies or 20ft ISO containers for loading sizes **L**ess than **C**ontainer **L**oad (LCL), because the most growing part of freight transport in Europe are partial loads as an answer to the "just in time" logistic.

In the last years several typical trends in freight market and logistic solutions could have been seen:

- more direct connections
- smaller loading size
- more partial loading (LCL)
- More handling and sorting
- For assembling and distribution trucks are the mostly used transport mode
- Less rail transport
- Lower storage capacities and stock-keeping

Existing intermodal transport units (ITU) have a loading space of 1 or 1/2 truck or rail wagon (full load transport). With smaller boxes for a reduced loading capacity (compared to existing ITU) but optimal transhipment possibilities these problems can be solved.

3.2 The European transport reality

In the european freight transport 2 standard units have two be respected:

- The swap body class c:

Figure 14 examples for swap body class C

www.geseaco.com

- The euro-pallet (dimensions 600 x 800, 800 x 1200 , 1000 x 1200):

Figure 15 example for euro-pallets

www.computerfrachtenboerse.de/Europaletten.htm

The european pallets don’t fit to the ISO-Standard of the worldwide used ISO-Containers.

Figure 16 1200mm-wide pallets in ISO-Container

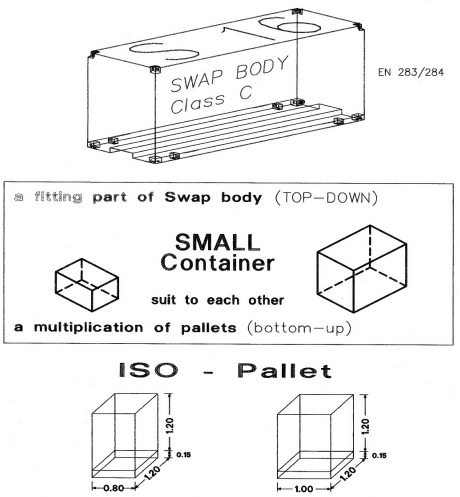
www.seacell.info

3.3 The idea of COST 339

3.3.1 Basics for the development of a new loading unit

Within the COST 339 action “Small Container” the question, if intermodal boxes smaller than standardised European swap bodies and ISO containers are a possibility to open the growing market of LCL for intermodal transport, was answered and a box family of 1/4 and 1/2 of the class C 7.45m swap body and their technology for transport, transhipment and handling at customer side is recommended. For the integration in existing transport chains and behaviour in COST 339 these requirements were specified:

- Standardised corner fittings at bottom and top
- legs similar like legs of swap bodies
- Fixing together to class C swap bodies
- Corner fittings allows fixation on trucks and rail-wagons as well as using transhipment equipment of intermodal terminals
- Forklift pockets because weight allows to use common forklifts



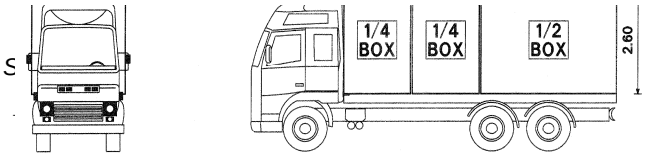
The boxes can be transported alone on trucks or vans in collecting and distribution traffic. In the long-distances they are transported coupled to units with the dimensions of swap-bodies class C. In the coupled mode they can be transferred with existing equipment in terminals and can be transported with existing vehicles without adaptation.

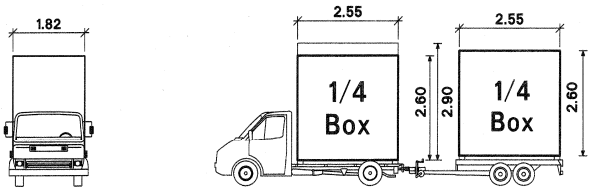
In a top-down-bottom-up-methodology a new type of standardized loading unit was drafted:

Figure 17 top-down-bottom-up-methodology

European Commission: COST Action 339 Small Containers, Final report of the action, Brussels, 2002

Figure 18 Use of small boxes for assembling and distribution with trucks





European Commission: COST Action 339 Small Containers, Final report of the action, Brussels, 2002

Figure 19 use of small boxes in City-Logistic or areas with restrictions for trucks

European Commission: COST Action 339 Small Containers, Final report of the action, Brussels, 2002

3.3.2 Advantages of small boxes

Small boxes will open the possibility to reduce costs, failure risks and transportation time of today's partial loading transport together with the profit to open this massive growing market for intermodal transport. With the concept of a box family including swap bodies as a full truck loading, today's splitting of transport concepts for partial loading and full truck loading can be vanquished.

With small containers partial or (LCL) loadings can be delivered directly without or with less reloading processes. Higher transhipment costs of boxes are less than cost reduction for intermediate storage, reloading and sorting. Further partial loadings can be transported protected in the whole transport chain. Within damages of good during reloading can be reduced.

In City Logistics small containers can be used as an alternative to trucks and vans long time staying for cargo handling in small roads and lanes. Small boxes can be unloaded faster and can be used as storage till consignee find time to reload and as storage for back freight (packages or other products). Box costs can be covered with better use of trucks and vans for transport company and with better time planning and storage place winning for consignees.

Existing short sea freight distribution, where trucks and vans goes by ferries to small ports without any transhipment equipment (e.g. Greek islands) are an economical possibility to use small containers. Small containers use less surface and volume on board and can be handled easily by forklifts staying on ferry or on ports. Further drivers must not attend the loadings during sailing. Those Transport mode is much more economical as existing practise, because ferry transport and driver costs can be reduced, trucks and vans can be used more efficient and investments in boxes and forklifts on ferries are not so expensive.

Hazardous goods can be transported in an economical way in smaller batch sizes than existing tank trucks or swap bodies. Within the risk for damages can be reduced. The benefit isn't on the economical side of transport companies but there is a public interest to crashworthiness.

3.4 Continuation of the work of COST 339 in EUROCONT

It is evident, that the development and introduction of a new standardized loading unit must be sustained in the frame of European research, because commercial initiatives are not practicable as long as transport companies, forwarders and good distribution companies can operate with existing technologies. The positive effects only can be generated, when there is a (European-) wide use of small boxes. Therefore a standard (CEN) is necessary. With a standard even the prices for small boxes will be lower, because the engineering effort for the manufacturers can be reduced.

3.4.1 Aim of EUROCONT

The aim of the project EUROCONT is to enable the introduction of small containers as a fully compatible system into the existing intermodal transport chains. Project innovation is creating a loading unit family fulfilling the need for a better adoption of partial loading sizes, like partial or less than truck/container loads. Adapted from the need of lightweight boxes (high speed

transport, vans with a weight limit of 3.5 tons) developments of new sustainable construction technologies are envisaged. The project will demonstrate and convince legislators and end users, that a possibility exists to increase the market share of intermodal transport (on rail, road, waterway and air) by using standardized low cost transport units for different loading sizes.

3.4.2 Content of EUROCONT

The project EUROCONT, which is actually in preparation has 4 working fields:

- Virtual:
  finding economical interesting and proposed successful transport chains and cases for small boxes.
- Engineering:
  development and engineering of technical details,
  choose of material,
  preparation of prototype-construction.
- Physical:
  construction of prototype-boxes,
  testing by integration in existing transport chains with different transport modes.
- Standardization:
  Preparation of the standardisation process.

3.5 Reasons for increasing efficiency with small boxes

The main aspect for increasing efficiency is the replacement of assembling and sorting of the goods done in handwork in hubs by assembling small boxes to loading units for the intermodal transport, which can be done by technical and automatable equipment.

For logistic solutions in partial loadings there is no need to assemble and assort the goods in hubs. This assembling work is mostly handwork (with forklifters, lift trucks, sack trucks, etc.) By cancelling this handwork, there is also cancelled the risk of freight damage, failure in assembling and thefts.

With small boxes the intermodal transport can take part in the highly increasing market of partial loadings. Therefore the efficiency and economy of existing intermodal services and terminals can be improved by more handled and transported loading units.

4. References

InHoTra-Consortium (2002): D3: Report on Common Methodology about the assessment for horizontal transhipment technologies, *Zürich*

European Commission (2002): COST Action 339 Small Containers, Final report of the action, *Brussels*

Further information:

www.inhotra.org

www.cordis.lu/cost-transport/src/cost-339.htm