



Technical and operational Developments needed for a better Market Success of Intermodal Freight Transport

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Abstract

Based on today's situation with a policy (European as well as Swiss) demanding more intermodal transport and a missing market success in reality, presentation will give some inputs on the way to a better market share of intermodal transports. Elements are:

- Critical elements of the transport chain in intermodal freight transport
- New operation forms for rail transport
- New transshipment technologies
- Organisational problems like co-ordination of the transport chain, responsibility of the whole transport and quality control
- New intermodal box family

Keywords

Intermodality - Transport Chain - Freight – Container Transshipment – Rail Operation – Transport Organisation - Swiss Transport Research Conference – STRC 2001 – Monte Verità

- 1. Today's Situation in Intermodal Transport

Swiss transport and environmental policy says that freight must be transported on rail. Reasons are:

- Transportation policy
- Capacity of Swiss road network will be limited
- Better use of existing and new built rail network (Bahn 2000, Alptransit)
- Environmental policy
- Reduction of pollution
- Reduction of noise

Today freight transport demand is more and more between consignees who have no direct access to the railway. So freight on rail is only possible, when there exists a good offer for intermodal transport in national and international relations in Switzerland as well as in whole Europe.

Reality is, that in North - South transit through Switzerland and in the international traffic exists some well used offers between greatest agglomerations but only on some very long distances over 500 - 700km. Market share is very small, because only a very small part of all transported goods on the Swiss road network will be transported over 500 km. More or less there is on a few relations the North- South transit and Import - Export operated by private companies.

Especially in Swiss inland relations (like East/west and Northern Part to Tessin) exists no intermodal transport offers or only in any special cases like Swiss Post with a own system and a first step to a inland offer on the relation Dietikon - Geneve, Those first step is the result of the Swiss project named PPEGASUS and a demonstration in the EU project IDIOMA.

So there is missing offers for inland transport and for Import/Export covering the demand in most regions by Swiss railways or by private companies.

- 2. Barriers to a better use of Intermodal Transport

Reasons of today's situations are a lot of barriers or obstacles. Those barriers are in different fields:

- On the operational side there doesn't exist transport offers on rail covering all regions - missing terminals near customers - and existing offers doesn't cover the demand to transport time and quality. Used rail operations is direct or shuttle trains between two terminals.
- In intermodal transport as one product of good transport there doesn't exist an operator and controller responsible for the whole transport chain. Within co-ordination is expensive and quality supply and controlling from house to house is missing.
- Transport prices are higher than road transport on relations under 5-700km

- 2.1 Operational problems

- Rail operation forms

Direct trains needs a great demand between two terminals (more than 50 ITU's). Only a few relations in Europe covers a market to fill complete trains.

Normally direct trains arrive at morning in a terminal, because it's needed to use the night steps for rail transport. Within exists a peak at the railway side of the terminal. Following this peak all customers want to have their units at the same time at their house for optimising loading operation.

- Train division

Today terminals are not so long that whole long trains (600-700m) can be handled in the terminal. So trains must divided after arrival. That needs shunting tracks, locomotives and personal.

- **Opening hours of terminals**

For the consignors the closing time is often too early and for the consignees the opening time too late. Longer opening times are an economical problem because more staff is needed. To extend opening times there must be a potential volume that could be activated with it.

- **Terminal technology**

Today terminal technology is available for greater terminals. Investment and operation costs are as high as costs per ITU are only acceptable, when a greater number of ITU's per day where handled.

Further there is no transshipment technology available, where allows a transshipment under catenary.

- **New intermodal loading units**

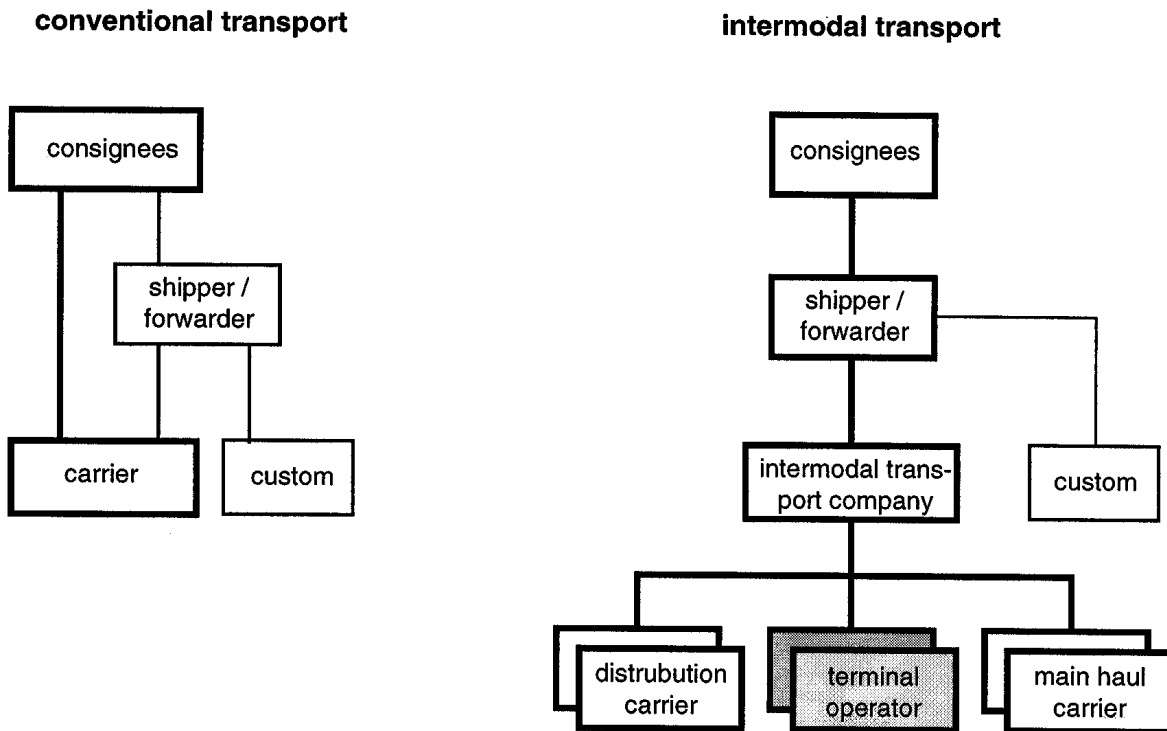
Most growth in good transport is the market of small loading size or less than container loading (LCL). Trucks will be used for assembling and distribution on a longer part of the transport way. Within this part of good transport is not practically for intermodal transport. Smallest ITU's are the Class C swap body or the 20' container (only used on overseas transport chains). An integration of LCL in intermodal transport requires a new generation of small containers.

- **2.2 Organisational problems**

- **Co-ordination between all partners**

Differing from the conventional freight transport in an intermodal transport participate a lot of partners. The organisation and the supervision are therefore much more complicated.

It's very important; that the companies in the intermodal transport have a compatible electronically data exchange to reduce the administrative expenses and accelerate the handing-over of the transport documents.



Comparison of transport modes / organisation of transports

The consequences of this complex transport organisation are:

- Every IT-company has there own (mostly) international network. The customer can hardly survey the supply of the different companies and compare the prices.
- Changes between the different networks for more destinations are difficult.
- The transports units belongs to one partner and they have to survey this units separately. Normally the unit are leased the to customer for the duration of transport.

- New international arrangements between the partners are necessary although the railways of Europe are doing international transports for many decades now and they are used to a co-operation.

- **Timing of road distribution**

To take advantage of the fast handling of the transshipment equipment it's important that the road vehicles or the trains are at the right time at the right place to take over the ITU's. That is a very complex procedure and needs perfect contacts between the participating partners.

Especially difficult is the timing of the road transport because of traffic jams. The timing problem between the transport modes is important for cost efficiency (waiting times, stacking). The fact that the operator of the terminal and road transport often is not the same company is a difficulty.

- **Distribution and collection of load units**

The distribution is less economic if the freight flow isn't the same in both directions. Therefore it's better to organise the distribution in a way to avoid empty trips. If more than one company is doing the distribution, it's more difficult to find matching freight flows.

- **2.3 Economical problems**

- **Investments**

Terminals are expensive and very specialised infrastructure investments. High investment cost are necessary for a low operation costs. Low investment costs causes in most cases high operation costs. There must be found an optimum.

Terminal with large traffic flows needs big areas. The placement of the terminal should be on a ground with good traffic connections for road and rail (ev. river), in the middle of the potential serving area and with low ground prices. In densely populated regions it is difficult or impossible to find such places.

- Transshipment costs

The transshipment costs consist of amortisation of the investment, personal costs, maintaining costs, energy costs and a supplementary for management, risk and profit. The following table shows an example of calculating the transshipment costs for different sizes of terminals and different traffic flows. The exact calculating is described in Annexe 2. The cost for one transshipment differs in a wide range. If the terminal has an optimal load factor the costs are about ECU 25. – to 30. –. Because of better productivity larger terminals are better than small ones.

Terminal size	large		medium			small	
	500'000 Load Units (LU) per year 2'000 Load Units (LU) per day	300'000 1'200	200'000 800	100'000 400	50'000 200	30'000 120	15'000 60
infrastructure costs	58%	60%	57%	61%	63%	51%	57%
total [mio ECU]	100	100	50	50	50	7	7
estimated lifetime [years]	25	25	25	25	25	25	25
per year [mio ECU]	7.000	7.000	3.500	3.500	3.500	0.490	0.490
per LU [ECU]	14.00	23.33	17.50	35.00	70.00	16.33	32.67
personal costs	8%	5%	9%	5%	3%	18%	10%
productivity [LU/p*h]	14	14	10	10	10	5	5
staff [#]	18.7	11.2	10.5	5.2	2.6	3.1	1.6
per year [1000 ECU]	1'027	616	575	288	144	173	86
per LU [ECU]	2.05	2.05	2.88	2.88	2.88	5.75	5.75
maintainance costs	20%	21%	20%	21%	21%	17%	20%
per year [mio ECU]	2.400	2.400	1.200	1.200	1.200	0.168	0.168
per LU [ECU]	4.80	8.00	6.00	12.00	24.00	5.60	11.20
energy costs	1%	1%	1%	1%	0%	1%	1%
per year [ECU]	150'000	90'000	60'000	30'000	15'000	9'000	4'500
per LU [ECU]	0.30	0.30	0.30	0.30	0.30	0.30	0.30
management	13%	13%	13%	13%	13%	13%	13%
per year [mio ECU]	1.587	1.516	0.800	0.753	0.729	0.126	0.112
per LU [ECU]	3.17	5.05	4.00	7.53	14.58	4.20	7.49
total							
per year [mio ECU]	10.58	10.11	5.34	5.02	4.86	0.84	0.75
per LU [ECU]	24.33	38.74	30.68	57.70	111.75	32.18	57.41

Examples of transshipment costs

- Road distribution

The costs for road distribution are normally higher than the transshipment costs. They depend on a big part on the optimal use of the truck fleet over the whole day. A special problem is unpaired or irregular consignment flows.

- Pricing

The transport prices consist of the costs and the profits of each partner. A lot of partners cause higher transport prices for the customer because each company carries the transport risks and each company has to earn money. The sum of the individual transport risks is higher than the risk for the whole transport in one.

- **3. Main Objects for a successful Intermodal Transport**

Main objects are:

- Basic objective for a success is the new organisation or to find an operator for the whole transport chain.
- Build up a transport offer from house to house covering the whole country resp. whole Europe and within
- Need of new operation forms on the rail side
- Need of small terminal infrastructure for an economic transshipment.
- New intermodal transport units for less-than-container loading (LCL)

- **3.1 Organisation**

With a responsible company for the market product intermodal transport as well as road transport or conventional rail transport (complete train, full load wagon) a main objective for as successful intermodal transport can be fulfilled.



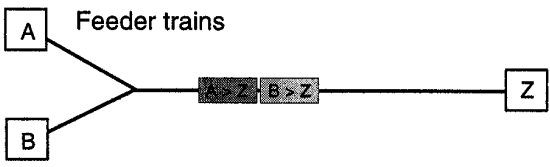
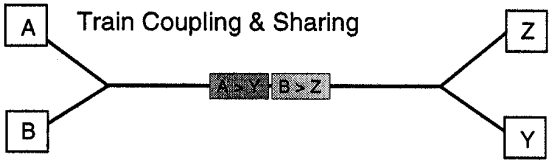

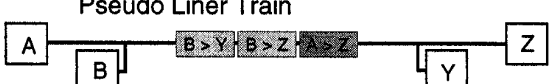
- A responsible company can guarantee the quality of all elements of the transport chain.
- A group of responsible companies can build up a European wide transport offer on rail, water and road.
- Within those companies or an other company can build up a pool of ITU's for an optimal use with minimising transport of empty ITU's
- Organisational works can be minimised (cost reduction)
- Unified telematic solutions for the controlling of transport and the information of customers can be minimised.

Who are the possible companies for leadership in intermodal transport? On the land side there are the railway companies. They are linked over the whole continent, works since a long time with standards and has at least theoretical the intellectual competence for long distance transport. It's possible, that liberalisation of European railway system is an obstacle.

- **3.2 Operation**

- **Rail operation forms**

To build up a transport offer between terminals with small transport flows to different other terminals and for short distance transport offers we need new rail operation forms.

<p>Direct Trains</p>	<p>Characteristics:</p> <ul style="list-style-type: none"> • direct train from A to B without handling on the way • start and end in A or B
<p>Shuttle train</p> 	<ul style="list-style-type: none"> • shuttle trains with fixed wagon composition
<p>Block train</p> 	<ul style="list-style-type: none"> • block trains with only as many wagons as needed
<p>Feeder Systems</p>	<p>Characteristics:</p> <ul style="list-style-type: none"> • short feeder line and long main hauls
<p>Feeder trains</p> 	<ul style="list-style-type: none"> • feeder trains: short feeder trains couple in a junction to a wagon group train for the long distance haul
<p>Train Coupling & Sharing</p> 	<ul style="list-style-type: none"> • train coupling and sharing: self driven wagon groups couple in a junction for the long distance haul and split to separate destinations
<p>Pick-up Trains</p> 	<ul style="list-style-type: none"> • pick-up trains: trains that pick-up a wagon group in a terminal on the way
<p>Pseudo Liner Train</p> 	<ul style="list-style-type: none"> • pseudo liner train: liner train that picks up wagon groups and uncouple them in destination terminals; <u>not all terminals are connected with each other</u>

Liner trains

Liner trains are trains running from terminal to terminal - distance -50-100km between terminals- with a short stop time for loading/unloading. Within ITU's can transported also on shorter distances. On some European main axes there is possible to offer a timetable with trains all 2-6h for fulfilling a lot of transport requirements. Small terminals can be connected via hubs with the long distance main network.

Swiss PEGASUS project foresees two liner trains, one from Geneva to the terminal of Wolfurt. ÖBB for connection to Eastern Europe and one from Basel to Busto Arsizio near Milano. The two trains have a rendezvous in the area of Zürich.

Feeder trains

Feeder trains are wagon groups of a long distance shuttle train to connect small terminals with main terminals. The wagon group rolls independent only on a short part of the journey. For fast coupling/uncoupling with the shuttle there is a typical use of Cargo Sprinters named as train coupling/sharing system.

Hub & spoke system

From different terminals rolls shuttle trains to a hub, where ITU's will transhipped to other trains with a final destination (different destinations with liner trains). ITU's should be transhipped or the wagons will be sorted like in shunting yards of full load traffic. Challenge of such hubs is the possibility to minimise stop time of all trains to 60 minutes. Only with a minimised stop time over night steps are possible.

An existing solution is the hub Metz Sablon of the INTERRCONTAINER company. Other systems doesn't exist, but are planned in Germany near Hannover. The problem is to find transhipment technologies allowing an economical transhipment in a short time.

Short distance shuttle

A special solution for a very economical rail transport described and calculated as a model case is a shuttle on 2-300km distance between seaports and main terminals. Such a shuttle can run in one night in both directions. Within the train costs can be reduced.

- Small terminals

For most new forms today's terminals with gantry cranes or rubber tired cranes, special terminal personal and a great area needed are too expensive. So new forms are searched.

On the one side more automatic handling for personal cost reductions is an answer. Within can be fulfilled the important requirement for loner opening hours of the terminal, a typical obstacle of today.

Especially for working under catenary -a requirement for liner train stops- there is needed a economic system of horizontal transshipment, who tranship the ITU's vertically only out of the twistlocks on trucks and rail-wagons. In a European project named INHOTRA such horizontal transshipment machines are in construction. A Swiss prototype was tested in Dietikon in the field of the IDIOMA project.

A further important requirement is a high degree of automatic handling. Automatic handling allows a fast handling with more than one machine on liner train terminals on the one side and a handling with not specialised personal at liner train terminal as well as at small terminals. Within an important cost element at small terminals can be eliminated or minimised.

- Small containers

A main objective is the standardisation of a small container family. In COST 339 will be designed such a family viewed on different aspects.

- With a bottom-up methodology was developed the requirements on the view of loading size (Pallets and useful loading volume and weight).
- With a top-down methodology was developed the design on the view of existing ITU standards and transport vehicles on road and rail.

The result is a proposal of a 1/4 and 1/2 Class C swap body of 7.45m length. Those boxes can be loaded with 4 or 9 pallets. Some special requirements are described and fixed:

- Boxes can be loaded on wagons and trucks normally used for containers and swap bodies
- Transshipment with cranes (corner fittings), fork lift (pockets) and on rolling floors
- 3 classes of weight
- Need of a standardised IT technology for loading survey and pool administration
- Most of existing air pallets and boxes can be transported on the landside directly in those small containers to the consignees.

1/4 box with surface of 1.80 x 2.55m can be transported with vans (b.e. in city logistic) as well as in a new created high speed freight trains with closed wagons (2nd use of old TGV trains).

The proposal of a standardisation will be ready in summer 2001. After the COST works there must done some detailed studies in the frame of the European R&D program as preliminary works of a European standardisation in the field of CEN.

- **Economical Improvement**

Today's organisation needs a lot of co-ordination works. When an organisation is responsible for the whole transport chain co-ordination is less expensive. Further the transport quality and transport time can be reduced, so customers are willing to pay more for money.

A clear responsibility on one hand is the key for a better use of trucks in the pre and post haulage. When trucks can be used for delivery of 6-8 ITU's per day on short distance instead of 2-4 ITU's on longer distances costs for pre- and post haulage can be reduced. Because pre- and post haulage share is about 40% of total transport costs, a better organisation is very important for a more economical intermodal transport.

New operation forms costs in generally more than the shuttle trains on long distances. So in general a cost reduction of rail operation is required. Today's terminals don't allow a direct access of trains following missing catenary and mostly too short tracks (At Zürich shuttle trains coming from Antwerpen and Rotterdam must be divided in three parts). So shunting costs

makes transport more expensive. For all forms of trains a direct access of the complete train is an economical win situation.

Further overnight shuttle trains stays the whole day in terminals and uses tracks. New forms like liner trains has a reduced average speed but rolls during more time (day and night or over night shuttles will be used as liner trains during the day. New forms are attractive because the wagons can be used for more kilometres par day.

With small containers intermodal transport becomes a better market share in the field of LCL sizes with a higher price level than full loading on long distances.

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