DIOMIS

Benchmarking Intermodal Rail Transport in the United States and Europe

Developing Infrastructure & Operating Models for Intermodal Shift

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CONTENTS

1. OBJECTIVES OF THE SURVEY

Combined or intermodal rail/road transport[1] is one of the most remarkable success stories of European post-war logistics. Within 40 years, starting up at the end of the 1960s, the intermodal stakeholders achieved to create a logistic business in its own right. Based on a series of technological innovations, numerous commercial and operational improvements and the continuous enlargement of the network of domestic and international services, the stakeholders won the recognition of shippers, forwarding agents and shipping lines throughout Europe.

Also the prospects for the European intermodal industry are excellent. Notwithstanding the current global economic crisis, intermodal service providers are likely to move about 268 million tonnes of goods by 2015, which is more than twice the 2005 volumes. The report Agenda 2015 for Combined Transport in Europe[2] presented by the UIC in January 2008 highlights this growth potential. At the same time it addresses the challenges of the intermodal industry . This particularly concerns the question of how intermodal freight traffic can grow against an increasingly congested European rail network. And secondly, in order to seize the opportunity that more and more shippers and logistic service providers are set to shifting cargo off the road, the key intermodal actors are called upon for substantially upgrading the performance and efficiency of services, inaugurating advanced supply chain solutions, and innovating in terms of technology and operations.

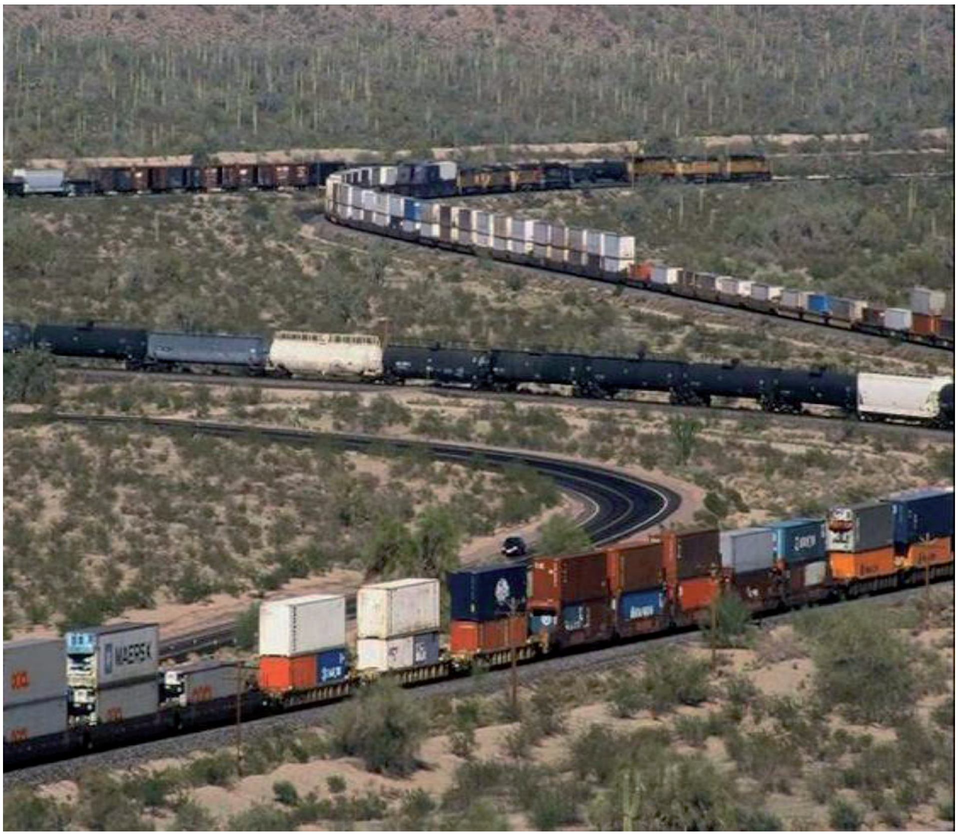
During the DIOMIS study, it became clear that many intermodal stakeholders, both on the supply and demand side, have developed intelligent instruments to enhance services or cope with infrastructure constraints. What was missing was a dissemination policy of such best practices. The UIC has started to bridge this gap by elaborating good practice manuals addressing various areas of the intermodal process chain[2].

1. We're using combined transport and intermodal transport as synonyms.
2. Available at www.uic.org/diomis.

This report is based on that very philosophy. The question it aims to answer is: What can be learned from the American intermodal industry? How does intermodal transportation in the United States and Europe compare? Though the geographic focus of this survey was the U.S. it also took account of some aspects of the intermodal industry in Canada, which, as a matter of fact, are closely interrelated as concerns services, operations and infrastructure. Thus some parts of this report exceed the U.S. scope and cover North America.

Another reason for this survey is the misunderstanding in Europe about the intermodal industry in America and how both systems work. Whilst some aspects may be transferred across the Atlantic others can't, but their differences need to be understood.

So this report, provides a precise description of the U.S. intermodal rail transportation industry, but also compares it with the European business in order to reveal best practices with benchmarking potential. In this respect it highlights practices and technologies that could be transferred or adopted by European intermodal actors, and points out to common challenges.



Source: AAR

2. THE INTERMODAL TRANSPORT INDUSTRY IN THE UNITED STATES

In the United States – like in Europe – intermodal transportation has been the fastest growing rail freight market segment for the last two decades. In 2003, intermodal services in the U.S. even became the top selling freight segment in terms of revenue and thus exceeded coal as the main commodity for the first time ever. This fact unmistakably reflects the role rail plays in the U.S. – like in virtually every industrial economy - in coping with the general growth of cargo flows and the increased volume of foreign trade and global container movements. In America the outstanding evolution of intermodal services has been closely connected with the deregulation of the railway industry in the 1980's, which freed the sector from the ties of state price control and other regulatory measures, and insuflated some dynamics in rail freight services in general.

Against this background the organization and performance of the U.S. intermodal industry can be much better understood if set in the current context of the overall railway industry and the impacts of deregulation almost thirty years ago.

Source: UP

3. THE FREIGHT RAILWAY INDUSTRY IN THE UNITED STATES

3.1 - Evolution of U.S. freight railway industry since the deregulation

The development of the U.S. and European rail freight traffic after the 2nd World War bears a great resemblance even though the underlying railway systems differed significantly. European railways were not only owned by national states but also managed as an administration rather than a company, and operated both passenger and freight traffic as well as the rail network in a fully integrated organization. In contrast to that, all major U.S. railways were privately owned and managed companies usually completely dedicated to rail freight services. They were - and still are – integrated companies as concerns the property of the rail line infrastructure and other related facilities such as marshalling yards or terminals.

In the United States –like in Europe - the importance of rail freight traffic rapidly declined after the War. According to the *Federal Railroad Administration (FRA)*, a division of the U.S. Department of Transportation, from 1950 to 1980 rail's market share dropped by 33 per cent from 56.1 to 37.5 per cent. The economic conditions of the entire freight railway industry increasingly deteriorated so that, by the 1970s, it was close to collapse. Since revenues were not appropriate railways were not able to maintain their networks appropriately. According to the *Association of American Railroads (AAR)*, in the mid-1970s, more than 47,000 miles of rail lines had to be operated below normal speed limit for safety reasons. To compare: today the total U.S. freight line network comprises about 140,000 miles of line, of which 95,000 are operated by the seven major Class I railways, defined by an operating revenue of $359.6 million or more.

The severe competition from road transport operators - or motor carriers, as they are called in America – contributed to this dramatic situation. But what was recognized by both the rail industry itself and the U.S. federal government as the main cause for the weakness of freight railways was the regulatory framework and particularly the strict price regulation enforced by the *Interstate Commerce Commission (ICC),* the federal regulating authority. While it was primarily intended to protect shippers from excessive or discriminatory freight rates, it stifled innovation and constrained railways in supplying competitive services, produce efficiently and generate sufficient income to invest into equipment and infrastructure.

Source: UP

Free market conditions for freight railways were considered key to improve their competitiveness. This required for replacing – or, rather eliminating – the Interstate Commerce Act from 1887, on which the U.S. federal regulation of railways had been based for almost a century. The Railroad Revitalization and Regulatory Reform Act established in 1976 created more or less the guidelines of deregulation.

The real break-through, however, came when the U.S. Congress passed the *Staggers Rail Act* in October 1980. This law named after the Chairman of the responsible Committee, brought about major changes some of which are detailed hereunder:

- Generally, the authority of the regulator ICC, which was replaced by the *Surface Transportation Board (STB)* in 1996, was substantially curtailed and limited to categories of traffic or commodities where competition is not effective.
- Railways were permitted to charge any rate for a rail freight service according to market needs or opportunities unless the ICC decided that there was no effective competition on this specific market. They were also allowed to charge different rates to customers and conclude confidential contracts, which must not be reviewed by the ICC.

- Railways were permitted to determine for themselves, which routing of a rail shipment is the most efficient.
- The procedure for selling rail lines e.g. to a short line i.e. regional railway was considerably facilitated.
- The ICC was authorized to exempt categories of traffic from regulation completely if it were not held necessary to prevent abuse of rail's market power. On this basis, all intermodal traffic was exempted in the early 1980s.

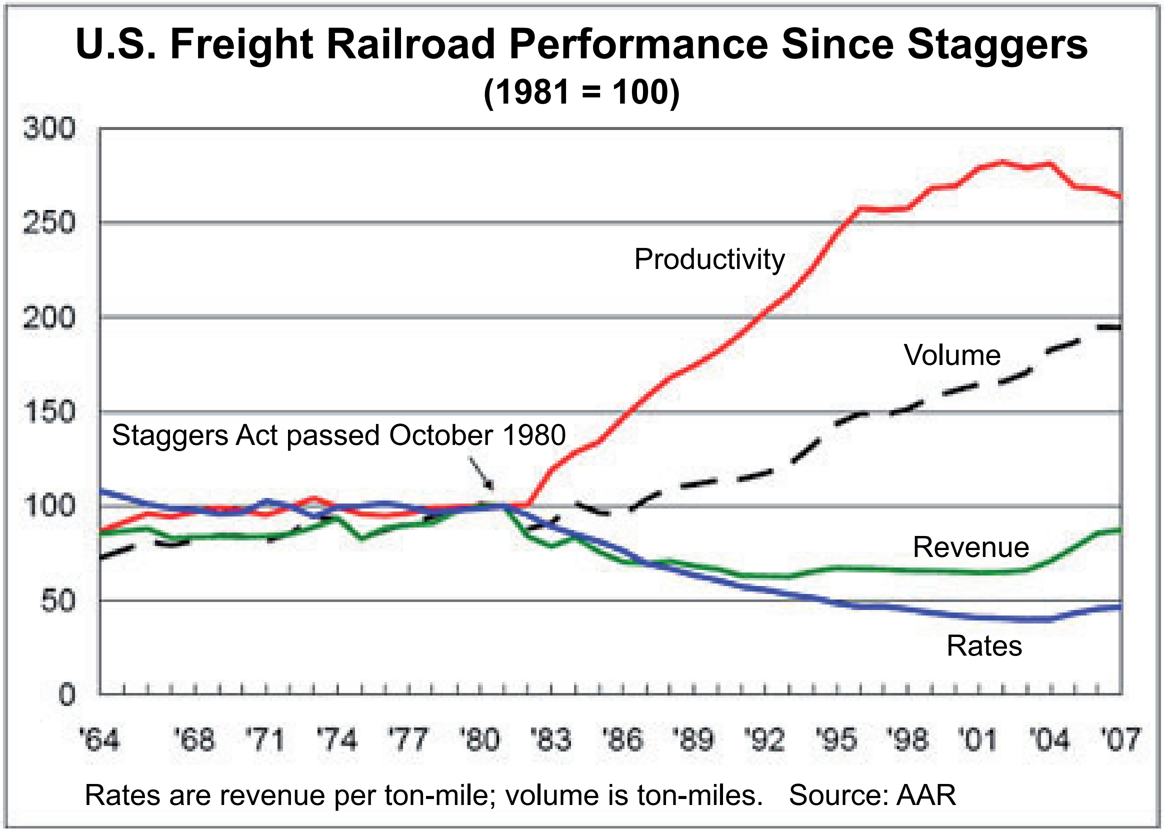
In the United States the deregulation of the freight railways under the *Staggers Rail Act* is widely regarded as a big success. The rail industry therefore is proud to quote a World Bank expert as follows: "Because of a market-based approach involving minimal government intervention, today's U.S. freight railroad add up to a network that, comparing the total cost to shippers and taxpayers, gives the world's most effective rail freight service" [3].

As a matter of fact, the impact of deregulation on the performance of rail freight traffic is spectacular. Due to an increased flexibility and economic freedom freight railways were able to design services more to customer needs, quote market-based freight rates and deal with their infrastructure as required. As a result, the total volume measured in revenue ton-miles doubled in the post-Staggers era until 2007 (see also ***Figure 1*** overleaf). The market share of rail rose again and, according to the *FRA*, has reached some 41 per cent today.

Even more remarkable is that freight railways enhanced their productivity by more than 160 per cent during that period. This result has been attained through numerous mergers especially among the Class I railways, the more efficient employment of equipment, staff, and facilities, and the sale or abandonment of poorly used lines. Further productivity gains have been achieved by the modernization of equipment e.g. locomotives and wagons, and infrastructure. Thanks to an improved profitability railways invested into infrastructure and equipment a total of approximately $420 billion from 1980 to 2007. The investments into the upgrading and enlargement of rail lines permitted to run longer and heavier trains, increased the velocity of trains and thus accelerated the roundtrip time of rolling stock. Too, they prepared the way to deploy innovative and highly efficient technologies such as the double-stack container transport.

3 AAR: The Staggers Act: Balanced regulation That Works. January 2009.

Figure 1. U.S. freight railways: evolution of key performance indicators



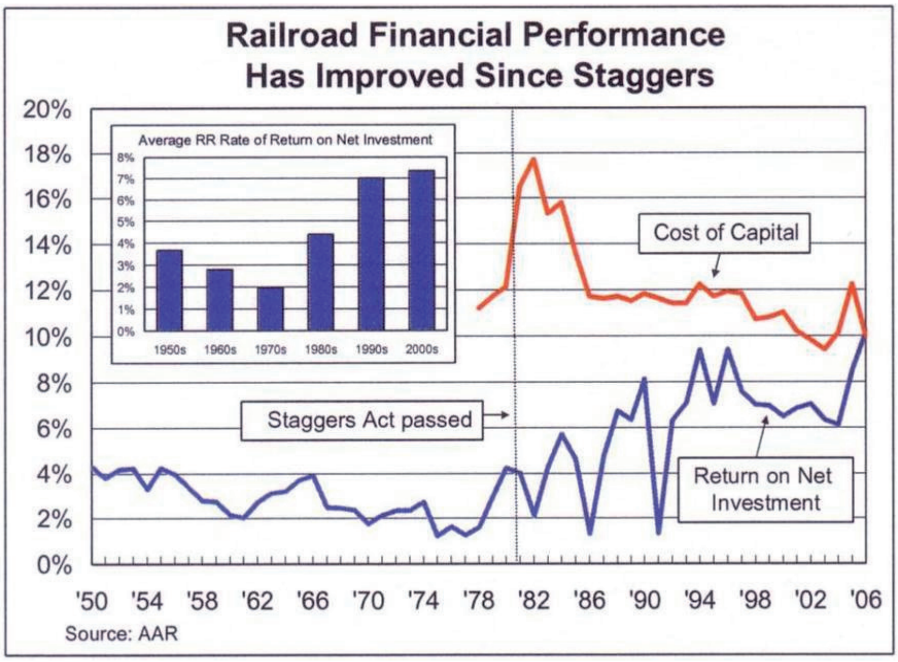
Source: Association of American Railroads (AAR)

The increase of productivity has also led to a much more efficient use of infrastructure. According to the *AAR* statistics, in 2007, freight railways carried three times more cargo measured in ton-miles per mile of track than in the year 1980. The *FRA* has put this development as follows: "Railroad productivity has increased substantially as more freight is moved over a smaller network with a smaller workforce."

There is consensus among all experts that the American economy has benefited most from the deregulation of the freight railway industry. Since the *Staggers Rail Act* freight rates have plummeted more than 50 per cent, adjusted for inflation, saving rail customers several billion dollars of logistic cost annually. On the other hand, this means that, due to the competitive environment, railways had to pass on the largest part of their productivity increase - U.S. rail experts like *C. Martland* estimated that about 80 per cent of all savings went into freight rate reductions – and could not use it completely for improving their profitability.

In spite of that the financial situation of the freight railway industry appears to be much healthier than 30 years ago. Railways have raised the rate of return and, in 2006, for the first time, earned enough to cover the cost of capital (see ***Figure 2***). Other positive indicators are that in recent years the prices for U.S. railways stocks soared, and Warren Buffet, the legendary entrepreneur, purchased a substantial percentage of BNSF Railway Company shares.

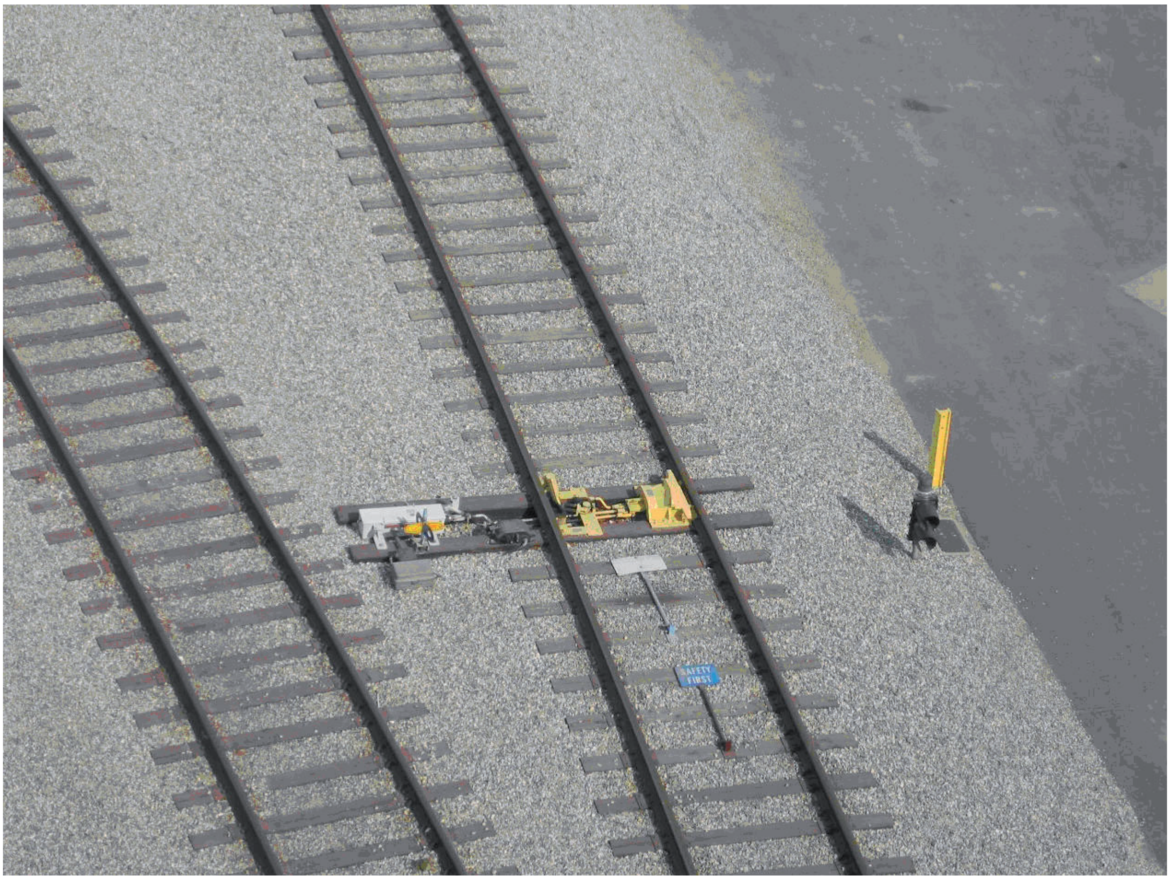
Figure 2. U.S. freight railways: evolution of financial performance



Source: Association of American Railroads (AAR)

Deregulation also generated substantial social benefits. Through various measures freight railways have accomplished to use fuel much more efficiently. According to *FRA* data, between 1990 and 2004, they raised their performance from 332 to 410 ton-miles per gallon of fuel. As a consequence, the environmental impacts especially as concerns air polluting substances have been cut back considerably.

What is of paramount importance for the American society, however, is that freight railways have tremendously improved their safety record, which, prior to 1980, was very poor. Train accident rates declined by more than 70 per cent since 1980. This was chiefly due to the enhancement of the track infrastructure, massive investments in train safety devices, and the general increase of the quality of services.



Source: KombiConsult

3.2 - The impact of deregulation on freight railway market structure

Freight railways in the United States are classified by the *Surface Transportation Board*, the federal agency responsible for regulation of the rail industry, according to revenues. For 2007 the revenue thresholds, which are adjusted annually, were determined as follows:

- Class I: ≥ \$359.6 million (€ 77m)
- Class II: ≥ \$28.8 (€ 22m) - \$359.6 million
- Class III: < \$28.8 million

The deregulation under the *Staggers Rail Act* has restored the competitiveness and viability of rail freight services and strengthened the whole industry. This process, however, has fundamentally changed the market structure. Today, there are only seven Class I railways in contrast to about 40 in 1980. Even if the regularly upward adjustment of the revenue threshold might somewhat distort the ratio it clearly demonstrates the enormous consolidation of this industry, which saw numerous mergers in the last 25 years. ***Figure 3*** is intended to give an impression of how the current Class I railways – Burlington Northern Santa Fe (BNSF), Canadian National (CN), Canadian Pacific (CP), CSX, Kansas City Southern (KCS), Norfolk Southern (NS) and Union Pacific (UP) - emerged through the stages of consolidation.

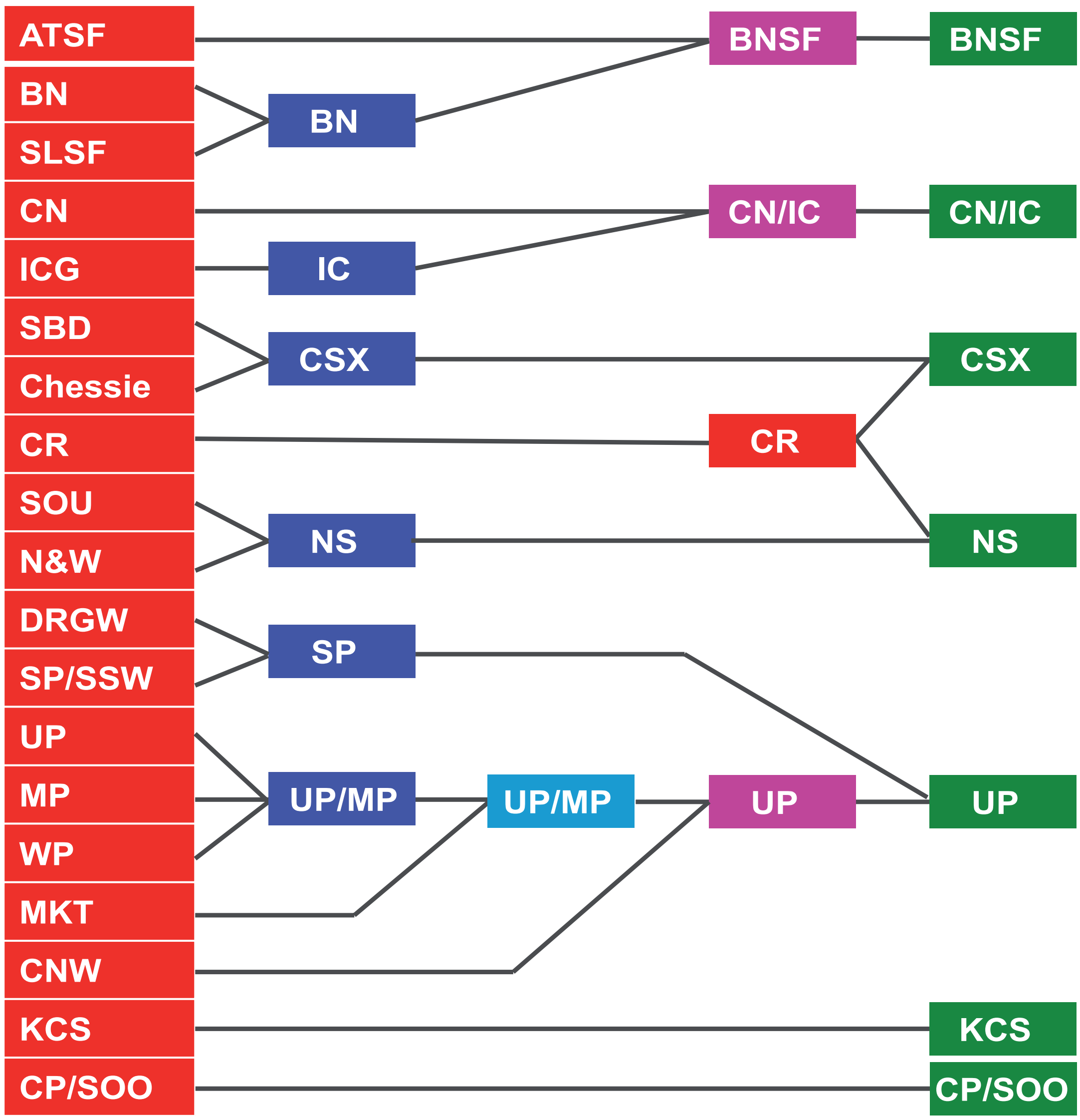
The consolidation process has clearly polarized the U.S. freight railway industry into “big” and “small” companies and correspondingly led to a new division of work. After every merger the surviving Class I railway company not only had more equipment, more staff and traffic volume than before but enlarged its network of tracks as well. Thus the railways, which, prior to 1980, mostly operated on a geographically limited scope, transformed into large networks. Even if currently no railway owns a really nationwide trackage each of the big four BNSF, UP, CSX and NS provides for a network that serves US economic and population mega-regions. With the Mississippi river roughly as the dividing line, BNSF and UP dominate the western part of the United States while the CSX and NS networks mainly serve the densely populated East (see ***Figure 4***).

As a result, the seven Class I railways now own a rail network of 94,313 miles (150,000 km) corresponding to 67 per cent of the total of 140,134 miles, in 2007. They move about 95 per cent of all cargo in terms of revenue, of which the big four account for approximately 90 per cent (see for more data chapter 2.1.3). Class I railways mainly operate long-distance interstate services across the U.S. and eventually cross-border traffic with Canada and Mexico.

For the year 2007, the *AAR* statistics recorded 33 Class II and 523 Class III freight railways. In many cases they have acquired trackage from Class I railways, which the latter found they could not operate efficiently. The Class II railways also referred to as regional railways own a total of approximately 17,000 miles of rail lines. Typically, they provide services on a regional level in economic centres or between neighbouring U.S. states. In 2007, each company generated average revenues of $55 million (€ 40m). Class III companies are small “short line” railways. Usually they own branch lines with one track averaging to 55 miles (90 km) in length. In total they account for almost 29,000 miles of tracks. Class III railways chiefly serve local customers and earn mean revenues of $4 million (€ 3m).

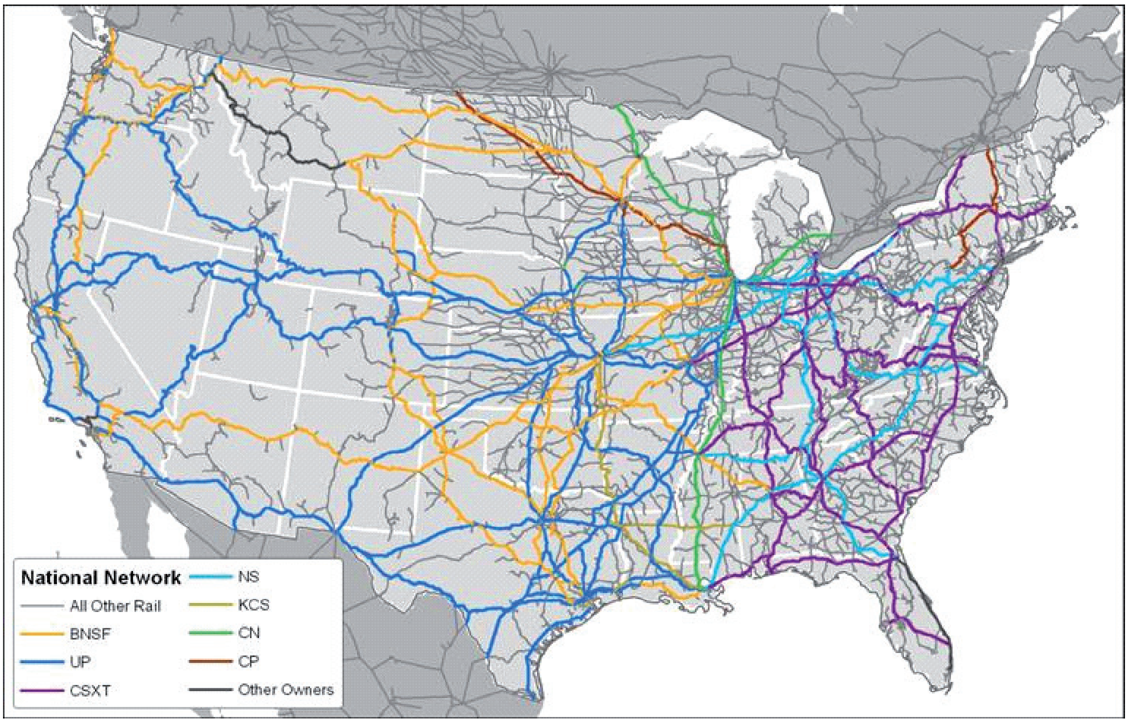
Even if both categories of railways are used to operating in a limited geographical area they may also feed volumes into the Class I railway systems and interchange trains with them. In this respect they're involved in intermodal services as well. Based on *Railinc's* short line statistics we estimate that they move 400,000 to 500,000 containers and semi-trailers annually.

Figure 3. History of mergers of U.S. Class I freight railways (from left to right)



Source: Federal Railroad Administration (DOT)

Figure 4. U.S. national rail freight network and primary freight corridors



Source: AAR/Cambridge Systematics: National Rail Freight Capacity Study, 2007

As mentioned previously the consolidation of the U.S. freight rail industry has generated substantial productivity gains. So the creation of large networks enables railways managing the infrastructure much more efficiently by achieving economies of scale. The larger networks are also more economic in terms of train operation since the number of interfaces between railways have declined considerably. Long-distance trains must not be interchanged anymore or very little. This has also contributed to an enhanced quality of service. Against this background the change of the market structure can be considered both as a prerequisite for paving the way towards a stable and efficient industry and as a result of this process of transformation.

On the other hand, a recent discussion in the U.S. brought about the debate according to which oligopolization of the freight rail industry may lead railways to abuse their market power and charge “excessive” freight rates particularly to so-called “captive customers”. These are shippers that have no choice than using rail as means of transport or are dependent on the service of a single railway. This particularly applies to the transport of bulk commodities and manufacturers located in more rural areas endowed with a minimum of infrastructure.

There are political and economic groups that call for a re-regulation of the freight railway industry. It is heavily opposed by the railways and their supporters who emphasize that the **overall** price level for rail freight services has been halved in the post-Staggers era much in favour of rail customers, and the most recent slight rate increase was mainly due to the rise in diesel fuel prices. The railways have also brought strong evidence that the profitability of the rail industry is still below the U.S. average. This fact has been confirmed by the STB, which also stated that it has not recognized an excessive pricing behaviour. Ultimately, the current regulatory framework allows the STB to determine maximum rates if a railway were regarded to abuse its market power.

It is certainly not possible, from a European standpoint, to assess whether this evidence is suitable for rebuking suggestions and allegations concerning a "discriminatory" pricing or if the increasingly limited intra-modal competition of the railway industry is prone to justify them quasi *ex post*. But since we can already observe a trend of consolidation in the European rail freight business, which is not contradictory with the ongoing emergence of new entrants, it will be a matter of particular interest if and how the new Obama administration will deal with this issue.

Source: AAR

3.3 - The performance of Class I freight railways

The Class I category of freight railways includes five U.S. national companies as well as Canadian National and Canadian Pacific, which are headquartered in Canada but operate tracks and freight services in the north of the United States. The Class I railways account for the overwhelming majority of U.S. rail freight transportation in every respect: infrastructure, volume, and revenues. Some key figures are presented in ***Figure 5*** (see overleaf).

Figure 5. U.S. Class I railways: key figures

Class I Railway	Operating revenue ($ billions)	Expense-revenue ratio (%)	Traffic performance (bn ton-miles)	Network (road) owned (miles)	Staff (n°)
Union Pacific Railroad Co.	16.249	80.5%	562	26,687	53,130
BNSF Railway Co.	15.909	78.6%	655	23,228	41,181
Norfolk Southern Railway	9.432	74.8%	196	16,320	30,334
CSX Transportation	9.039	81.4%	247	17,351	31,157
Grand Trunk Corp. (Canadian National)	2.258	63.3%	55	6,282	5,878
Kansas City Southern Railway Co.	0.926	83.2%	30	2,664	2,955
Soo Line Railroad Co. (Canadian Pacific)	0.786	70.6%	25	1,580	2,581

Source: AAR: Railroad Facts 2008

Altogether, the Class I railways owned a rail network of 94,440 miles in length. This is what is called "*miles of road"* in the U.S. railway industry. This figure excludes yard tracks and sidings, nor does it reflect whether a mile of road includes two or more parallel tracks. These features, however, are taken into account in the measure "*miles of track"*. Based on that Class I railways owned 161,114 miles of track in 2007.

In the same year, the railways had a volume of traffic of 1,770 billion ton-miles corresponding to 2,600 billion tonne-kilometres in metric measures [4]. Their total operating revenue increased to an all-time high of $54.6 billion (€42bn) compared to $52.2bn in the previous year.

Union Pacific and BNSF which own the large rail networks in western U.S. are the biggest railways. This is mainly due to the fact that they perform the particularly long hauls between the west coast and the strong economic regions in the centre such as Chicago or Dallas. On these corridors they can benefit from train payload and length parameters, which usually are higher than in the east (see also ***Figure 6***). In addition they carry enormous amounts of coal.

Though Norfolk Southern is serving the U.S. east of the Mississippi, what entails comparatively shorter transport distances and on average smaller train parameters, it appears to be operating the most efficiently – apart from the two Canadian-based railways.

4. American tons are short tons. 1 short ton = 0.90718 metric tons.

As a matter of fact, among the U.S. domestic companies NS achieved the lowest operating ratio measuring the relationship between operational costs and revenues in the year 2007.

Figure 6. U.S. Class I railways: performance indicators of freight traffic according to geographical criteria 2007

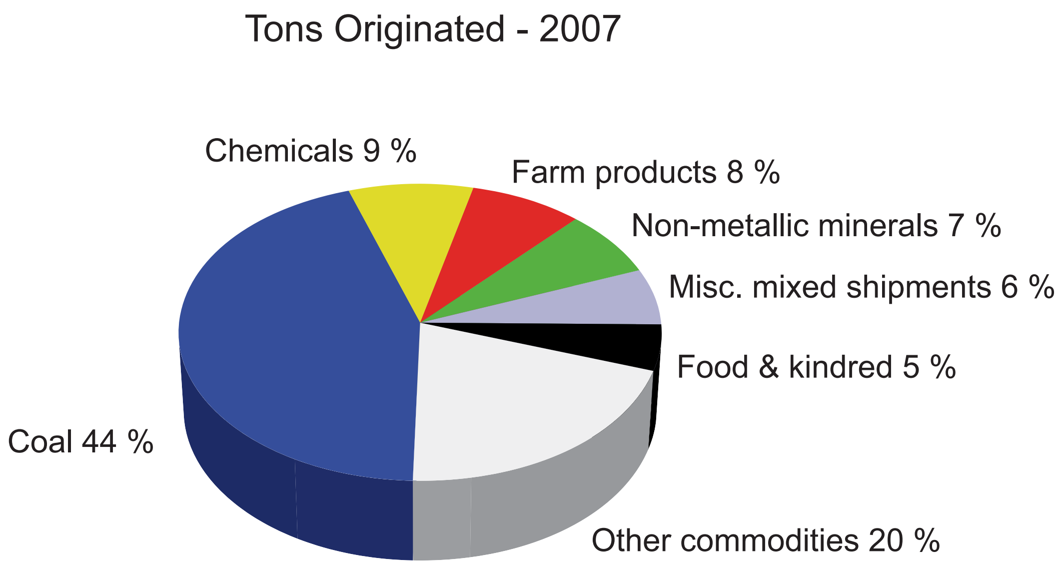
	East	West	U.S.
Tons originated (millions)	837.4	1,102.4	1,939.8
Revenues ton-miles (billions)	498.1	1,272.4	1,770.5
Freight train-miles (millions)	190.8	532.7	543.5
∅ wagons per train	60.5	75.6	70.3

Source: AAR: Railroad Facts 2008

Figure 7 (see overleaf) clearly shows that coal continues to be the dominant commodity for U.S. railways. With a volume of 850 million tons it accounts for about 44 per cent of the entire tonnage shipped in 2007. Coal, however, has a much lesser weight as concerns its contribution to the Class I railways' earnings. This commodity generated only 22.7 per cent ($11.5bn) of the total gross revenues of $50.6bn.

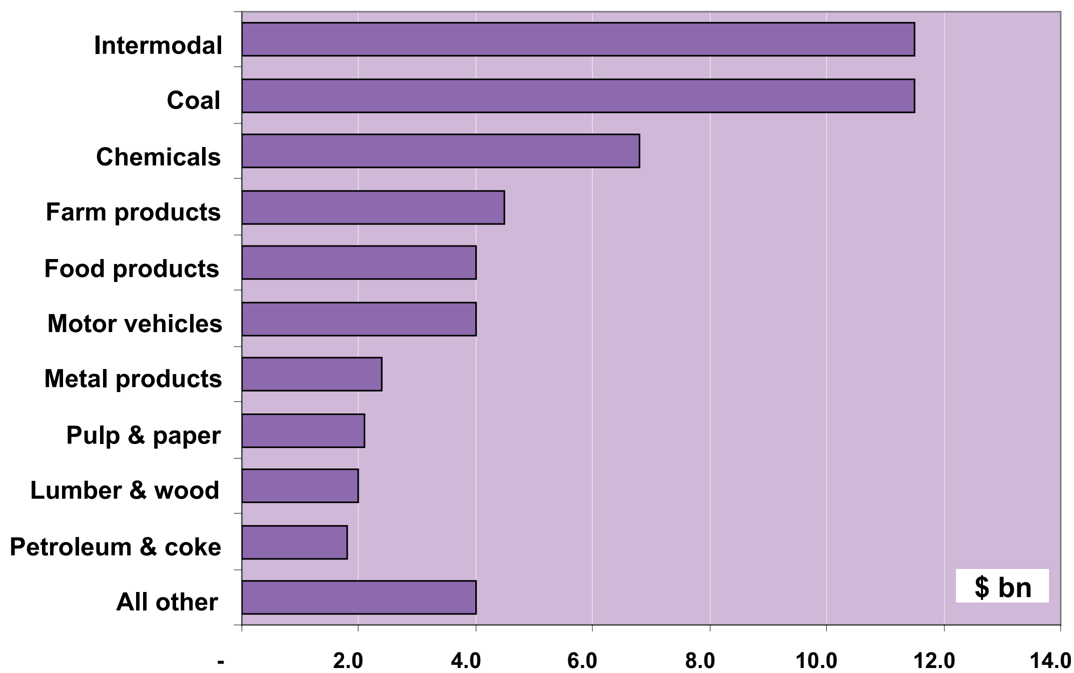
This is quite in contrast to intermodal traffic. In 2007, intermodal services had a share of just under 10 per cent of the total tonnage (see chapter 2.2) yet generated slightly more revenue than coal (see also ***Figure 8*** overleaf). After 2003, for the first time in U.S. freight railway history, intermodal traffic outperformed coal it was the fifth year in a row that it was the primary source of revenue for railways. According to preliminary data this won't be the case in 2008. Owing to the increased demand for energy and, at the same time, the slump in global container traffic, Class I railways are likely to have generated more dollars from coal than intermodal transport.

Figure 7. U.S. Class I railways: traffic volume by commodity group 2007



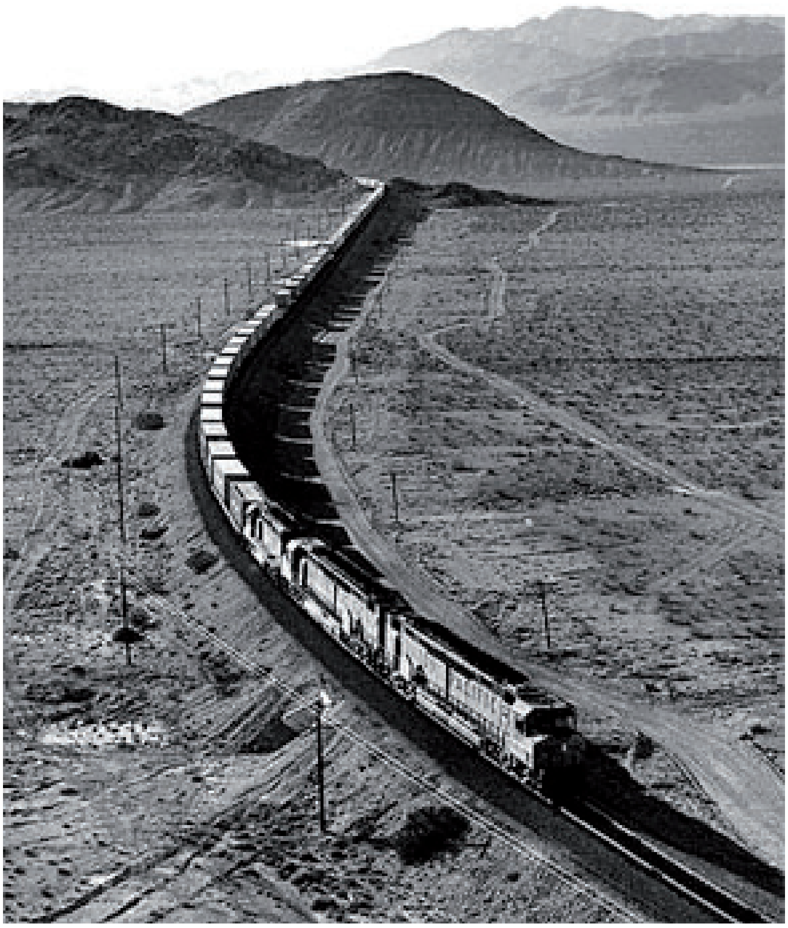
Source: AAR: Railroad Facts 2008

Figure 8. U.S. Class I railways: gross revenue by type of freight 2007



Source: AAR

But even if intermodal has caught up with coal in terms of revenue and left behind other typical rail-based cargoes such as chemical and farm products the railways are of the view that these commodities, especially coal, continue to be the bread-and-butter of freight with respect to profitability. But railways also emphasized that in the last decade they were successful in enhancing intermodal traffic economically to an extent that this market segment is becoming an increasingly important generator of returns.



Source: BNSF

4. INTERMODAL TRAFFIC VOLUME

4.1 - Intermodal market segments and technologies in North America

The freight railways in North America as suppliers of intermodal services distinguish two market segments:

- International traffic is the intermodal transport of sea-borne freight containers – mostly ISO containers - between American sea ports and inland areas. This is what, in Europe, is known as container hinterland transport.
- Domestic traffic is the intermodal transport of commodities with origin and destination in North America. This is what, in Europe, is called continental traffic. For shipping cargo railways and their customers employ domestic containers, liftable trailers (semi-trailers), and - to a small extent – RoadRailers®. Like in Europe, domestic equipment is designed to compete with road freight traffic as concerns weights and dimensions.

The North American intermodal industry has been employing two transport technologies, which both imply the vertical transhipment of the intermodal equipment:

- Container on Flatcar (COFC): This is the transportation of both marine (ISO) and domestic containers on a flat car, which is a container wagon in European terminology. American railways emphasize that the COFC movement is made without the container being mounted on a chassis (see ***Figure 9***).
- Trailer on Flatcar (TOFC): This is the movement of a semi-trailer or a container mounted on a chassis on a special flat car. This technology is also known as piggyback transport (see ***Figure 10***).

Additionally, the RoadRailer® technology is being employed. It is a horizontal loading system of special trailers mounted on rail bogies. Though tested by various railways this technology has only become successful with Norfolk Southern that, in mid-1980s, has spun it off as a separate business area in the subsidiary Triple Crown Services (see ***Figure 11***).

Figure 9. U.S. intermodal technology: container on flatcar

Source: KombiConsult

Figure 10. U.S. intermodal technology: trailer on flatcar

Source: BNSF

Figure 11. U.S. intermodal technology: RoadRailer

Source: NS

4.2 - Intermodal traffic volume 2007

There are two sources of information on the North American intermodal industry. The *American Association of Railroads (AAR)* provides statistical data on the intermodal traffic of U.S. Class I railways performed over rail networks in the United States. The *Intermodal Association of North America (IANA)* compiles data on a wider scope than the *AAR*. It takes account of the entire traffic of the two Canadian freight railways thus including also the traffic not affecting the U.S. On the other hand, it appears that Kansas City Southern which carried more than half a million of intermodal units in 2007, does not participate in the *IANA* analysis. Apart from the different scope the *AAR* and *IANA* databases are also not completely harmonized as concerns the categorization of traffic (see more in chapter 2.x Equipment). Both of them, however, use the measure "loading" or "load" to record intermodal traffic. A loading corresponds to one piece or unit of intermodal equipment moved by rail.

According to *IANA's Intermodal Market Trends & Statistics Report*, in 2007, freight railways shipped 14,078,952 intermodal loadings in North America, down 1.1 per cent from the 2006 all-time high of 14,234,074 loadings. International traffic of marine containers represented 59.2 per cent of total volume, 40.8 per cent were domestic shipments (see ***Figure 12***). Based on *IANA's* detailed quarterly analysis of the intermodal industry we were able to estimate the traffic volume measured in TEU. This exercise shows that domestic and international traffic contributed to total 2007 traffic of about 28.7 million TEU almost in equal parts.

In 2007, intermodal traffic in the United States totalled 12,026,660 loadings corresponding to 24.7 million TEU, based on our calculations. The *AAR* reported that the volume had decreased by 2.1 per cent from the record year 2006 when the U.S. Class I freight railways moved 12,282,221 units. Based on the analysis of *IANA* and *AAR* statistical data we estimate that, in 2007, international container traffic accounted for approximately 57 per cent and domestic shipments for 43 per cent.

The U.S. intermodal industry doesn't publish its consolidated tonnage. According to *AAR* specifications, the commodity group "miscellaneous mixed shipments" accounting for 125 million tons (see ***Figure 7***) is almost completely intermodal volume. About one third of intermodal tonnage, however, has been allocated to other commodity groups. If both sources were consolidated the volume of goods moved on intermodal services in 2007 would amount to some 180 million short tons (163 million metric tons).

Figure 12. Intermodal traffic in North America by market segments: 2007

Market segment		Traffic volume	
		Loadings	TEU
Domestic	Containers	3,598,006	4,600,000
	Trailers	2,145,466	9,800,000
	Subtotal	5,743,472	14,400,000
International	Containers	8,335,480	14,300,000
Total intermodal		14,078,952	28,700,000

Source: IANA, KombiConsult calculations

If we applied the European convention to report the gross tonnage in rail freight transportation including both the weight of the goods carried and the tare weight of the equipment employed, and assume an average tare weight of 3.5 metric tonnes per piece of intermodal equipment, intermodal traffic in the U.S. would account for a gross weight of 205 million metric tons. This gives an average gross weight of 17 tonnes per intermodal loading and 8.3 tonnes per TEU.

For many years Burlington Northern Santa Fe (BNSF) has been the largest intermodal service provider in North America. In 2007, BNSF moved some 5 million units thus about 45 per cent more than the next big railway, the Union Pacific (UP). It should be observed that ***Figure 13*** (see overleaf) presents the individual volumes of railways. Due to a certain extent of interchange traffic they contain double counts, which *AAR* and *IANA* are keen to eliminate for their consolidated statistics. International traffic is predominating intermodal volumes with all railways. This also applies to Kansas City Southern (KCS) and Norfolk Southern (NS), for which detailed data were not available.

Figure 13. Intermodal traffic of major North American railways: 2007

Railway	Intermodal traffic			Intermodal as percentage of freight revenues
	Total loadings	Domestic	International	
BNSF	5,065,005	45%	55%	33%
CN	1,324,000	48%	52%	19%
CP	1,238,000	41%	59%	29%
CSX	2,111,000	46%	54%	14%
KCS	526,370	-	-	8%
NS	3,013,426	-	-	21%
UP	3,453,000	35%	65%	19%

Source: Railway websites, KombiConsult calculations

BNSF also is the market leader in North America when it comes to how much intermodal traffic is contributing to rail freight activities. Most strikingly, intermodal services have generated one third of all freight revenues of the company in the year 2007. Intermodal traffic has a similarly strong performance with Canadian Pacific (CP) where this market segment has a share of about 29 per cent of its freight turnover. Apart from and CSX and KCS all other major railways report intermodal traffic accounting for about 20 per cent of their revenues.

It would be interesting to compare these ratios with the importance intermodal transport has with European railways even though – due to different business models (see chapter 2.3) – figures would not be completely comparable. So it is known that about 50 per cent of Trenitalia's turnover originates from intermodal services while it is estimated that this industry contributes about 20 to 25 per cent to Deutsche Bahn's rail freight revenues.

Source: AAR

4.3 - Evolution of intermodal traffic volume since the 1950s

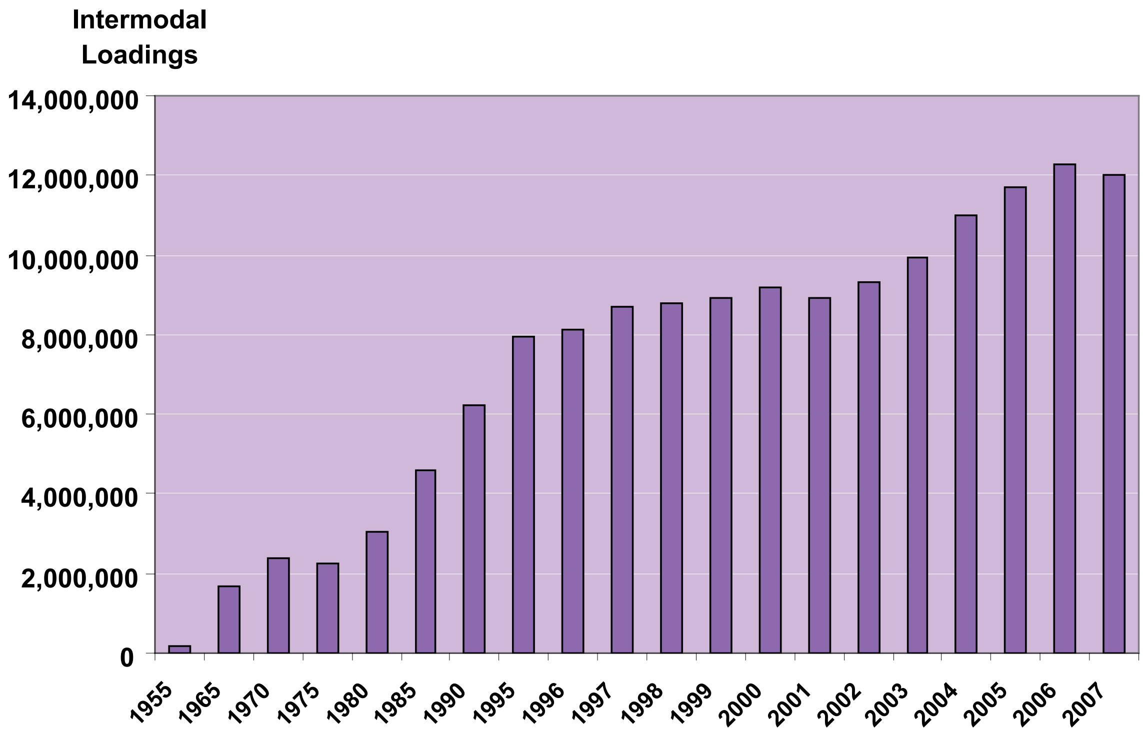
American railways registered intermodal traffic as a separate type of freight for the first time, in 1955. In that year, they shipped 168,000 units. Within 15 years, until 1970, numbers continuously climbed to reach 2.3 million loadings. The 1970s were a decade of stagnation for intermodal traffic and for the entire U.S. rail freight industry. In 1980, when the *Staggers Rail Act* was passed, U.S. railways carried just over 3 million loadings.

Deregulation clearly gave intermodal traffic a tremendous momentum. Railways took advantage of the opportunities established through the increased economic freedom and introduced service and technology innovations such as dedicated intermodal services and double-stack trains. As a result intermodal traffic skyrocketed and doubled volume by 1990. During the 1990s US freight railways raised intermodal movements by another 50 per cent until, in 2001, due to the economic downturn following the terrorist attacks, the intermodal industry saw a slight decline for the first time in 20 years. Over the whole period the development of the North American intermodal industry ran almost parallel (see ***Figures 14 & 15*** overleaf).

U.S. intermodal traffic recovered rapidly and achieved very high growth rates again since 2003. In contrast to previous periods when domestic and international traffic contributed to the increase of volumes equally or even the domestic market at higher rates, this time growth was clearly driven by the international container business. Especially the liberalization of trade for Chinese export products floated the U.S. west coast ports namely Los Angeles and Long Beach with full import and – mostly – empty export containers. As a result, the international intermodal traffic of U.S. railways soared and reached its peak in 2006.

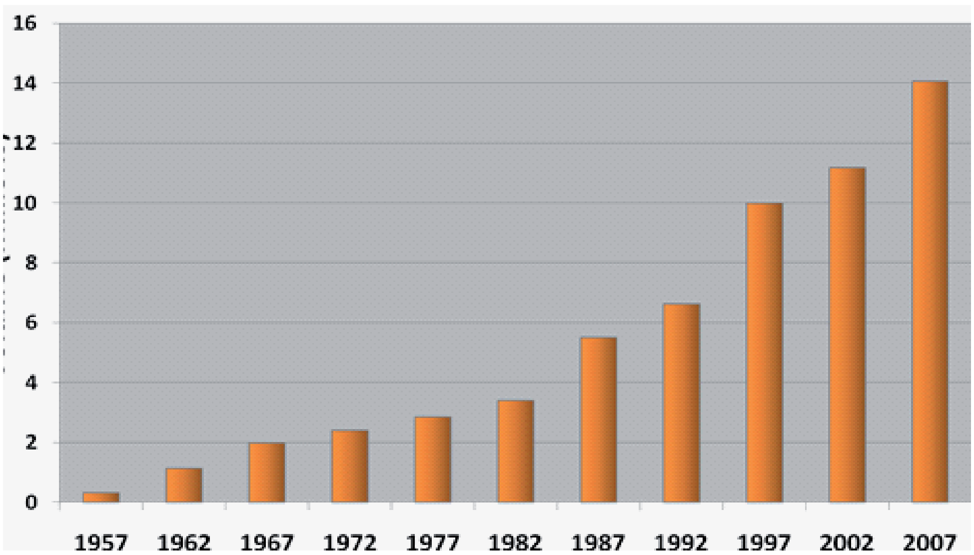
The U.S. west coast ports were among the first in the freight transport industry to receive the signals of a slowing down of the American economy. For in early autumn 2007, the container boom ebbed down and seaborne throughput fell under 2006 figures for the same period. Similarily, international intermodal traffic was hit by the decline of Far East trade exactly one year before the economic crisis reached Europe. Since volumes only dropped in the fourth quarter 2007 total intermodal traffic on an annual base decreased just slightly. The year 2008 was much worse: ISO container loadings were considerably lower than in previous years virtually over the entire year. In contrast to that, in 2008, domestic volumes surprisingly increased and partly offset the reduction from international traffic (see ***Figure 16***). Some experts believe that this was due to increased trans-loads from 40’ to 53’ equipment in consolidation centres close to ports (see for more in chapter 6.2).

Figure 14. U.S. intermodal traffic volume (in million loadings) 1955-2007



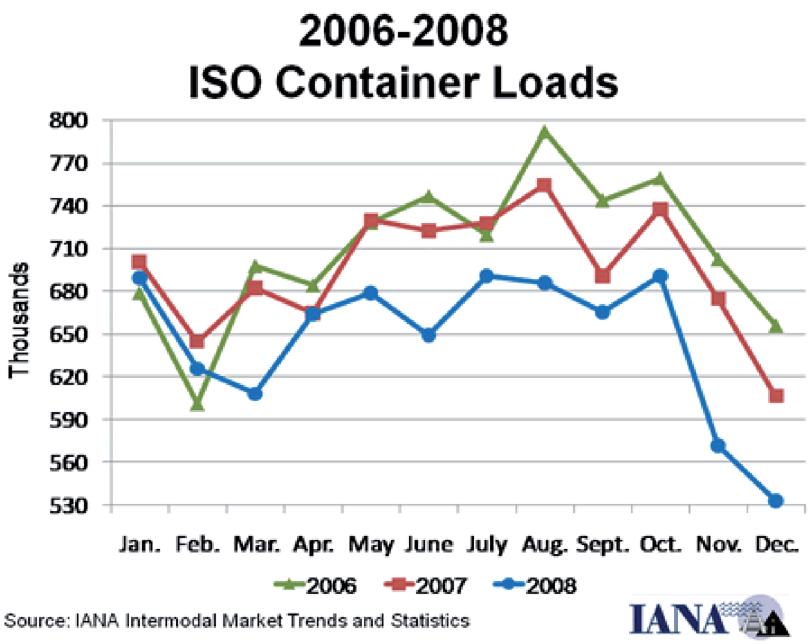
Source: AAR: Railroad Facts 2008.

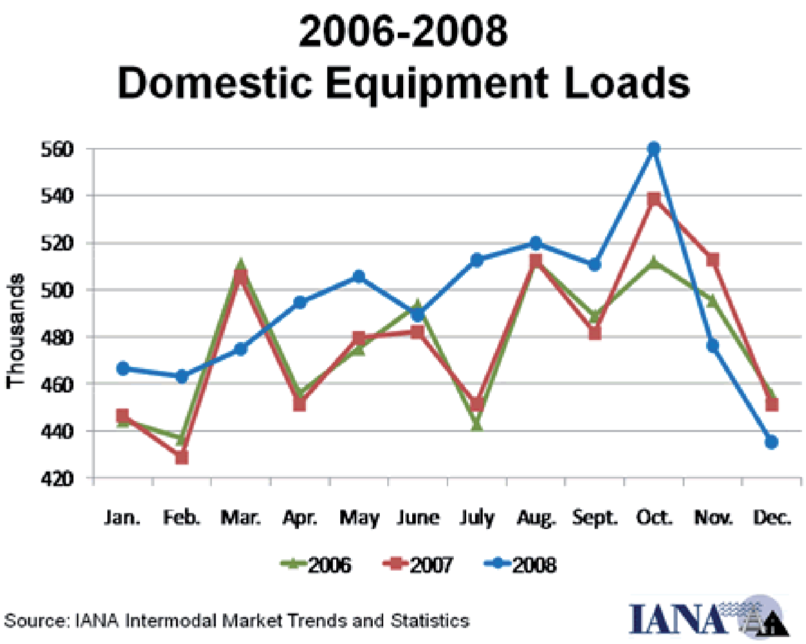
Figure 15. North American intermodal traffic volume (in million loadings) 1957-2007



Source: IANA website

Figure 16. Intermodal traffic in North America by ISO and domestic loadings: monthly figures 2006-2008





Source: IANA website

4.4 - Comparison of intermodal volume in North America and Europe 2007

In 2007, the intermodal industry in Europe achieved an all-time record when volumes rose to 17.1 million TEU.[5] Despite that, total North American intermodal traffic was almost 70 per cent and U.S. traffic about 45 per cent higher than in Europe. While, in America, the two intermodal market segments, international and domestic/continental traffic, accounted for almost the same amount of TEU, in Europe, hinterland rail transport of marine containers came off better with a share of 57 per cent (see ***Figure 17***). This is particularly owing to the different pattern of intermodal equipment employed on both sides of the Atlantic. 20' and 30' tank and bulk containers mainly carrying chemical products have a rather high percentage of European continental traffic. It is obvious that the "TEU weight" of those units is substantially smaller than the 48' and 53' domestic containers and trailers, which clearly dominate the American domestic market.

Figure 17. Intermodal traffic in North America, USA and Europe by segments: 2007

Market segment	Intermodal traffic volume (TEU)		
	North America	USA	Europe
Domestic / Continental	14,400,000	12,900,000	7,352,855
International / Container hinterland	14,300,000	11,800,000	9,759,965
Total	28,700,000	24,700,000	17,112,820

Source: IANA, AAR, UIC, KombiConsult calculations

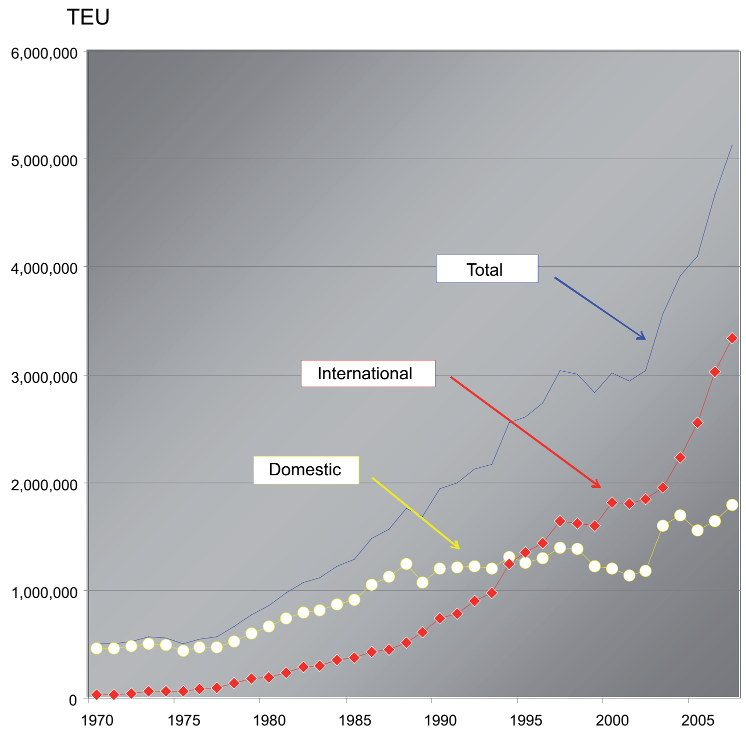
The U.S. intermodal industry also has a lead over Europe as concerns the tonnage shipped on intermodal services though the edge is distinctively smaller. According to our calculations the US Class I freight railways moved a gross weight of 205 million metric tons, in 2007. This gives an average of 17 tonnes per intermodal loading and 8.3 tonnes per TEU. In the same year European intermodal traffic amounted to 172.2 million tonnes thus 19 per cent less than in the U.S. Overall average gross weight, however, was more than 20 per cent higher and even reached 10 tonnes per TEU.

5. UIC: Report on Combined Transport in Europe 2007. Paris 2009.

First of all, this finding suggests the structure of commodities varies between both intermodal industries. In fact, U.S. railways representatives reported that both on domestic and international services the share of light-weight products is comparatively high. International traffic is dominated by full import containers from China and other eastern Asian countries carrying mostly voluminous consumer goods, and empties returning to ports. But also domestic intermodal services are often geared to customers shipping rather light-weight consumer goods, industrial products, parcels, and Less-than-Truckload (LTL) shipments. In contrast to that, the European intermodal industry can sell services especially for continental cargo on the argument that, on many corridors, it can enable increased payloads compared to road transport.

In Europe, in contrast to North America, comprehensive statistical data on intermodal traffic hadn't been recorded prior to the pioneering survey of the International Union of Railways (UIC) in 2006. Until then, although only representing approximately 35 per cent of the total intermodal traffic volume, the only reliable source of domestic and international intermodal data was provided by the UIRR (association of intermodal operators) see ***Figure 18***.

Figure 18. Intermodal traffic of UIRR member companies: 1970-2007



Source: UIRR, KombiConsult graph

Source: CN

5. BUSINESS MODELS

The business models of the North American intermodal industry differ largely, in most cases even fundamentally, from the situation in Europe. In America, the key players are the major freight railways that have shaped the intermodal business models. They feature a very straight supplier-customer relationship while, in Europe, the business models mostly reflect the fairly complex structure of intermodal actors. Here they are particularly determined through the establishment of a new category of specialized logistic service provider, the intermodal operator, which is not familiar in North America. The European intermodal operator is economically responsible for and organizing the intermodal chain of transport, develops and defines the products and determines how services are produced on rail.

In order to highlight the main differences and similarities between America and Europe, we will first describe the North American business models and then compare them with the European ones

5.1 - Intermodal business models in North America

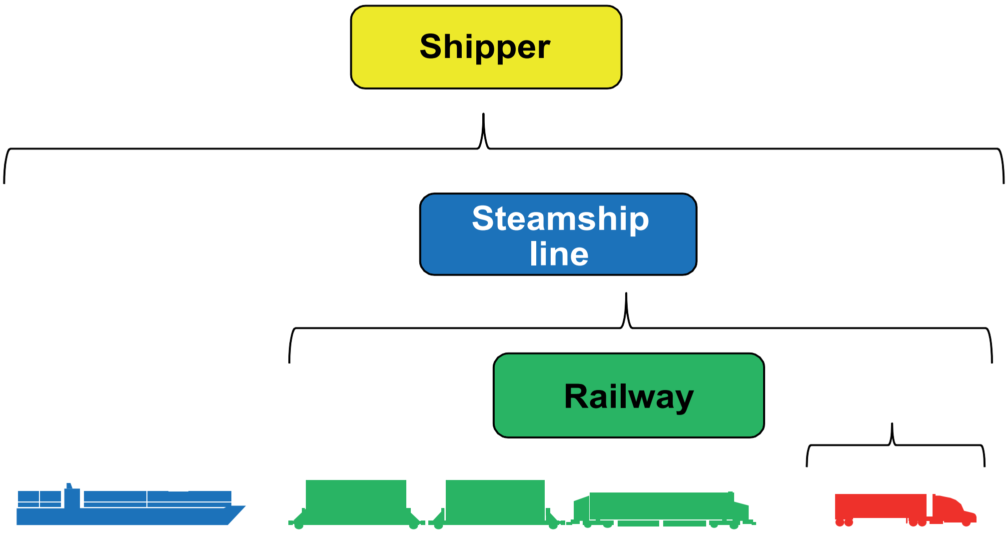
The major North American freight railways are the only ones that design, organize, sell, produce and fulfil intermodal services as a kind of one-stop shop. A prerequisite for this business model – though not necessarily its “logic” result – is full integration. The US Railways own and provide themselves for the majority of critical resources, as follows:

- Rail network. Additionally, if they seek to supply services to locations off their network they can often rely on trackage rights – the right to operate on foreign rail lines by own locos and staff – or haulage rights – the opportunity to subcontract traction service to foreign railway.
- Intermodal terminals.
- Locomotives.
- Wagons. Railways own one part of intermodal wagons required, the other part is supplied from the wagon pool of TTX, a cooperative society, collectively owned by major American railways.

Against this background, the American freight railways have developed distinguished business models for the international and the domestic intermodal traffic segments in terms of market positioning, selection of distribution channels and scope of services, which reflect the specific logistic requirements and customer structures of both markets. What is remarkable, is that all North American freight railways have adopted the same business models except for one case, which will be explained below.

The North American intermodal industry considers the **international traffic**, the transport of marine containers between ports and inland locations, as a retail business. This means that they sell these services directly and virtually only to steamship lines, which in turn organize the entire transcontinental movement of a container on behalf of a shipper. Depending on customer preference railways provide either a port-to-door or a port-to-terminal service (see ***Figure 19***). If it's a door-to-door transport including drayage, i.e. the over-the-road transport of a container between a terminal and a customer location, railways usually do not carry out this service but contract it to a motor trucking company.

Figure 19. Business model in U.S. international intermodal traffic



Source: KombiConsult

Source: KCS

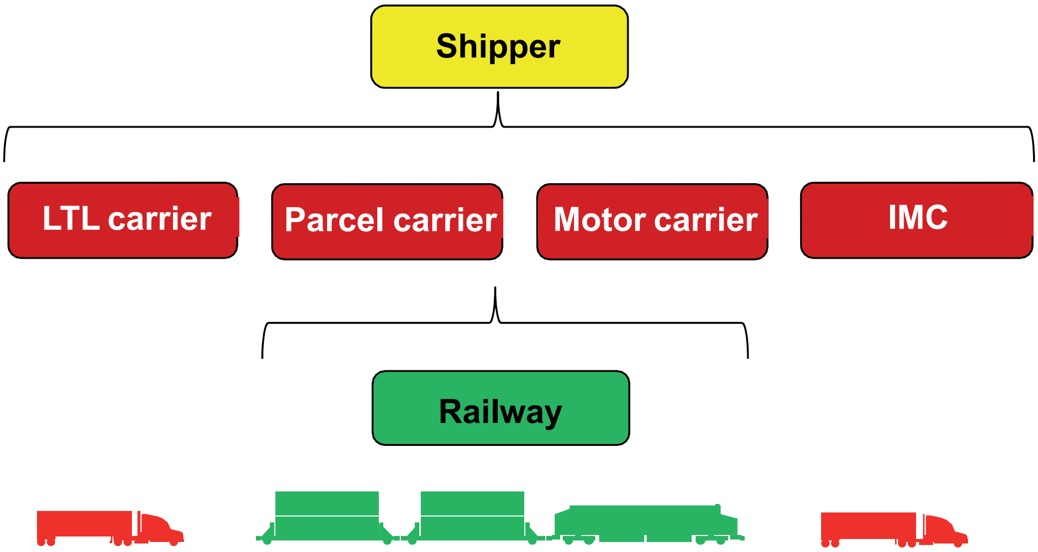
The US Railways' approach of **domestic intermodal transport** is as clear as their approach of international traffic. There is however one exception, and it is not generally so in Canada. Railways in the U.S. are selling domestic intermodal services on a wholesale basis to various groups of logistic services providers who have the contact to the final customer such as the industrial manufacturer or retailer of consumer goods. They therefore organize and carry out the door-to-door service (see also ***Figure 20*** overleaf). Domestic intermodal customers come from the following categories of logistic service providers:

(1) Motor carriers are likely to represent the largest group of logistic service providers in America. These are road operators performing full-truckload (FTL) movements with own and – if it's not an owner-operator - contracted trucks and drivers. Over the past 20 years, road-based companies and increasingly big motor carriers have become major customers to the intermodal industry since they have recognized the economic benefits of using rail for long hauls and deploying their trucks for local or regional drayage services. Main customers are J.B. Hunt, Schneider National, Swift, and Werner. Virtually all motor carriers started intermodal traffic by employing liftable trailers. In recent years, many of them have changed their equipment strategy and are shifting to domestic containers, which – due to double-stack transport – ensure more favourable rail rates. FTL usually are less time-sensitive but very cost-oriented.

(2) Less-than-truckload (LTL) carriers in North America are committed to a service, which, in Europe, forwarding agents for groupage cargo do. They collect small-size freight flows, below FTL loads, on a regional level and consolidate individual shipments to full truckloads at their hubs. At the receiving hubs the truckloads are broken up, shipments sorted and distributed by delivery trucks. In contrast to Europe where many, especially medium-size forwarders are sharing the groupage market, in the U.S., LTL carriers are a comparatively small group of service providers with a handful of companies dominating about 75 to 80 per cent of the market volume. Notwithstanding that LTL shipments – like in Europe – are extremely demanding as concerns transit time and reliability, American railways were successful to establish intermodal services matching these requirements. As a result major LTL carriers such as Yellow, Con-way or FedEx National LTL have become regular customers.

(3) Parcel carriers have virtually the same service level requirements. UPS, the largest parcel service provider in the world and the top U.S. logistic company, is not only using intermodal services intensely but, according to railway information, is even the biggest customer of U.S. domestic intermodal traffic. Another parcel carrier moving freight on intermodal services is U.S. Postal Services.

Figure 20. Business model in U.S. domestic intermodal traffic



Source: KombiConsult

(4) Intermodal marketing companies (IMC) emerged in the 1980s. IMC's or third parties, as they were called, generally, were asset-free logistic companies that were committed to shifting freight from road to rail. They were a kind of "freight broker" that bought fixed capacities of intermodal trains and filled them with loads they collected mostly from smaller shippers. Logistic operations such as trucking were used to be contracted. Meanwhile IMC's have extended this basic business model and equally have freight moving over the road. Too, some IMC's own assets such as containers, trucks, warehouses or even freight wagons. While in the beginning IMC's were a specialty of the North American intermodal industry this business model has been transferred to Europe and is known as 3PL or 4PL on both sides of the Atlantic. Among intermodal customers are 3PL carriers such as APL Logistics, Exel, or the Hub Group, as well as Pacer as one of the few 4PLs, which in the U.S. means a 3PL but doing business with own equipment.

The capabilities of these target customer groups have not only determined the market positioning of U.S. freight railways in domestic traffic – no direct sale to shippers - but also the scope of service. Since all customers - except for many IMC's – employ own intermodal equipment and usually organize the pick-up and delivery of intermodal equipment themselves the U.S. freight railways overwhelmingly provide terminal-to terminal services – or ramp-to-ramp services as it is also called in the U.S.

In earlier years, railways were used to supply customers that didn't provide for own, leased or rented intermodal trailers or containers, with rail-controlled equipment. They particularly had a large fleet of liftable trailers, which was deliberately reduced to promote the more cost-efficient container transport (see also chapter 9). For example Norfolk Southern and Union Pacific established a joint pool of 53' domestic containers. Compared to the amount of customer-owned equipment – only J.B. Hunt provides for a fleet of some 40,000 53' domestic containers - the extent of rail-controlled equipment, however, is moderate.

North American domestic intermodal traffic knows two major exceptions from the business model described above:

(1) As concerns their U.S. activities, Canadian National and Canadian Pacific are delivering domestic services through wholesalers like all Class I freight railways. In Canada, however, they are providing the majority of domestic movements on a direct to retailer basis including the door-to-door transport of cargo. It could not yet be clarified whether this market positioning leads to conflicts of interest and "internal" competition for freight with their wholesale customers.

(2) Triple Crown Services, a subsidiary of Norfolk Southern, operates a dedicated network of RoadRailer services east of the Mississippi. Triple Crown is a full-service logistic provider directly to shippers. Based on its fleet of some 6,500 RoadRailer trailers the company is organizing and performing the door-to-door transport of commodities. It has particularly been serving the automotive industry but has now broadened its customer base. Triple Crown is renowned for its superb service quality and has won a couple of industry awards over the years. The RoadRailer technology is a stand-alone system not compatible with "conventional" intermodal equipment and infrastructure. In order to create a market for this technology it is supposed that Triple Crown was obliged to select this retail-based business model.

5.2 - Intermodal business models in Europe

The differences in the economic and regulatory framework of the European rail freight industry compared to the American situation had a substantial influence on the business models of European intermodal traffic though they haven't completely prejudiced them. The main differences are as follows:

- European Union legislation requires from state railways to separate the management of the infrastructure from commercial activities.
- Freight railways in the U.S. provide for their own, private rail network. Since, in Europe, networks are state-owned public infrastructure network managers are subject to EU and national regulation, which requires them to ensure a non-discriminatory access for every authorised user.
- The situation is similar with regard to intermodal terminals in Europe as most of them are publicly owned.

The liberalization of the rail freight industry in Europe made impossible an "all-inclusive" intermodal business model such as in North America. But even when European railways were integrated companies the business models were much more complex than in North America and essentially centred around a new category of logistic service provider, the intermodal operator. So not only did the regulatory framework impact on the shape of business models in Europe, but it also did on the mentality. From the beginning in the 1960s the intermodal operators had the primary function to bring together two rather antagonistic "worlds", the world of state railways and the world of shippers and logistic service providers that had cargo to be moved. Intermodal operators were supposed to link the demand for rail services with the production side of rail transport.

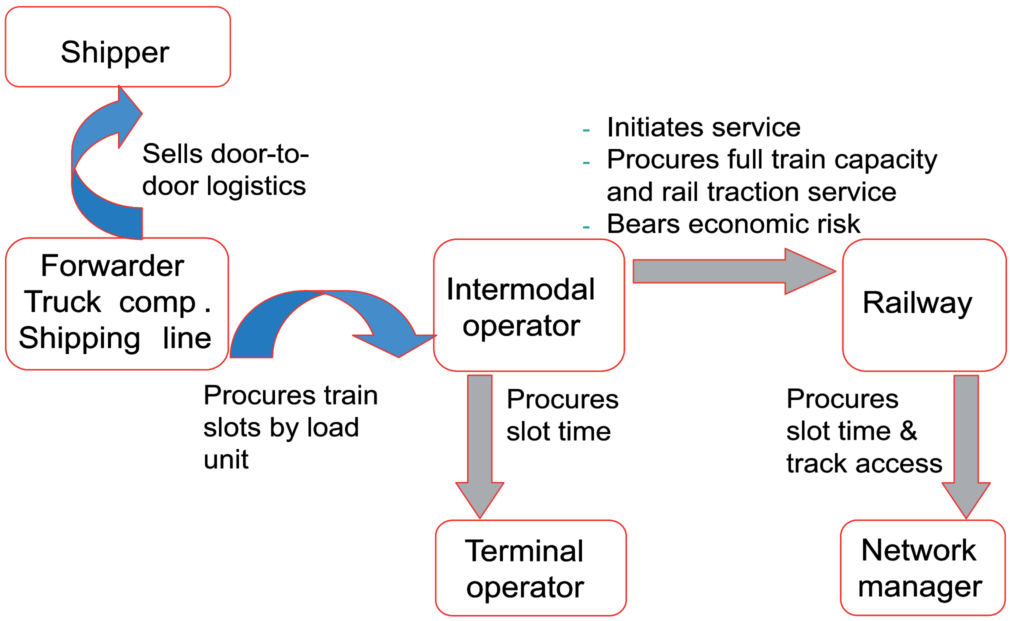
This role has been maintained to date. What has changed significantly however, is that intermodal operators have strengthened their responsibilities and involvement in the intermodal chain. Among the various business models, the classic or **generalist type of intermodal operator** is estimated to represent a market share of about 60 per cent of total intermodal rail/road traffic in Europe. It is characterized as follows (see also ***Figure 21***):

- This intermodal operator is defining, implementing and operating intermodal services on account of third parties.
- He is used to operate "open" services. Train space can be booked by any customer.
- Increasingly, this intermodal operator is purchasing block train services from railway undertakings and thus takes on the economic risk of filling train capacity

- The generalist type of operator traditionally preferred to maintain a “broker” role and keep his assets as low as possible. Therefore he was purchasing supply services such as transhipment, rail transport, wagons or road trucking.
- In recent years, owing to increased competition in intermodal traffic following the liberalization of this industry and of rail traction, more and more generalist operators have re-considered their approach especially with regard to improving their control on the intermodal supply chain and increased their content of the value chain. Thus it becomes more important to own or operate key terminals, gain experience in traction services, offer pick-up and delivery trucking.

As concerns the market of continental shipments generalist intermodal operators usually are applying the wholesale model and selling terminal-to-terminal services to forwarding agents, express and parcel carriers and road operators, which themselves deliver the door-to-door services to shippers and also organize the over-the-road pick-up and delivery of equipment. So the market positioning of European intermodal operators completely match the approach of the U.S. freight railways to their domestic traffic, which is comparable to the European continental services. Obviously, the intermodal service providers on both continents do acknowledge the leadership of the logistic industry in this market and prefer a clear and neutral distribution channel for their services.

Figure 21. Business model of European intermodal traffic: generalist type of intermodal operator



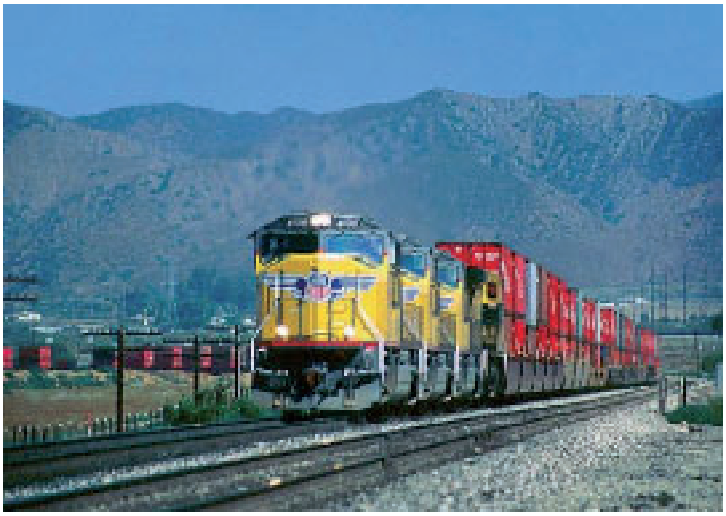
Source: KombiConsult

As concerns the rail hinterland traffic of marine containers European intermodal operators are faced with a very different situation compared to American railways. The latter can focus on one group of customers, the steamship lines. In Europe, carrier's haulage - when the shipping line is controlling the hinterland transport of a container - has gained market shares in recent years. Despite this, European forwarding agents traditionally strong in controlling the transcontinental movement of containers have maintained a firm market presence. According to industry information, the majority of hinterland containers continue to be shipped under merchant haulage as it is called. As a consequence, generalist intermodal operators in Europe are usually required to serve both customer groups in order to make sure their trains are loaded efficiently. As regards the scope of services, though, they are largely in the same position as their American colleagues. They deliver both port-to-door and door-to-door services. For the latter they are used to contract trucking companies to carry out the road leg of the service.

In addition to the business model of the generalist intermodal operator two other business models have become more common in Europe. One of them is the **railway in operator role**. Freight railways, which previously carried out traction services on behalf of intermodal operators, are seeking a horizontal extension of their scope of logistics in combined transport. Usually they are providing an "open" system of intermodal services targeting primarily the logistic industry's customers. In this respect those European railways are drawing nearer to the business model of U.S. railways.

Another intermodal business model may be designated as **logistic service provider in operator role.** It has been developed by forwarders and shipping lines whose core business is to perform door-to-door or port-to-port logistics. Initially, their intermodal services were rather designed as "closed systems" for conveying shipments arising from within their own logistics. However, the companies quickly adopted the operator role by offering spare transport capacity to other users in order to improve the capacity utilisation rate, and, with the extension of the business, specifically plan intermodal services with regard to volumes of third parties. Some of these new operators even push the integration further ahead by providing rail transportation or terminal handling services of their own.

By establishing proprietary intermodal services the logistic service providers extended their existing value chain and accomplished an increased integration of the supply chain. At the same time they "eliminated" the broker function of the generalist operator at least for those shipments, which are carried on their own services.



Source: UP

5.3 - Comparison of American and European intermodal business models

The key players who initiate, design and manage intermodal services differ in Europe and in North America. In America, the major freight railways are driving intermodal traffic and have developed distinguished business models for the domestic and the international business, which are taking account of the specific patterns governing the demand side of the American logistic industry.

European intermodal traffic, in contrast, has primarily been shaped by intermodal operators. They are a new category of logistic service provider tailored to the specific economic, regulatory and competitive environment of the European continent. There is no direct equivalent of the intermodal operator in Northern America even though the early IMCs and intermodal operators had some common features particularly as concerns the "broker" role.

What strikes the European expert is that the American intermodal industry seems to opt for rather standardized business models. US Class I freight railways design similar intermodal products for the same group of customers and establish comparable service promises. One reason for this situation might be a lack of competition since every major freight railway owns its network of lines, This could reduce the necessity for every company to distinguish itself from another. The authors of this report, however, believe that the fairly homogeneous business models much more reflect a mentality of many American enterprises. They wish to keep their business simple and understandable for their customers, or as BNSF has put it in a presentation on its Intermodal Vision: "Create intermodal rail service for our customers that is easy to understand and use: simple network; simple network offerings."

The situation in Europe seems to be quite different. Any business model is much more complex and less transparent than in the U.S.. In our view this is primarily owing to the fact that, in Europe, virtually every physical or organizational role in the intermodal chain of transport has also been allocated to a separate actor (see also ***Figure 22***).

Further, even if we can pinpoint the major business models, most intermodal operators tend to differentiate services and if it's through "cosmetic" supplements. The variety or even diversity in the European intermodal industry is also reflected in the number of intermodal service providers. According to the2007 UIC Combined Transport study, 105 companies supplied intermodal services in Europe. Their aggregated traffic volume, however, accounted for just about 60 per cent of the number of shipments moved by the six major North American freight railways in the same period. Even if we consider that most domestic intermodal markets in Europe continue to be served primarily by national service providers one could wonder if the polypolistic market structure is really healthy for this industry and fostering its progress.

Figure 22. Key actors of intermodal traffic in Europe

	Actor	Description
Demand side	Steamship line	Overseas transport of containers
	Forwarding agent	Organization of door-to-door transport of cargo for third parties independent of mode of transport
	Road operator	Carrying out of freight transport for third parties with trucks
	Shipper	Distributor or procurer of commodities (manufacturer, commerce)
Supply side	Railway (undertaking)	Supplier of rail traction services; carrying out of freight transport by rail
	Infrastructure (network) manager	Owner and operator of rail infrastructure (tracks, signals etc.)
	Terminal operator	Manager of intermodal facility enabling rail/road transhipment
	Wagon operator	Supplier of intermodal railcars for lease or rent
	Intermodal operator	Supplier of intermodal services

Source: KombiConsult

6. MARKETING POLICY

6.1 - Intermodal products and services in the U.S.

The U.S. freight railways are used to offer differentiated products for the international container and the domestic business. Basically, the services for both market segments also are produced separately with dedicated trains and – in port areas – at market-specific intermodal terminals. The marketing approach of the railways that is how they are configuring the intermodal services is essentially determined by their assessment that the domestic traffic tends to be time-sensitive whereas container hinterland traffic is more volume-driven.

6.1.1 International intermodal services

Cost-efficiency and regularity are considered key to serve the international intermodal business successfully. According to railway information, the vast majority of marine container movements in America is not time-critical. Instead shipping lines are expecting from railways competitive freight rates. In order to meet this objective railways have applied the following main leverages:

- In the 1980s, international traffic was not profitable. Railways served many small-size inland terminals, and traffic was performed as mixed production together with conventional boxcar services. It was fundamental for railways to establish dedicated intermodal services and achieve full-train capability. This was ensured by drastically reducing the number of O/D links and terminals intermodal trains called at.
- Another prerequisite to reduce the production cost per unit carried on intermodal services is to improve the loading capacity. During the last 25 years American railways have made large progress in this respect through increasing the maximum weight and particularly the length of trains (see also chapter 2.5). What, however, was a quantum leap in boosting the productivity of rail transport was the implementation of double-stack wagons at the beginning of the 1980s. Hereby the loading capacity of intermodal trains was nearly doubled.

- The American railways emphasize that it is crucial for them to control the entire port-to-door chain. This enables them to manage the flow of containers on a trade lane so that a regularly high train capacity load factor can be accomplished and resources employed efficiently. To ensure efficient services for example they use “slow” containers, which are conveying commodities to be delivered within a long time-span, as a buffer-stock to complete trains.

The emphasis on highly competitive rates is reflected in the service level offered for international traffic. Compared to domestic services (see below) marine containers are moved fairly slowly across the country. The schedules for international services see trains covering an average distance of 350 to about 500 miles per day, corresponding to an average speed of 25 to 35 kilometres per hour. This results in the following transit times measured from cut-off at origin to availability at destination, on important trade lanes:

- Los Angeles – Dallas (1,550 miles – 2,500 km): 3.5 – 5 days
- Los Angeles – Chicago (2,100 miles – 3,400 km): 4 – 6 days

The fundamental change of the marketing and production policies since the 1980s – dedicated intermodal services independent from conventional traffic - has also led to intermodal trains shipping marine containers operating on fixed and regular time-schedules. This makes intermodal rail predictable – more predictable than truck being stuck in congested roads, as confirmed by U.S. motor carriers – and can be much better integrated into the logistics solutions of shipping lines and their customers.

Service schedules generally are published and can be downloaded from the railways' websites. U.S. railways usually offer daily departures seven days a week on every single link. Since in large U.S. container ports railways often are operating several intermodal terminals – the port area of Los Angeles/Long Beach provides for eleven on-dock and near-dock facilities - a trade lane such as L.A.-Chicago is served by a number of daily trains.

The example of the ports of Los Angeles and Long Beach shows that the U.S. intermodal industry - in cooperation with ports and shipping lines - was tremendously successful in shifting container volumes from truck to rail. Even if trucks are generally faster, in the year 2006, almost no container was carried by long-haul trucks any longer. In contrast to that, Rail had achieved a share of 43 per cent of the total sea-borne container throughput while 57 per cent were distributed or collected by road on so-called local services in the L.A. area.

6.1.2 Domestic intermodal services

The domestic transportation of freight in the U.S. –comparable to the transport of continental cargo in Europe – is generally considerably more time-sensitive than the carriage of marine containers. At the same time, the domestic market is also much more differentiated as concerns the service quality and cost implications of various commodities. The U.S. freight railways are set to matching the distinctive needs of the various customer groups and therefore provide various service level options for the domestic intermodal transportation of trailers and containers.

The main marketing instrument applied to differentiate services on one trade lane is the speed of intermodal shipments between origin and destination. The fastest domestic intermodal services are usually geared to high-end customers such as parcel and LTL carriers. They are providing the base load though at peak seasons of the year they may even utilise the full capacity. If not, the load capacity will be completed by units of other customers that do not necessarily need the high service velocity. In effect these trains consolidate various customer shipments with different quality level requirements.

The marketing policy of the American freight railways for the domestic intermodal traffic seems to aim at an even more sophisticated differentiation of service levels designed to match specific customer needs. So top intermodal products can be defined in terms of speed of service but can also include particular service features, which distinguish them from "lower-grade" services. Among the marketing instruments identified during the survey the one most applied is granting certain priorities to customers . The following list is intended to give an overview of service features used:

- Priority access on train: reserved capacity.
- Priority cut-off time and time of availability: last in the gate; first off the train - first out of gate.
- Service guarantee: e.g. full or partly refund of freight rate if schedule is failed.
- Guaranteed reservations of equipment
- Transport accompanying service above standard e.g. special shipment monitoring

Service level differentiations are usually complemented with a price differentiation as well. For higher service levels customers must pay a premium to freight rates. Since the prices are not public the extent to which price differentiation is used cannot be assessed.

In order to demonstrate the marketing approach of U.S. freight railways in their domestic intermodal traffic two prominent examples are described hereunder:

(1) BNSF that operates primarily between the west coast and the agglomerations in the centre of the U.S., provides two service levels:

- "*Expedited Service*" for trailers and containers: intermodal trains feature a mileage from 550 to more than 700 miles (1,125 km) per day.
- "*Premium Service*" primarily for containers: services average more than 500 miles (800 km) per day.

Expedited Service is reputed to be the fastest product in the U.S. intermodal industry. The service is even faster than a single-driver truck, which, according to information provided by U.S. motor carriers, can make about 600 miles per day. Calculation is based on an average speed of 55 miles per hour and the working time regulation stipulating a maximum of an 11-hour-shift for a single truck driver who subsequently is obliged to rest for 10 hours.

It should, however, be observed that a team-driver truck (2 drivers) still is faster than rail but then the cost per shipment is likely to double the cost of intermodal transport on long hauls.

In order to highlight the differences between BNSF's two service levels the schedules measured from cut-off time at departing terminal to time of availability at destination in two major trade lanes are presented in ***Figure 23***.

Figure 23. Domestic intermodal traffic: comparison of BNSF service levels

Trade lane	Distance (miles)	Distance (km)	Service level	Service time (h)	∅ Speed (km/h)
Los Angeles - Dallas	1545	2484	Expedited Service Premium Service	68 92	37 27
Los Angeles - Chicago	2120	3409	Expedited Service Premium Service	59 94	58 36

Source: BNSF website; KombiConsult calculations

According to BNSF information, additionally the company is operating a L.A.-Chicago service for the parcel carrier UPS. This service makes the journey within 52 hours corresponding to an average speed of 66 km/h between the terminals.

For its *Premium Service* level BNSF also offers a 100% on-time guarantee currently on 26 O/D links. If the intermodal shipments are not available at the destination terminal on time as given by the public time-schedule, customers can request for a full refund of the freight rate. The guarantee has to be purchased separately. Based on our research, at present, the BNSF guarantee is the most extensive service guarantee provided by U.S. railways.

(2) Norfolk Southern and Union Pacific have joined forces to enable transcontinental domestic services for trailers and containers under the brand "*Blue Streak*". Services are operated over the networks of the two railways as interline traffic. This product comprises of four service levels: Super*Flyer*, Expedited Plus; Expedited, and Standard (see also ***Figure 24***).

They differ in terms of transit time although the differences between service levels are apparently smaller than those between BNSF's domestic services (see ***Figure 23***). NS and UP do not meet the speed of BNSF's fast trains either. Super*Flyer* , the highest service level, covers approximately 500 miles per day, which is also a bit less than a single-driver truck can do. For higher service levels NS and UP have additionally foreseen more favourable time-windows at origin and destination terminals as concerns the cut-off time and availability for shipments.

Figure 24. Joint NS/UP "*Blue Streak*" domestic intermodal product: service levels

Trade lane	Distance		Service level	Service time	Speed
	(miles)	(km)		(h)	(km/h)
Los Angeles - Atlanta	2567	4128	SuperFlyer	88	47
			Expedited	95	43
			Standard	108	38

Source: NS website; KombiConsult calculations

Source: NS

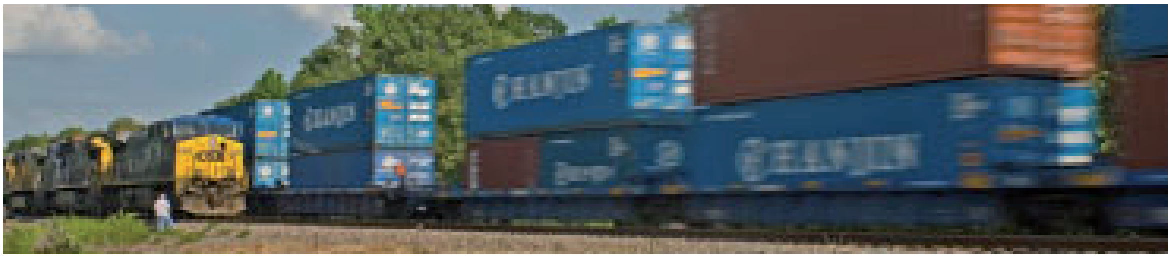
The scope of service differentiation of the "*Blue Streak*" product extends the speed issue. NS and UP employ the following features to meet specific shipment requirements (see ***Figure 25***):

- Guaranteed reservations for equipment supplied by the railways in the framework of their EMP domestic container pool
- Priority access on trains: protected departure time and reserved capacity.
- Proactive service monitoring: if a train is running behind schedule the railways keep the customer informed of its status.
- Subject to next-day rolling: shipments moved in the "Standard" service level can be shifted on the next day departure.
- Service guarantee: When NS and UP launched the new product they offered a full refund service guarantee for selected links if shipments were not available on time. According to recent information, this service guarantee is not valid anymore.

Figure 25. Joint NS/UP "*Blue Streak*" domestic intermodal product: service differentiations applied

Service Level	Service Guarantee	Equipment Guarantee	Priority Access	Proactive Monitoring	Subject to Rolling
Super*Flyer*	Select lanes	Yes	Yes	Yes	No
Expedited Plus	No	Yes	Yes	Yes	No
Expedited	No	No	Yes	Yes	No
Standard	No	No	No	No	Yes

Source: NS website



Source: AAR

6.2 - Pricing policy of U.S. freight railways

(1) Freight rates are a sensitive issue in the U.S. just like in Europe. The survey on the U.S. intermodal industry revealed that there are couple of public price (tariff) schemes, which can be downloaded from railways' websites. In either case they are related to international traffic. It was not possible to clarify however, on which conditions freight rates would be published or not. However, the majority of price authorities, as freight rate schemes are called by American freight railways, are confidential and only registered customers get access to them. Apart from these price authorities customers may also negotiate rates under certain conditions.

(2) Intermodal customers in the U.S. should familiarize with a list of surcharges to the freight rate, which are collected for specific services. Among them are some fees, which European customers are also familiar with. It should be noted that the following overview is not intended to provide an exhaustive list of surcharges:

- Surcharges for interim storage of intermodal load units at inland terminals. The published rates are extraordinarily higher than what is common in Europe.
- Surcharge for the transport of units carrying hazardous goods.
- Surcharge for the transport of temperature-controlled units.
- Fuel surcharge: With the fuel surcharge railways pass on to customers the change of the price of fuel purchased. The surcharge is adjusted weekly based on the price index of the U.S. Federal Department of Energy. Fuel surcharges are not a peculiar instrument of American railway but are common in the U.S. logistics industry. However, in recent years when oil prices soared, the fuel surcharge became an additional sales argument for intermodal services. Since rail is using fuel more efficiently than trucks the spread between the cost of road and rail became larger.
- Alameda surcharge: The Alameda Corridor is a 20-mile rail line that connects the Port of Los Angeles and Long Beach to BNSF's and UP's transcontinental rail network. The Corridor was funded by a combination of bonds, grants, and a federal loan. Railways must pay user fees to generate revenue to pay off the bond debt and federal loan. The fees apply to both seaborne containers that originate or terminate at the port facilities as well as to domestic units that move on rail over the Alameda Corridor. The charge is differentiated by the length and loading status of the unit. For example, the surcharge is $38.62 for a loaded 40' seaborne container and $12.96 for a loaded 53' domestic container or trailer.

(3) American railways perform the majority of intermodal traffic over their own networks. But since virtually every railway has some “missing links” with important areas of economic activity – for example no company provides for a transcontinental line between the east and west coast of the U.S. – the railways are required to co-operate on the trade lane in question. Depending on the commercial and contractual relationship between the railways for this interline traffic one of the following price models is applied:

- If railways have concluded a joint-line agreement customers will be quoted a through freight rate covering the entire transport also eventually including a transhipment or road transfer at the interchange station.
- If it’s not a joint-line service each of the rail carriers will apply its price authority for the relevant line section. So the total cost of this interline traffic is composed of the individual freight rates for the rail sections plus the cost for rail or road transfer. The expectation is that, in this case, the total transport costs are considerably higher than with through rates. According to information from intermodal customers, however, this does not necessarily apply. Allegedly, there are experts in the logistics industry who assess the cost-effectiveness of both models when purchasing intermodal services which need to be performed over more than one rail network.

(4) What the survey on the U.S. intermodal industry clearly revealed was that it is determined to exploit the full potential of price differentiation in the light of specific needs of commodities or customers, and a lack of transparency on market information. This doesn’t only apply to domestic services where the offerings of distinguished service levels already imply a differentiation in prices, but also in international traffic. Railway companies are keen to employ experts who are able to identify the “right” freight rate for various customers who seek to ship their containers. According to railways information, those “bill optimizers” are able to contribute substantially to an increased profit margin.

Source: AAR

(5) U.S. railways also are forced to use their pricing policy to avoid distribution channel conflicts against the following background. On trade lanes connecting ports with inland areas railways are used to providing separate intermodal services for marine containers and domestic shipments in parallel. Since the domestic equipment provides for considerably more capacity than ISO containers some logistic service provider have recognized the opportunity for a “transloading business”. This is when imported marine containers are carried by truck to an off-dock consolidation centre where cargo is transhipped into domestic equipment. As a matter of fact, three 53’ domestic containers have the capacity of five 40’ ISO containers. The savings in transport cost are such enormous that they apparently more than compensate for the cost of road trucking and consolidation. The port authority of Los Angeles estimates that meanwhile more than 10 per cent of its marine container throughput are transloaded by specialist companies.

The railways obviously are set to counter this trend. BNSF for example tries to minimize the spread between international and domestic prices in a way to reduce the incentives for trucking containers out of the port to transloaders.

6.3 - Performance measurements of U.S. freight railways

Except for Canadian National, all U.S. Class I railways voluntarily report performance data on the AAR website. Based on a standardised methodology they provide statistics for three features:

- Wagons on line: the average daily number of wagons on the network
- Terminal dwell: average time a wagon spends at a specified terminal location
- Train speed: average velocity achieved for line-haul movement excluding terminal time.

Performance measurements are given for every major type of freight including intermodal traffic. An example of a comprehensive performance sheet is given in ***Figure 26***.

The most interesting performance indicator for intermodal customers is supposed to be the train speed. The maximum speed of intermodal trains on all rail networks ranges from 60 to 70 mph, corresponding to 96 – 112 km/h. Generally speaking, for most railways, the speed of intermodal trains averages about 30 mph (approximately 50 km/h), with BNSF actually achieving above-average values. The historical average for railways is 34.8 mph.

(55.7 km/h), whereas in January 2009 speeds averaged 37.8 mph (60.5 km/h).

With an overall average of about 30 mph (48 km/h), intermodal traffic speeds in the U.S. are much faster than for conventional freight, which averages 20 mph (32 km/h). Interestingly, however, speed is unlikely to be the most relevant characteristic for coal or grain transport.

These AAR performance statistics certainly are a marketing tool for railways but they also constitute an information source for customers and a benchmarking tool for the railways themselves. Unfortunately the railways have yet to introduce a measurement for the punctuality and reliability of trains. This would be of particular interest for all concerned.

Figure 26. Norfolk Southern performance sheet for year 2007

NORFOLK SOUTHERN - MONTHLY 2007
FROM AAR RAILROAD PERFORMANCE MEASURES

NS MONTHLY DATA	Jan 2007	Feb 2007	Mar 2007	Apr 2007	May 2007	Jun 2007	Jul 2007	Aug 2007	Sep 2007	Oct 2007	Nov 2007	Dec 2007
Cars on Line By Car Owner												
System	77257	77521	77599	77586	77716	77586	76648	76460	76007	75695	75611	75897
Foreign RR	32331	34986	35563	34933	34065	34298	32596	32990	32950	32129	31381	31152
Private	92758	95342	95417	93915	93282	93651	91739	91601	91686	92365	92315	92472
Total	202346	207849	208579	206434	205063	205535	200983	201051	200643	200189	199307	199521
Pct. Private	45.8	45.9	45.7	45.5	45.5	45.6	45.6	45.6	45.7	46.1	46.3	46.3
Cars on Line By Car Type												
Box	25176	25367	25956	25372	24758	25264	24546	23845	23595	23306	23347	22980
Covered Hopper	45620	46980	47929	47515	46707	46705	45847	45580	46244	46452	45909	45664
Gondola	19889	20565	20384	20096	20169	20166	19335	19287	18805	18940	18494	19182
Intermodal	7542	7835	7794	7329	7333	7038	7117	6827	6988	7090	7036	7249
Multilevel	10605	11625	10309	11280	11300	11489	10914	12121	12153	11299	11003	10626
Open Hopper	54786	55281	55532	55263	55127	54641	53748	54414	53962	54153	54376	54850
Tank	31834	32542	32858	32111	31998	32633	32173	31954	32042	32228	32279	32296
Other	6894	7656	7817	7466	7672	7600	7303	7023	6853	6720	6864	6674
Total	202346	207851	208579	206432	205064	205536	200983	201051	200642	200188	199308	199521
Train Speed (Miles per Hour)												
Intermodal	28.9	25.7	26.1	27.5	26.8	27.9	28.8	27.8	28.0	27.9	28.5	27.8
Manifest	22.0	19.1	19.0	20.2	20.1	20.3	21.5	20.6	21.0	20.6	21.3	20.8
Multilevel	24.2	20.5	20.8	21.7	20.1	21.3	23.6	21.6	22.5	22.1	23.0	22.0
Coal Unit	16.2	14.9	15.1	15.8	15.3	15.3	16.2	15.0	15.9	15.8	16.5	15.6
Grain Unit	19.2	18.3	17.2	18.7	17.7	17.8	19.2	18.0	18.4	17.8	18.7	18.7
All Trains	22.8	20.3	20.3	21.4	21.0	21.4	22.6	21.4	22.0	21.7	22.4	21.7
Terminal Dwell (Hours)												
Allentown, PA	24.2	26.7	24.5	22.6	24.1	24.0	23.2	23.4	25.3	22.8	22.2	23.9
Bellevue, OH	23.8	40.4	34.6	32.0	27.2	29.2	22.5	25.4	23.0	22.9	22.9	28.5
Birmingham, AL	27.2	26.6	28.3	26.7	25.5	28.1	32.5	28.7	29.4	26.8	26.9	28.8
Chattanooga, TN	26.2	26.6	31.2	27.1	27.4	29.4	27.3	26.3	27.8	27.4	28.8	27.9
Columbus, OH	15.0	21.9	20.6	16.1	14.6	16.4	12.6	15.5	12.5	17.1	18.7	20.5
Conway, PA	22.4	28.1	32.5	27.3	28.8	27.1	25.4	24.6	23.5	22.7	24.8	25.9
Decatur, IL	23.4	28.0	25.6	24.8	26.4	24.9	24.6	26.0	23.9	24.9	25.6	27.9
Elkhart, IN	24.1	36.3	34.2	33.3	27.9	26.8	23.0	24.1	24.8	25.0	25.5	31.4
Knoxville, TN	25.4	29.5	28.4	25.0	25.5	26.3	25.0	24.2	26.0	26.7	26.7	28.6
Linwood, NC	25.8	22.8	22.0	22.2	21.9	21.1	21.2	21.9	21.7	21.7	22.0	23.1
Macon, GA	23.0	23.5	24.2	23.1	23.3	26.2	25.5	26.2	29.4	26.5	26.6	27.0
New Orleans, LA	17.7	20.0	16.5	16.4	14.1	15.4	13.5	14.7	13.8	14.7	14.1	15.6
Roanoke, VA	29.2	26.9	29.5	30.0	31.3	29.7	29.5	32.7	27.1	27.8	27.0	30.7
Sheffield, AL	21.7	23.3	22.5	21.1	23.7	22.4	22.0	21.1	21.9	21.2	22.8	24.4
Entire Railroad	20.9	23.0	23.4	22.1	21.8	22.2	21.6	21.2	21.2	20.9	20.7	22.6

Source: NS website

6.4 - Marketing policy for Intermodal service providers in Europe vs the U.S

(1) The overwhelming majority of intermodal rail/road services currently operated in Europe are geared to competing on cost/price, in the first place with road-haulage companies and, eventually, with other intermodal companies if competing services were provided.

Intermodal operators are used to fixed service parameters, especially in terms of timetabling, train weight/length and wagon sets compliant with the requirements of existing customers and/or other interested parties previously interviewed during market investigation, and largely match the performance levels of road operations. To catch customer business, in most cases, it is paramount that the total cost of the intermodal supply chain should end-up lower than that of road-only conveyance. The calculation will take into account the direct costs of door-to-door transport as well as the amount of equipment based on round-trip schedules, advantages from the regulatory framework and other influences, where- relevant.

This marketing approach has prevailed primarily as a result of the deregulation of the EU freight transport market since the mid-1980s, involving in particular the elimination of non-qualitative market-access restrictions and quotas. It triggered off a tremendous competition on rates and service quality both inter- and intra-modally. The bottomline was that road transport emerged from this process as the winner. Raod-haulage companies considerably improved the standard of service offered to shippers and, at the same time, successfully conformed to these standards by raising performance as well as efficiency levels. Within about ten years, until the late 1990s, this resulted in road-freight rates reducing by up to 30 to 50 per cent depending on commodity and trade route.

Railways, by contrast, failed to catch up with these developments and were unsuccessful in upgrading their quality of service, due largely to the very slow process of re-engineering railways from public-service administrations to market-driven enterprises and the implementation of competition for rail-service providers. As a result, intermodal operators whose services strongly rely on the capabilities and skills of railways were left with one key marketing instrument: ***price***.

(2) In recent years more and more shippers and container lines have opted for intermodal services or strengthened their commitment to this logistics system. Here their prime strategic interest is to secure a stable, regular and lasting supply chain for moving their cargo against the background of increasingly-saturated road and rail infrastructure. Even if these customers of intermodal service providers are quite naturally reluctant to pay a higher price than for road haulage, they nevertheless serve as an additional marketing tool for intermodal operators in designing and selling their products.

In this respect it is simply amazing to observe how the environmental benefits of rail transport particularly in terms of the "climate killer" carbon-dioxide emissions have increasingly become selling arguments. Even though shippers and logistics service providers will not be inclined to pay a premium on top of the freight rate, "green logistics" will nevertheless make it easier for intermodal service providers to sell products at equal price compared with road haulage.

(3) What is not yet common practice in European intermodal transport is to promise service guarantees especially in terms of on-time delivery to intermodal customers. Several reasons explain this state of affairs (see below). As a rule, customers are advised that the operators do not guarantee the time-schedule for services published. Operators are only liable for paying compensation in case of extraordinary delays.

In recent years, some services have been launched with built-in service guarantees and corresponding compensation schemes. These services are targeted at time-sensitive high-end freight such as groupage cargo (LTL) or parcels traffic. According to our information all these services are operated on domestic routes, thus avoiding the risk of failures and ill-coordinated border-crossing operations.

(4) Basically we can observe the following pricing strategies in European intermodal traffic:

- Fixed, equal freight rate for every customer according to price list
- Negotiated customer rates
- Post-sale discount on volumes
- Pre-sale discount on committed volume to be moved per service/day/week/month
- Stand-by rates, marginal-cost pricing on excess capacity
- Fixed rates but significant discounts on stand-by units or marginal-cost pricing for selling empty space

To our knowledge sophisticated schemes based on price and quality differentiation are not employed as yet. This may be due to the insignificant difference between best and poorest intermodal products, and/or the margin which an operator could apply to distinguish quality of service.

(5) What is typical for operator-driven "open" block-train services is that intermodal service providers in Europe do not require their customers to enter into a contractual obligation to ship a certain number of units by each service if the capacities employed result more or less from the day-to-day decisions of customers.

However, intermodal operators are increasingly keen to reserve train capacities for individual customers in advance, thus reducing their economic risks.

(6) U.S. railways have entered into partnerships with motor or parcels carriers or shipping lines that are pursuing strategies based on a modal shift to intermodal transport. According to our assessment, such partnerships have proved to be highly successful in that they have instituted mutual commitments, with customers “promising” to provide base loads for services and increase volumes; and railways correspondingly feeling responsible to gear services in line with customer requirements.

European intermodal service providers have also entered into “special relationships” with certain customers determined to reinforce their intermodal commitment. A striking example of such European-style partnerships are the “company trains”, or intermodal services block-purchased by one customer. However, suppliers and customers of intermodal services are reluctant to go as far as the American intermodal industry down this route. This may be due to a “European” attitude to leave things somewhat unsettled so as to have the freedom to switch to another intermodal service provider if the latter offers a better product.

Source: CN

7. RAIL PRODUCTION

7.1 - Rail production for intermodal services in the U.S.

Intermodal transport in the U.S. – in fact, in North America as a whole – today is overwhelmingly operated as dedicated services or trainload services (its brand-name in the U.S.) independent from other, conventional types of rail freight traffic. This also represents a major change compared to the situation prior to the Staggers Act and during the 1980s when mixed operations were standard practice. This coincides broadly with the development of rail production in European intermodal traffic during the last 20 years.

The survey on U.S. intermodalism revealed various rail operating models distinguishable according to the following criteria: full trainload technology, less-than-trainload (LTL), and interchange traffic between railway networks.

(1) Wherever feasible, the U.S. railways – like European intermodal operators - seek to serve trade routes with **direct point-to-point trains.** However such full-trainload systems require that the catchment areas around terminals generate a sufficiently high and regular number of shipments. Regular schedules in the U.S. mean that intermodal services are operated five to seven days a week. It was not possible to obtain definitive information on how many intermodal routes are served by direct trains. However, it would appear that they at least convey the majority of intermodal shipments in the U.S.

(2) An increasing number of intermodal services are performed with **shuttle trains** featuring fixed sets of wagons on their round-trip schedule. Shuttle production concepts are particularly relevant for trains dedicated to the carriage of marine containers in international traffic but are also common for dedicated TOFC or mixed TOFC and domestic container services. For U.S. railways the shuttle train concept is easier to implement as compared with European intermodal service providers, due to the following characteristics:

- The loading units shipped by intermodal services are standardised and comparatively homogeneous particularly in terms of equipment (see chapter 2.6):
  - In international traffic, loads are moved primarily in modular 20' and 40' containers. 45' containers – and a small number of 48 footers – readily fit into this system since they are stacked atop 20' and 40' containers in double-stack operations, or loaded onto 45' well wagons (see ***Figure 27***).
  - In domestic traffic, 40' and 45' equipment is rapidly being phased out. For the time being, railways will have to continue serving those clients still using this type of equipment, but they can primarily deploy modular wagons accommodating 48' and 53' domestic containers or trailers.
- The maximum permitted axle-load of wagons is about 31.8 metric tonnes – against 22.5 tonnes in Europe. This comparatively high axle-load allows for the movement of virtually all commodities whether light or heavy.
- Despite this, most freight on U.S. intermodal services is rather voluminous, thus not requiring deployment of heavy-duty wagons.

Figure 27. Double-stack container traffic: 45' container stacked atop a 40' container on 40' articulated well wagon

Source: KombiConsult

(3) The majority of marine and domestic containers are moved on **double-stack trains**. Double-stack transport is the movement of containers on articulated wagons, which enables one container to be stacked on another. This production system has effectively revolutionised intermodal transport, and massively boosted rail productivity by allowing for the movement of virtually double the number of containers within the same train length.

Technologically speaking, U.S. railways employ so-called well wagons in lengths of 40’, 45’, 48’ and 53’ (see chapter 2.7 Wagons). Most of them are articulated wagons consisting of two and up to ten units. Containers stacked in top position may be larger than those loaded on the well floor, and thus are carried with an overhang over the others (see ***Figure 27***).

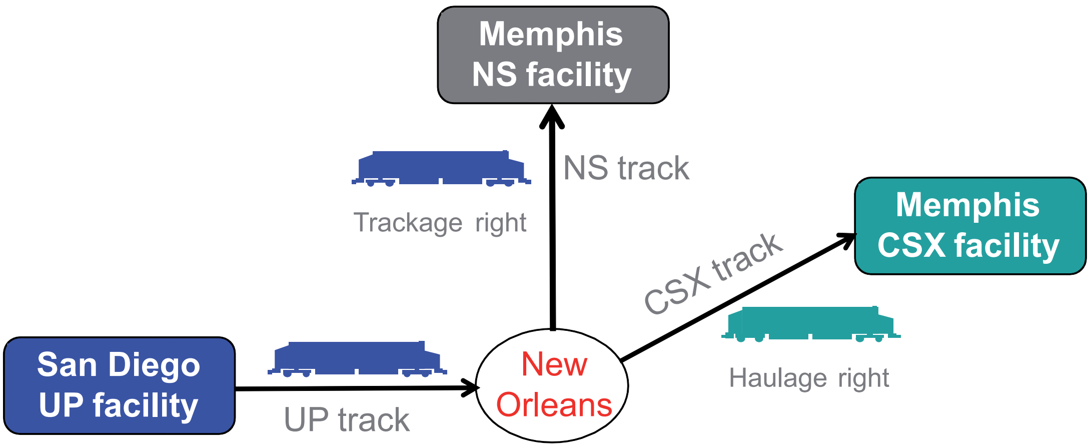
Since the 1980s the U.S. railways have heavily invested in clearing the loading gauge of rail lines to allow for double-stack operations. Some lines, especially in the eastern United States still put constraints on this efficient intermodal-transport concept. It is understood, however, that these lines, which are critical for interconnecting major economic centres, will be cleared for double-stack over the coming years.

Source: UP

(4) Even though US Class I railways operate large networks, they simply could not adequately reach some customers or markets if they had to rely solely on their own tracks. They can extend their geographical scope through interchange agreements with other railways. Where trainload services are concerned, the regulations applicable are as follows (see ***Figure 28***):

- Trackage rights: These rights allow a railway to operate on the lines of another railway by employing its own locomotives and staff. In the (fictitious) example given below, Union Pacific (UP) had trackage rights for the New Orleans-Memphis line of Norfolk Southern (NS) and would be permitted to continue with its own resources all the way to the NS Memphis intermodal terminal.
- Haulage right: This right entitles a railway to carry out rail services on the lines of another railway but must subcontract operations to this company. Our example shows that if UP had no trackage rights for the CSX line to Memphis, UP would have been obliged to have its train operated by CSX locomotives and staff.

Figure 28. Trackage and haulage rights in U.S. freight rail traffic
(fictitious example)



Source: KombiConsult

It was interesting to learn that interchange procedures between U.S. railways, which require locomotive and driver changeover, are rather vulnerable to coordination deficits, meaning that the railway taking over a train from another does not always deploy the necessary resources on time. This results in irregularities and delays. For this reason U.S. railways clearly prefer to maintain control over intermodal units shipped with them if at all possible.

A-contrario, interchange procedures are more synchronised if railways offer a joint intermodal service, in which case the product of each railway involved is likely to be stronger than if one railway is just performing a “haulage role” as part of the service package of another company.

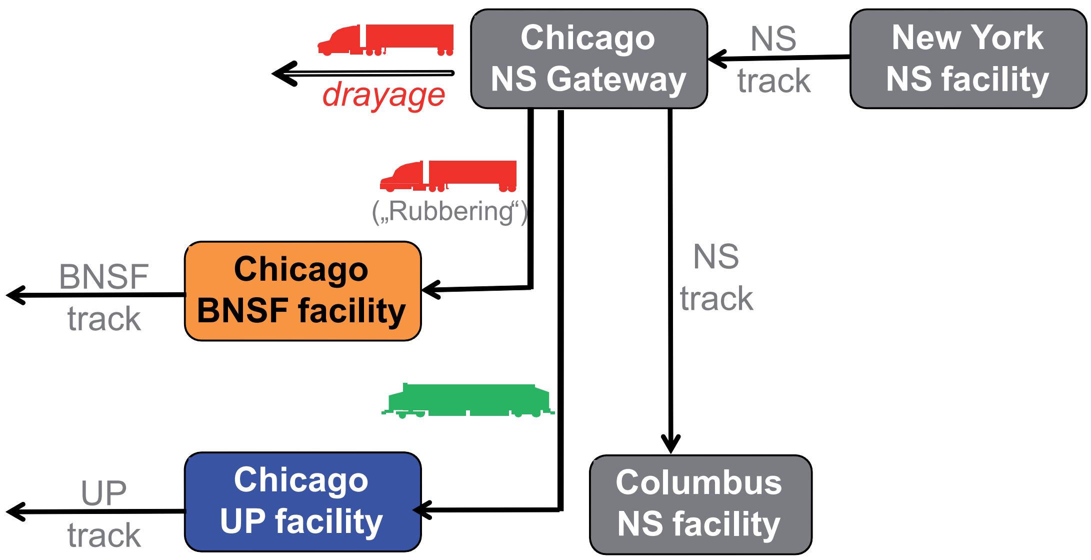
(5) U.S. railways seek to serve trade routes where the volumes offered for carriage are not sufficient to justify operation of a through service. A most common less-than-trainload production system is to form a full train at departure terminal from various **blocks of wagons,** of which one block – usually the largest – is bound for the destination of the underlying intermodal service. At receiving terminal, or rather at a nearby rail yard, the train is split-up and the blocks shunted either into the local terminal or to corresponding trains. There are then several scenarios for processing the intermodal shipments, depending on whether they continue on the tracks of the original railway or are interchanged with another railway (see ***Figure 29***):

- The block of wagons carrying the local shipments will be pushed into the intermodal terminals where units are due to be picked up by lorries for physical distribution.
- If the shipments were to continue to be moved by the same railway with another train, the block of wagons would be likely to be shunted in the rail yard to another track.
- If the shipments are destined to continue on an intermodal service operated by another railway, the manner in which the interchange will be carried out depends on the contractual relationship between the railways involved. If railways operate a direct service, the block of wagons will be rail-switched onto the other railway’s intermodal terminal. If not, shipments must separately be carried by lorry, a procedure which is also known as “rubbering”.

It goes without saying that this production system works in both directions similarly. The rail yard where the blocks of wagons are consolidated or split-up is called “Gateway”.

(6) In some cases railways combine the movement of intermodal shipments with the transport of finished cars. **Mixed production systems** widely used 20 to 30 years ago, today seem to have become the exception by reference to total volume. At any rate they are only feasible in areas where an auto manufacturer is present and offers other intermodal volumes.

Figure 29. Scenarios of less-than-trainload traffic by blocks of wagons (fictitious example)



Source: KombiConsult

7.2 - Comparison of rail production for intermodal services in the U.S. and Europe

In order for the transport services offered to be cost-effective, intermodal production systems are designed to achieve the maximum possible load factor. On both continents, every production system selected will therefore reflect the specific market situation particularly in terms of the assessment of potential market share, the type of cargo and customers, the geo-economics such as the geographic distribution of production centres, warehousing facilities and population patterns, transport distances, and the regularity or volatility of transport flows. Whereas in Europe the capabilities of the rail infrastructure network - maximum train weight and length, axle loads, and clearance gauge – are a particularly critical factor in determining a production system due to the severe restrictions and extreme diversity of characteristics encountered throughout Europe, in North America by contrast, railways hardly have to cope with infrastructure constraints at all (see also paragraph 5.2.3).

Despite major differences between North America and Europe in terms of geo-economic and infrastructure conditions, it is most striking how rail-based intermodal services have strongly converged over the past 20 years. This essential finding can be backed by facts resumed below, albeit some major differences remain due primarily to differences in the regulatory framework and infrastructure. The results can be summarised as follows:

(1) Both in the U.S. and Europe, intermodal services are performed overwhelmingly by means of dedicated production systems in relation to the volume of goods shipped.

(2) US and European intermodal service providers have increasingly been replacing less-than-trainload production systems with more efficient through and shuttle train services.

(3) Since U.S. railways and their European counterparts are geared to serving trade routes which do not generate sufficient and regular volumes to justify establishment of a through service, they all have designed less-than-trainload production systems. Freight railways in the U.S. focus on the operation of “block trains” that involve the interchange of blocks of wagons between individual O/D intermodal services. A very similar process organisation based on the “group train” concept is common practice in European intermodal traffic

(4) European intermodal service providers, however, have developed and are deploying a wider range of less-than-trainload services (see also ***Figure 30***)[6]. A particularly efficient production system is the Gateway traffic system revolving around separate train services interlinked at an intermodal terminal, which makes the system unique and only applicable in intermodal transport. The trains starting at the departure terminals move both shipments for the local market at destination (these being shipments scheduled to be picked- up by road vehicles for physical distribution), and shipments destined for on-carriage. These intermodal units change trains exactly like the passengers of inter-city trains, though in fact they are crane-transferred at the intermodal terminal in question. This production system obviously has not been found any application in the U.S. to date, while it is becoming more and more popular in Europe.

(5) Mixed train operations have become a comparative rarity everywhere. Whenever applied, they are used for carrying intermodal units together with automotive shipments on both continents, though U.S. railways combine intermodal with finished cars whereas, in Europe, these operations involve the transport of semi-finished parts or components. Here, mixed production systems are additionally employed for chemicals.

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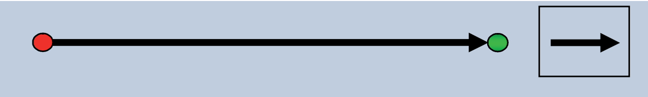
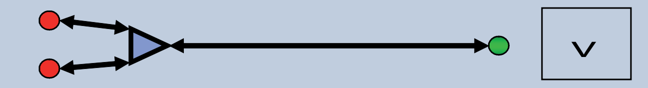
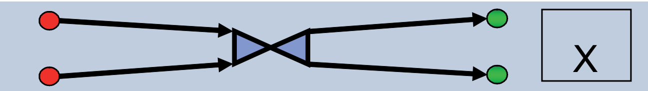
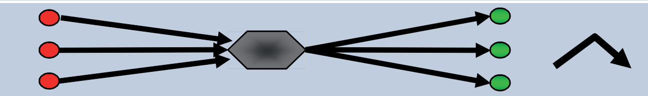
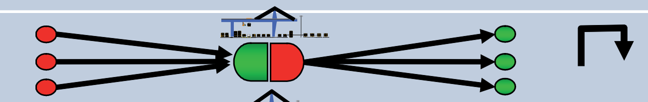
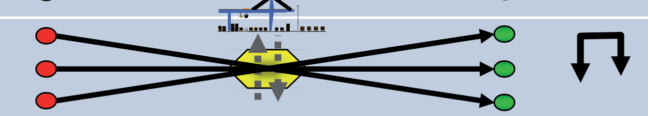
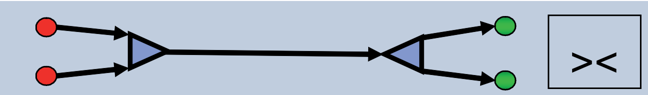
6. A comprehensive presentation includes the following DIOMIS report: UIC: International Combined Transport Production Systems including long and heavy trains (DIOMIS A7). Paris 2007.

(6) Finally, the survey also revealed a convergence of systems on a less pleasant issue. It is remarkable to see how U.S. railways blamed service deficits occurring in interchange traffic on a lack of co-ordination and commitment. One is reminded here of European international traffic and the failures of both RUs and Infrastructure Managers properly to co-ordinate cross-border procedures!

Figure 30. Overview of intermodal production systems in Europe

Field of employment	Production system	Symbol
Full-trainload O/D lanes	Direct train	
	Shuttle train	
Less-than-trainload O/D lanes	Y-shuttle train	
	Liner train	
	Group train	
	Turntable traffic	
	Gateway traffic	
	Megahub/Mainhub production	
	Mixed intermodal/ conventional train	

Source: KombiConsult

7.3 - Key indicators of intermodal trains in the U.S. and Europe

Intermodal trains in the US are significantly “larger” than European trains in virtually all respects. This is most striking if we compare the “best-in-class” performance indicators of European trains with the “standard” category of U.S. trains, and the “gap” between both intermodal rail systems becomes even wider if we consider the U.S. top category (see ***Figures 31-33*** overleaf):

(1) Axle loads: In the U.S. an axle-load of 31.8 metric tonnes is generally permitted. This is 40 % heavier than the European maximum of 22.5 tonnes, and it outnumbers the 20 tonnes limit (which is “standard” on many sections of the European rail network) by 60 %.

(2) Train weight: Typical intermodal trains both on domestic and international services are operated with a maximum gross weight of 1,300 to 1,600 tonnes. Especially in Southern Europe, 800 to 1,000 tonnes are often the maximum owing to infrastructure constraints or a lack of more powerful locomotives. In contrast to that, for the U.S. intermodal industry, train weight does not seem to be a limiting factor, or let us say that the survey was unable to provide evidence on today’s figures. Assuming the typical loading capacity of U.S. trains (see ***Figure 31***) and an average gross weight of 8.3 tonnes per TEU (see p. 32) , the gross weight would amount to 2,000 to 5,000 tonnes.

(3) Train length: Intermodal trains in the U.S. are at least twice as long as European trains - 600m vs. 1,340m – disregarding the severe infrastructure constraints in large parts of the European rail network, which bring-down the maximum permitted length even more. While 4,400’ long trains are somewhat the standard in U.S. east coast traffic, intermodal trains serving the west of the country are usually 6,000 to 8,000 foot long. On some routes to west-coast ports, BNSF and UP even have introduced trains reaching 10,000 feet in length. Better still, it is rumoured that Canadian National is planning to operate trains with a total length of 12,000 feet, or has even performed such trips.

(4) Loading capacity: The intermodal industry in Europe can count itself almost lucky when it can move 80 to 100 TEUs by one service. Intermodal trains in the U.S. have a loading capacity three to eight times higher, particularly in the west. Even though the U.S. railways need to employ two, three or even more locomotives to pull these long trains, the above ratio gives an indication of the enormous productivity and thus competitiveness of rail traffic.

Figure 31. General performance indicators of intermodal trains in the U.S.

Performance measurements	Max	Top	Standard
Max train length (m)	3,050 (10,000’)	1,830 - 2,440 (6-8,000’)	1,340 (4,400’)
Max speed (km/h)	113	96	-
Max axle load (tonnes)	31.8		

Source: AAR, IANA, BNSF, UP, KombiConsult research

Figure 32. Key performance indicators of intermodal trains in the U.S.

Performance measurements		East	West
Loading capacity	(TEU)	250 - 350	450 - 600
	(Truckloads)	120 - 170	200 - 280
Length of haul	(km)	1,000 - 1,200	2,500 - 3,500

Source: AAR, BNSF, UP, KombiConsult research

Figure 33. Key performance indicators of intermodal trains in Europe

Performance indicators	Top category	Medium category	Bottom category
Max gross weight (tonnes)	1,350 - 1,650	1,100 - 1,350	800 - 1,100
Max axle load (tonnes)	22.5	20	18
Max train length (m)	600 - 750	500 - 600	400 - 500
Max speed (km/h)	120 - 140 (160)	100	60 - 80
Loading capacity (TEU) (typical values)	81 - 100	61 - 80	41 - 55
Payload/gross weight ratio (typical values)	50 - 60 %	45 - 55 %	40 - 45 %

Source: KombiConsult research

(5) Speed: The US railways have kept up with Europe in terms of the maximum speed. Following massive improvements to their rail infrastructure, which had been in poor state of repair until the 1980s, they have raised the limit to 70mph (113 km/h), which is absolutely within the range of European top-category intermodal trains.

(6) Length of haul: In Europe, rail trips for intermodal services typically fall within the 250 – 600 km (160 – 375 miles) range in domestic traffic, and 700 – 1,300 km (500 – 620 miles) in cross-border traffic. The latter figures are comparable to the average length of haul in U.S. east-coast traffic whereas, in the western U.S., intermodal trips average 2,500 to 3,500 km. As a matter of fact, the disparity results from the difference in geo-economic patterns. In the western U.S, there are very few centres suitable for serving by intermodal trains between the west coast and the Mississippi. However, east of the Mississippi, the U.S. are much more densely populated and feature a more polycentric economy, thus resembling the European geography, which is also reflected in the intermodal transport distances.

Source: UP

8. INTERMODAL WAGON MANAGEMENT

The objective of wagon management is to provide the appropriate number, type and quality of wagons at the right place, at the right time and at a reasonable cost. In order to meet these requirements, wagon management covers the entire life cycle of a wagon, from market research, procurement, financing, service assignment and operations to maintenance and deployment of used wagons. In this respect the survey on intermodal transport in the U.S. is not only highly instructive since the industry there has chosen a completely different model for the provision of specialist intermodal wagons than in Europe, but is also startling as the U.S. is always considered as the home of competition[7].

8.1 - Intermodal wagon management in the U.S.

In the U.S., freight railways only own a small proportion of all intermodal wagons employed. The bulk of these wagons are actually provided by TTX.

What might be viewed spectacular from a European perspective is that TTX is a cooperative company whose shares are owned by ten of North America's leading railways which are also its primary customers (see ***Figure 34***). Today, TTX manages a pool of over 210,000 rail wagons employed for intermodal and automotive services as well as carrying lumber, machinery, building materials, steel, and other commodity groups where flat, covered and open wagons are required. Both the business model and the pooling agreements are under the jurisdiction of the DoT Surface Transportation Board which has granted TTX a limited anti-trust immunity, i.e. exempted the company from competition law.

7. A comprehensive presentation can be found in the UIC Report: "2005 / 2015 Report on Intermodal Rolling Stock in Europe", Paris 2009.

Figure 34. TTX Company's ownership

	Burlington Northern Santa Fe (BNSF)		Pan Am Railways
	Canadian National (CN)		Kansas City Southern (KSCI)
	Canadian Pacific (CP)		Norfolk Southern (NS)
	CSX Transportation (CSX)		Kansas City Southern de Mexico
	Ferromex		Union Pacific Corporation (UP)

Source: TTX, KombiConsult

TTX was established in 1955 by 41 railways with the aim of sharing assets in particular TrailerTrain equipment, for which railways wanted to share the economic risk. Today the main objective of TTX is to supply the U.S. railways with a fleet of reliable, high quality wagons matching the specific demand of their customers at competitive rates. TTX is also responsible for keeping the fleet at a reasonable size, balancing new equipment acquisitions with innovative modifications and upgrading the existing fleet. The major general benefits, which TTX renders to its customers, are as follows:

- Low-cost equipment resulting in inexpensive hire rates
- A reduction in idle days thanks to an efficient North America-wide pool of wagons
- Capital conservation: railways must not bear the capital cost for new equipment
- The owners' equipment risk is virtually eliminated thanks to the possibility for wagons to be returned within 5 days and for wagons to be modified for alternative uses
- TTX has three maintenance divisions performing various types of repair and modification work, and 31 Field Maintenance Operations carrying out inspections and less extensive repairs on site

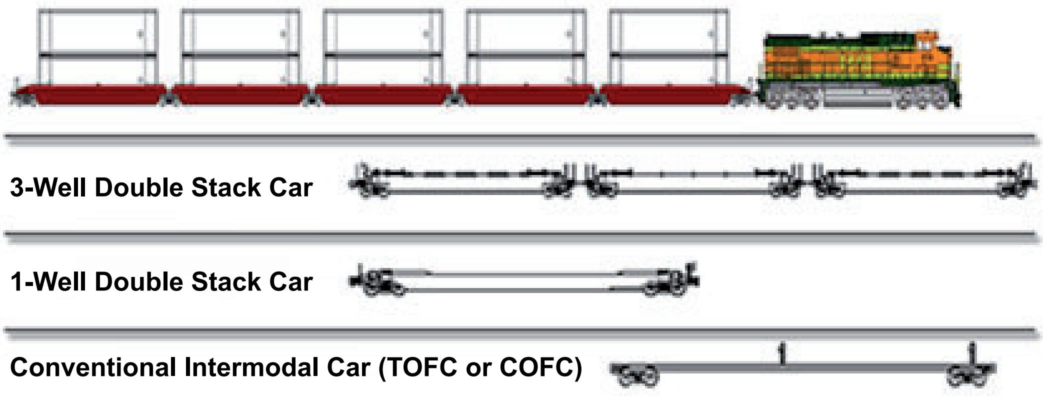
- Market analysis and planning
- Engineering research and development

The Intermodal Equipment Distribution Services handle day-to-day management for all intermodal wagons. On an average day, 92 to 94 % of the fleet is in service. TTX's distribution system enables wagons to be directed from railways with excess capacity to those railways that are short of wagons. This ensures that customers have sufficient equipment when they need it. In addition, wagons are directed to and from repair facilities and new wagons are brought from manufacturers to the railways. TTX, however, does not interfere with the freight railways' operational business and e.g. assigns wagons to services or determines wagon sequences.

Over the past ten years, TTX has invested $3.9bn (€3.0bn) in new wagon purchases, with 61 % dedicated to intermodal wagons. TTX currently operates a fleet of approximately 44,000 intermodal wagons (see ***Figure 35***). From a European standpoint, this straight figure would underestimate the fleet size as the majority of wagons are articulated vehicles comprising two, three, five, six, eight or even ten units or platforms for carrying intermodal equipment. Therefore the total loading capacity of TTX wagons in terms of intermodal units is estimated to be more than six times higher than represented by the number of 44,000 wagons. The current TTX intermodal fleet breaks down as follows:

- Less than 5 per cent of all wagons are single-unit vehicles.
- About 12,500 wagons are designed to carry trailers though some can also accommodate containers. They provide a loading capacity for almost 50,000 large road trailers. The most common design is the spine wagon, which in a similar design is also used in UK intermodal traffic. The spine wagon features a fairly "lean" design just composed of a central longitudinal beam, a platform for accommodating the trailer's axles, and a coupling device to absorb and secure the king pin (see ***Figure 36***).
- The majority of trailer-carrying wagons meanwhile are designed for 53' or 48' long trailers.
- Approximately 31,000 wagons are double-stack container wagons providing for more than 160,000 platforms. Since not every platform corresponds to a 40'+ container slot, the total loading capacity cannot readily be calculated. However, we estimate that double-stack wagons account for a loading capacity of almost 300,000 40' or larger containers.

Figure 35. Most common intermodal wagons in North America



Source: BNSF

Figure 36. TTX spine wagon for carrying trailers

Source: Marian Gaidzik (HaCon)

8.2 - Comparison of intermodal wagon management in the U.S. and Europe

In Europe, the business models for the provision and management of intermodal wagons vary substantially from the American cooperative wagon pool represented by TTX. Four basic models, disregarding how wagon purchases have been financed, are applied here:

- Incumbent railway undertakings (RUs) own and manage a large proportion of the intermodal wagon fleet. If requested by intermodal operators to quote a rate for a block-train service, RUs usually offer to supply their "railway" wagons for a separate rate as well.
- Some intermodal operators have procured a significant fleet of "private" intermodal wagons, which they manage on their own and usually only deploy on proprietary services.
- Other intermodal operators possessing wagons have handed over the management of their vehicles to a RU, which holds shares in the company concerned.
- Leasing/renting companies most likely have contributed most to increasing the fleet of intermodal wagons in Europe over the past 20 years. The market leader here certainly is AAE. These companies have succeeded in providing wagons to virtually every provider of intermodal or rail haulage services.

In the U.S., the intermodal wagon – or even more general, the rail wagon – is viewed rather as a "commodity" and not as a piece of competition. In this respect, there are great similarities with the motor-carrier and entire logistics industry in the U.S. For U.S. railways, it is obviously more important that TTX provides state-of-the-art and well-maintained wagons at competitive hiring rates, ensures optimum utilisation and assumes capital risks on "broader shoulders" than trying to compete on wagons. It bears pointing out, however, that the level of competition between Class I railways in intermodal traffic is not that intense considering that every railway owns a large network connecting major economic centres in the U.S.

By contrast, in Europe, a cooperative pooling potential corresponding to the TTX business model is very unlikely to be realised, as things now stand. Wagons are not regarded as "commodities" but as an instrument to achieve a competitive edge over others. This also applies to IT systems, intermodal equipment and other resources. This attitude is understandable against the background of the liberalisation of the European rail freight industry. Market economy and competition are highly appreciated and demanded from authorities – competition at every level is the order of the day – in an attempt to achieve a more efficient railway system.

For the time being, it has yet to be determined whether the European approach to managing necessary and valuable inputs for the production of intermodal services really brings about more efficient results than the U.S. solution. In the current, still transitory situation from a state-owned, integrated railway system to a new market balance, it would certainly be difficult to delve into this issue. Anyone daring to take a step in this direction would be suspected of trying to stifle competition. But authorities should ask themselves whether control over critical resources such as wagons does not in itself constrain the forces of competition.

Source: CN

9. INTERMODAL EQUIPMENT

9.1 - Intermodal equipment employed in North America and the U.S.

The North American intermodal industry knows four basic types of intermodal equipment or loading units, which are employed in various sizes:

- Marine containers
- Domestic containers
- Piggyback trailers/semi-trailers
- RoadRailer

The marine containers carried on international intermodal services in North America are pretty much the same as in Europe and the rest of the world. They are primarily made-up of 20' and 40' ISO standard containers plus a small number of 30' containers. In recent years, the fleet of 45' ISO containers has increased considerably though their share remains small compared to 20 and 40 footers. A few steamship lines also use 48' long x 8' wide containers on-ISO standard marine containers, which, however, can be moved by rail without any difficulty.

For domestic intermodal traffic, customers employ domestic containers and piggyback trailers designed for moving only in land transport by road and rail (see ***Figures 37-38***). They will be keen to see that the equipment is not only tailored to the needs of national customers but also provides the same characteristics as trucks in order to be competitive with through road traffic, particularly in terms of weights and dimensions, which should exploit the maximum permitted values for highway traffic.

As mentioned previously, the RoadRailer technology is marketed and operated completely separate from "general" intermodal traffic in North America. Triple Crown, a NS subsidiary, is committed to this technological niche market.

The company inaugurated first services in July 1986. It was very successful over the years particularly since it was committed to producing excellent quality and has arguably delivered the highest service quality in the entire intermodal industry. It took Triple Crown twenty years to raise traffic volumes to about 300,000 loadings annually, but since that time business has obviously been stagnating.

Figure 37. 53' domestic container in North America

Source: CN

Figure 38. 53' piggyback trailer in North America

Source: Marian Gaidzik (HaCon)

9.2 - Intermodal equipment employed in Europe

The European intermodal industry knows five basic intermodal technologies:

- Marine containers
- Domestic containers
- Swap bodies
- Piggyback trailers/semi-trailers
- Lorries on rolling motorway

The statement on marine containers in North America largely applies to Europe equally, where there has been a rise in the fleet of 45' containers. 48' containers, however, have yet to take-off. The fact of the matter is that they exceed the maximum permitted length for semi-trailers in Europe and therefore could not possibly be road-conveyed by pick-up and delivery services.

For European continental intermodal traffic, customers use domestic containers, swap bodies and piggyback trailers (see ***Figures 39-41***). In Europe, exactly like in North America, the domestic intermodal equipment is designed to match customer requirements and the capabilities of road transport. For this reason most of the equipment – except units employed for special cargo - is built to exploit the maximum permitted weights and dimensions.

The following description summarises the main characteristics of European loading units particularly with respect to ISO containers.

(1) Domestic containers

- Features complying with ISO freight containers
    - Principle of construction
    - Longitudinal and lateral distances of top and bottom corner fittings
    - Top spreader transhipment
- Main difference with ISO freight containers
    - Utilisation of maximum permitted weights and dimensions in EU or individual European countries (for domestic shipments)
    - Reduced stackability (2-4 high)
- Standardised as per UIC leaflet

(2) Swap bodies

- Features complying with ISO freight containers
    - Longitudinal and lateral distances of top and bottom corner fittings
- Main differences with ISO freight containers
    - Construction principle (similar to semi-trailer): “soft” body
    - Bottom-lift transhipment with grappler arms
    - Utilisation of maximum permitted weights and dimensions in EU or individual European countries (for domestic shipments)
    - Non stackable (as a rule)
    - Standing legs as additional features
- European standards

(3) Semi trailers

- Weights & dimensions according to EU legislation:
- Maximum length: 13.6 m /45’
- Maximum weight: 40/44 tonnes
- Bottom-lift transhipment with grappler arms
- Standardised as per UIC leaflet

Figure 39. 45’ curtainsider domestic container in Europe

Source: 45 Unit website

Figure 40. 7.15m (24') box-type swap body in Europe

Source: Kombiverkehr

Figure 41. 45' piggyback trailer in Europe

Source: Kombiverkehr

The carriage, on low-loader wagons, of complete lorries which are accompanied by their drivers in sleeping cars, is performed following a concept branded the "rolling motorway". This is a niche product which is specific primarily to the sensitive transalpine corridors, and contributes to relieving motorways of lorry traffic. Rolling-motorway services operate like ferries. Services provide for huge catchment areas on both sides of the rail trip – and lorries can travel distances ranging from 500 to 1,500 kilometres up to the loading station. It is typical that the rail trip is shorter than the road leg. It is therefore not a relevant technology for a network of efficient intermodal services designed to capture cargo flows close to source and destination.

9.3 - Equipment trends in domestic/continental intermodal traffic in North America and Europe

This chapter highlights common features and trends in North America and Europe and explains where and why the conditions governing the deployment of domestic intermodal equipment vary.

(1) Domestic containers are deployed on both continents against the same market background. Since ISO containers were - always - too small compared to the sizes which the regulations on weights and dimensions permitted for road traffic, intermodal customers had to develop a piece of equipment providing for similar capabilities. This was a prerequisite to competing efficiently with lorries (see also n° 3).

(2) Swap bodies actually have the same genesis. However, they are a specialty of the European forwarding industry and are not used in North America.

(3) There is great conformity as regards the development of domestic intermodal equipment in the U.S. and Europe. Users and manufacturers of this type of equipment were always eager to adapt it to changes in the regulations governing the weights and dimensions of road vehicles. As a result, intermodal units have become larger as regards the length, width and height of the body, to coincide with each change in the highway code.

In this regard it should be observed that the regulatory frameworks are rather similar on both continents. In Europe, the European Union administration is responsible for determining the weights and dimensions for EU cross-border traffic. The framework Directive 96/53/EG from 1996 provides the common denominator with which every Member State must comply.

Individual EU Member States, however, are allowed to derogate from this Directive, which is the case for about one third of all EU countries.

In the United States, the weights and dimensions of lorries in inter-state traffic are determined at federal level. Individual states, however, are permitted to exceed these values. So particularly in the western, rather sparsely-populated states of America, higher lorry weights and dimensions are applied. The highway code stipulates the maximum length of highway trailers and not necessarily the total length of the lorry. In the 1960s, highway trailers were not allowed to exceed 40’ in length, which also determined the maximum length of ISO containers at that time. The length was later increased to 45’ and 48’ and is now generally fixed at 53’ for one trailer. If, however, a motor vehicle tows two short trailers connected via a drawbar, each trailer may be up to 28’ long. At federal level, the maximum permitted gross weight for motor vehicles is set at 80,000 pounds corresponding to some 36 metric tonnes.

(4) Both in Europe and in North America intermodal customers are used to heading for the maximum. This fact is well known in Europe. Logistics companies investing in European intermodal equipment readily purchase containers, swap bodies or semi-trailers tailored to their business and the commodities they ship and – against this background - provide the maximum cube and tonnage. Most of them prefer some standard size in order to ensure cost-efficiency. But there are also many users that go for special design solutions in an attempt to realise competitive advantage by gaining some extra centimetres, kilograms or cubic-metres out of their equipment.

IANA’s intermodal statistics for North American intermodal traffic clearly show that the American customer also aims for the largest possible equipment – but always to a standard design (see ***Figure 42*** and also n° 7).

As regards intermodal trailers, the market is split into two segments. The full-lorryload motor carriers call for the maximum cube and a seamless loading floor in order to ensure an efficient loading and unloading process. As a result, today, more than 40 per cent of all trailer loadings are performed with 53’ double-axle units. The proportion of 45’ and 48’ trailers, however, has been declining over the years and, in 2008, their aggregated market share was just about as high as the share of 53’ trailers alone.

Figure 42. Share of equipment in intermodal traffic in North America (2008)

Equipment type		Share per class	Equipment type		Share per class
Trailers	20'	0%	Containers	20'	21%
	28'	19%		28'	0%
	40'	0%		40'	47%
	45'	18%		45'	3%
	48'	23%		48'	4%
	53'	40%		53'	26%
	Total	100%		Total	100%

Source: IANA

Parcels and LTL carriers, on the other hand, handle even more voluminous goods than FTL carriers. They therefore usually employ a lorry configuration of two single-axle 28' trailers resulting in a total unit length of 56'. This piece of equipment accounts for a remarkable 19 per cent share of all trailer movements (see ***Figure 43***). The short trailers deliver logistics companies another benefit in that they are much more suitable for use as singles on inner-city streets for collecting and distributing shipments.

Figure 43. 28' piggyback trailer in North America

Source: Marian Gaidzik (HaCon)

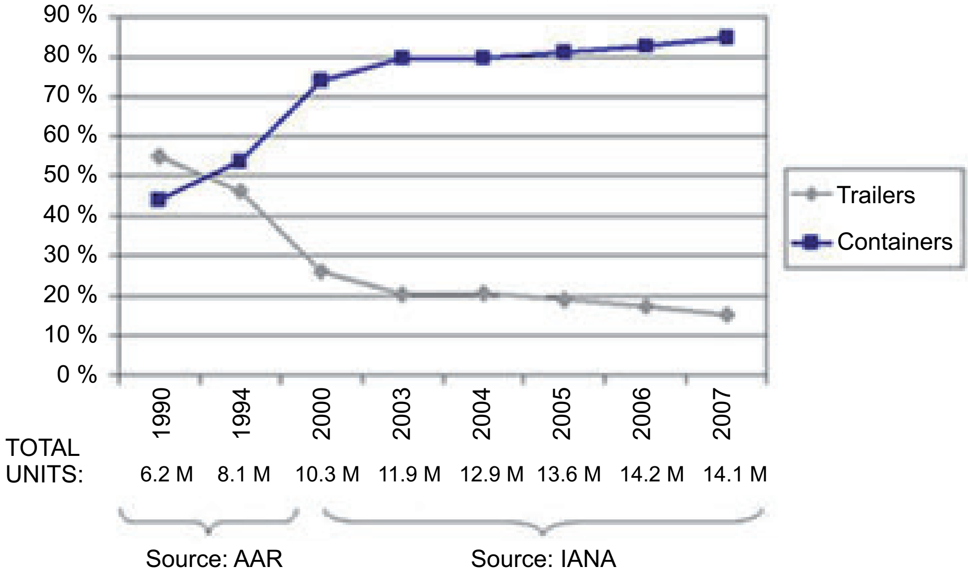
The situation in the domestic container market is absolutely comparable to what has been described for trailers. There is a clear trend towards the deployment of 53' containers, which are set to replace the 45' and 48' domestic units, even though this cannot be easily deduced from ***Figure 42*** since the container data also contains the shares of marine containers. Moreover it would seem that this development on the domestic container business is even faster than on the trailer market, and this trend is due to be reinforced by the move of many FTL carriers away from trailers to containers (see more in (5) below).

(5) Apart from the intra-sectoral trends in domestic intermodal equipment, the shift between the technologies is illustrative of, and highlights, the structural evolution of the intermodal industry. According to IANA statistics, in 1990, trailer movements held a share of more than 55 per cent of total North American intermodal traffic. Its modal split had dropped by 40 percentage points to 15 % by 2007 (see ***Figure 43***). ***Figure 44*** additionally shows that since 2001 trailer loadings declined both in numbers and in market share. The result is similar for intermodal traffic in the U.S. though not as devastating for trailers as in total North America. The volume of trailers decreased from 3.5 million units in 1995 to 2.6 million in 2007. The market share declined from 55.6% to 21.6% during that period.

The leverage which has given the crucial incentive and impulse to this development was - and still is – the incredible efficiency of double-stack container transport. Since the movement of domestic containers on double-stack wagons was much more cost-effective for the railways, the latter actively promoted this equipment and were close to "discriminating" against trailers. While until 15 years ago the major U.S. railways owned a large fleet of trailers which were rented to customers, they have since stopped purchasing any more trailers, and as a result their fleets have virtually dissolved.

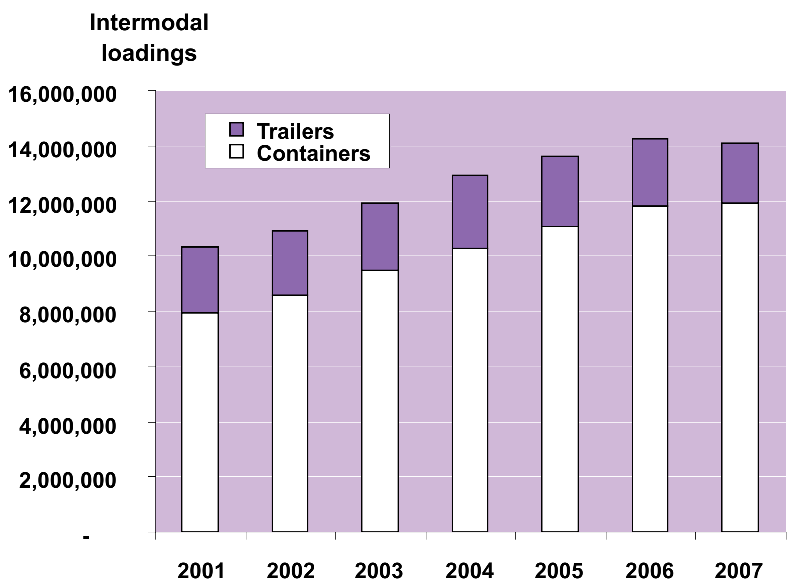
Trailer traffic also came under pressure from the side of motor carriers as more and more of them turned away partly from this technology. However, it appeared to us that most of them maintain a dual equipment strategy employing both domestic containers and trailers. This may be due to the fact that even if the efficiency of double-stack traffic is convincing, motor carriers must take into account the higher investment cost for containers plus chassis and the more demanding organisation of container traffic especially in terms of equipment balancing (containers, chassis, tractor) when large numbers of empty runs are involved.

Figure 44. Equipment trend in intermodal traffic in North America: 1990-2007



Source: IANA website

Figure 45. Intermodal traffic in North America by equipment: 2001-2007



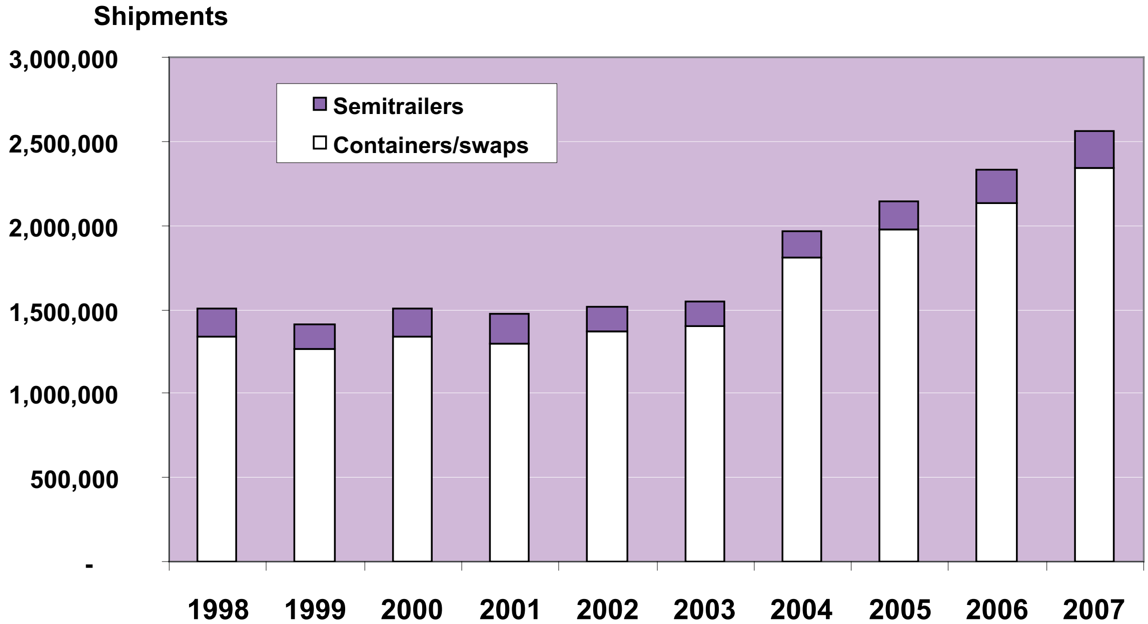
Source: IANA, KombiConsult calculations

Against this background a decision by JB Hunt , the second largest FTL carrier in the U.S. and one of the major intermodal customers, has generated much attention. J.B.Hunt has completely substituted its fleet of piggyback trailers for one standardised type of 53' domestic container.

It goes without saying that such a move has not only a technological and economic component but also a psychological implication. It means the company is giving away its modal flexibility, which is typically implied by the employment of highway trailers, and, at the same time, strengthening its commitment to the intermodal system.

(6) Semi-trailer traffic in Europe has also lost market share during the last 20 years. In the 1980s and 1990s, this technique was not as predominant as in the U.S. Semitrailers accounted for about 25 to 30 % of the total volume of the UIRR member companies which, prior to the deregulation of combined transport in Europe, were the only intermodal service providers allowed to ship semi-trailers. The UIRR members are still major carriers of trailers, and the UIRR is the only organisation supplying a statistical time-series.

Figure 46. Intermodal traffic of UIRR member companies by equipment: 1998-2007



Source: UIRR, KombiConsult calculations

According to this data, the semi-trailers share of total UIRR unaccompanied shipments had decreased to 11 per cent by 1998 (see ***Figure 45***). Modal split fell to its all-time low of 9.7 % in 2003. Since then, semi-trailers have experienced an outstanding revival. The total number of semi-trailers soared within four years from 1.55 million in 2003 to 2.56 million in 2007. This corresponds to a growth of 65 per cent. As a result the modal split has improved to approximately 15 %, which is exactly the level where the trailer stands in U.S. intermodal traffic.

(7) What has struck virtually any European observer of the U.S. logistics industry is the enormous degree of standardisation and homogeneisation of equipment. This applies to the rail industry and road industry alike, also to the intermodal industry. It would seem that there is virtually unique design for all trailers and domestic containers designed for shipping general cargo, at least in terms of the type of body construction and of outside features. Almost every piece of equipment is built to a box-type design only providing for rear doors for loading and unloading. Trailers or domestic containers fitted with tarpaulin “soft walls” are not familiar in the U.S. The high level of standardisation delivers many benefits:

- It cuts the cost of manufacturing the equipment substantially.
- If all equipment is similar or identical, the logistics processes can also be standardised.
- The professional skills required of large parts of the logistics workforce can be set low, with employees having only to be trained once.
- Logistics employees such as lorry drivers can easily switch companies and will be immediately familiar with the “new” equipment.

The approach of the logistics industry in U.S. to their equipment seems to reflect one of the unexpressed but always-lingering laws: make it easy and understandable. The intermodal logistics industry apparently is not inclined to compete on equipment. Innovation and differentiation with competitors are expressed in terms of logistics concepts, service quality, customer relationship, IT capabilities, cost, safety record, and – more recently - environmental care.

Source: JB Hunt

10. INTERMODAL TERMINALS

This chapter will analyse terminal concepts in terms of the design, process organisation, layout, handling technology, IT and operations in the U.S. In contrast to other chapters, this chapter starts with a brief characterisation of the typical intermodal terminal in Europe. In the last sub-chapter, the financing of intermodal terminals on both continents will be compared.

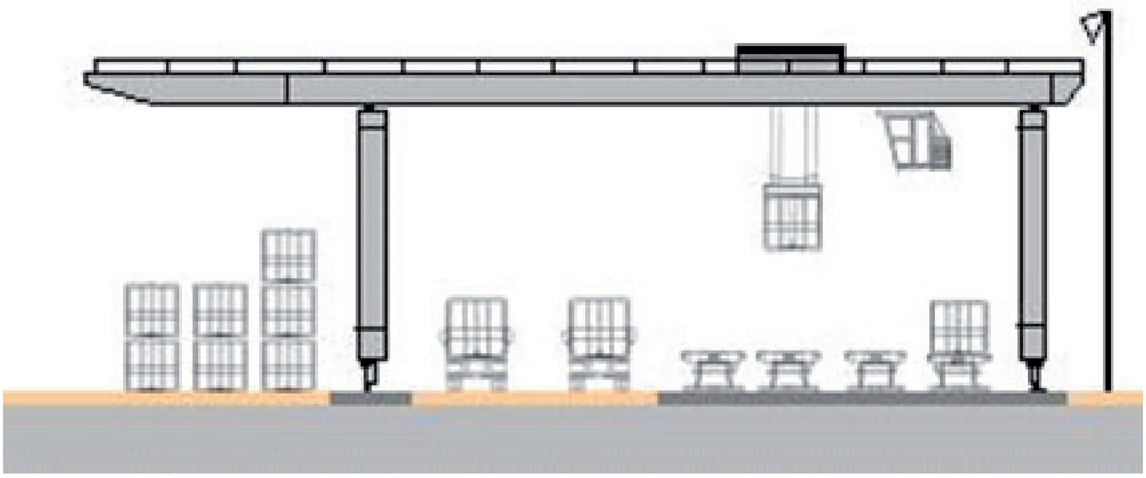
10.1 - Intermodal terminal concepts in Europe

As a matter of fact, there are various terminal concepts applied in Europe. The differences can be attributed to cultural, economic or historical reasons. In spite of that, during the last 10 to 15 years, one terminal concept providing common or very similar features has become more and more popular across Europe. This particular concept can be characterised as follows:

- The terminals are built “around” a handling area ensuring the transfer between road and rail. This handling area is best described as a module which can be multiplied if more capacity were to be required. The handling area , with capacity to handle an annual volume of 120,000-150,000 units, typically has the following components (see ***Figure 47***):
    - 4 tracks of each 600 – 700 m (2,000 – 2,300 ft)
    - 1 driving lane and 1 loading/unloading lane for lorries
    - 3-4 intermediate storage lanes
    - 2 rail-mounted gantry cranes over all tracks and lanes
- Additionally the terminals provide for 2-4 arrival/departure tracks adjacent to the facility or at nearby marshalling yards or rail stations.
- European rail/road terminals are used to allow all lorries entering the handling area. They consequently also carry out live-lifts between lorry and train.

- The check-in/check-out is usually a manual gate with desk service for drivers. There are few exceptions with semi-automated clearance processes.

Figure 47. Typical terminal concept in Europe: cross-section



10.2 - Terminal design and operational concepts in the U.S.

10.2.1 Ownership and management models

The overwhelming majority of intermodal terminals in the U.S. are owned by the major freight railways. They are part of the fully-integrated private railways. These facilities have been built and completely financed by them. In most cases the railways do not only control but also manage the terminals themselves using their own staff.

Some U.S.railways, however, have opted for a "buy" strategy in some places. The outsourcing of terminal operation functions can have a very different scope, as follows:

- The central terminal management remains with the railway owning the facility but this railway has tendered out to suppliers some functions such as wagon repair shops or the management of handling equipment.
- The railway keeps central control of all terminal functions but has outsourced every single task basically to another supplier.
- The railway has tendered out the entire management of the facility to a third party.

The intention of every outsourcing practice is to reduce the cost of terminal operations. Most railways have chosen a tender process to identify the best supplier(s).

The survey was not able to produce evidence to assess whether railways pursuing outsourcing strategies have done better than those who manage terminals completely on their own.

Apart from railway-owned terminals, there are so-called “private” facilities for example at plants of the automotive industry. Moreover, the situation at U.S. sea ports for on-dock terminals, i.e. facilities located on the docks of the waterside container-handling site, differs from the general principle. The port authorities own the land, which they lease to railways. The latter are then responsible for building the superstructure of the facility and manage it. It is not clear how the land is allocated to railways and whether they obtain a temporary or unlimited licence for operating the terminal. The allocation of land is most likely related to existing so-called rights-of-way of railways in the port area.

10.2.2 Terminal design, process organisation and equipment

U.S. intermodal terminals are usually built to a basic standard concept all over the country and vary virtually only in capacity and size. What largely determines the layout of terminals are the distinctive process organisation and handling technologies generally deployed:

- All lorries delivering outbound intermodal units must run through a strict check-in process at the in-gate (see more details in 10.1.3). The same applies for the out-gate clearance if a lorry has picked up a shipment for road delivery.
- Intermodal terminals in the U.S. are characterised by **the indirect handling** of intermodal units. Lorry- and rail-side operations are usually completely separated. The delivery lorries park the intermodal loading units for rail shipment in an interim parking area, and these units are subsequently transferred to the handling area by terminal vehicles. At some facilities, however, railways allow lorries to enter the handling area for direct or live-lift load transhipments. In most cases the railways block certain time-slots for the direct handling of intermodal units to avoid interferences with internal movements.
- Current U.S. terminals feature a **wheel-based operation**. Every intermodal loading unit is parked on wheels on the interim parking spot. This is self-evident for a trailer, but containers remain on the chassis used for their road conveyance. The complete set – container on chassis – is then taken by terminal tractors into the handling yard. No reach-stacker or fork-lift truck is required at the interim parking area. The prerequisite for this process organisation is that each intermodal customer is member of a **chassis pool**, uses one railway’s chassis pool, or has his own fleet of chassis delivered for use by the railway.

- The “heart” of the terminal, the handling yard, also features a standard design. The handling capacity of a facility is easily increased by multiplying the handling modules. Each includes the following components:
  - One handling track
  - One parking lane for the trailers and chassis-mounted containers to be transferred onto wagons
  - One driving lane for vehicles.
  - Mobile **rubber-tyred gantry cranes (RTG)** spanning the entire handling module to enforce the transhipment of units (see ***Figures 48 & 37***).
- Parking or support tracks for the intermediate parking of trainsets are also required. U.S. railways try to locate them adjacent to the terminal.

This terminal handling concept results in a typical layout adopted by all major railways and implemented at most intermodal terminals. Two examples are given in ***Figures 48 & 49***.

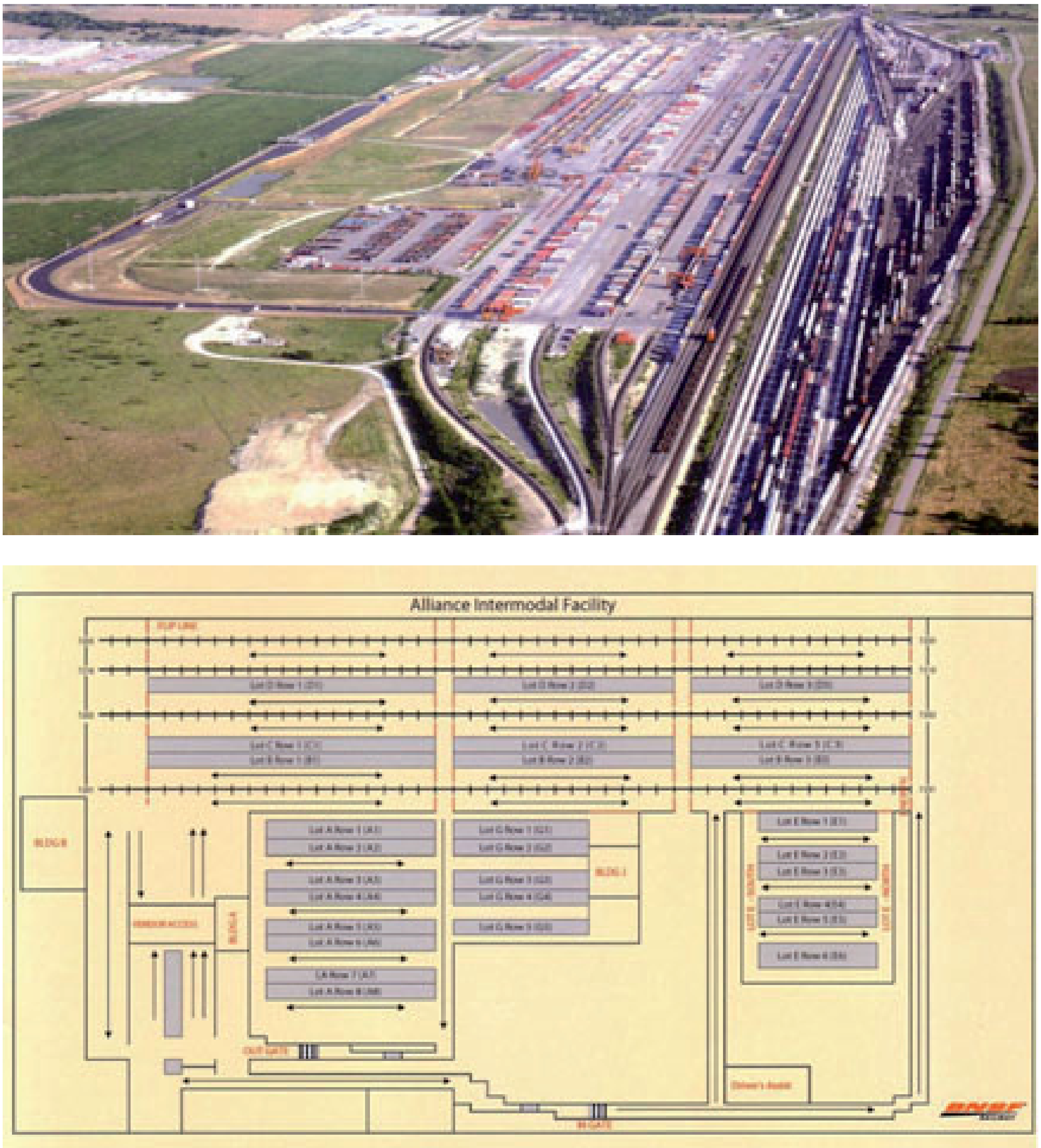
Figure 48. Rubber-tyred Gantry Crane and terminal tractor (tugmaster)

Source: Marian Gaidzik (HaCon)

Figure 49. UP intermodal terminal ICTF Los Angeles (CA): aerial and cross-section

Source: Port of Los Angeles

Figure 50. BNSF intermodal terminal Alliance (TX): aerial and layout map



Source: BNSF

10.2.3 Recent developments in terminal design and equipment

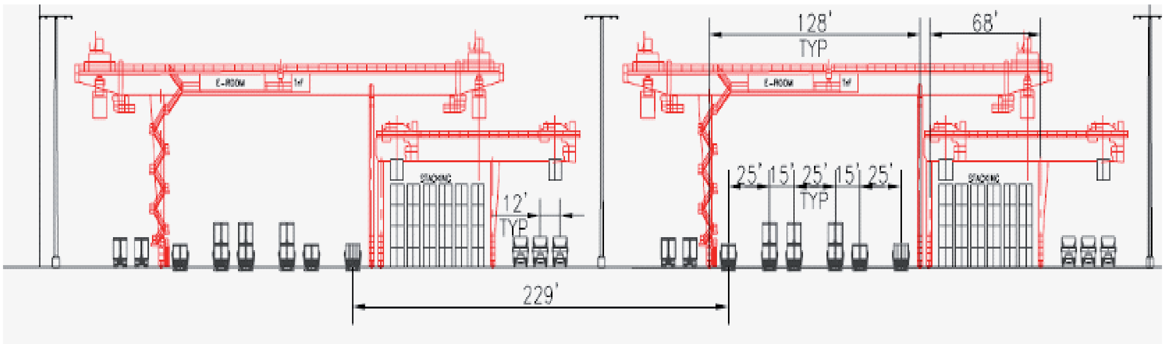
In recent years this well-proven terminal concept has been put on trial. Interestingly, the decisive impulse came from administrations especially of U.S. west-coast states such as California or Washington. California is also known in Europe for pursuing a rather independent environmental policy, which now extends to rail freight and intermodal traffic.

The U.S. states have determined a set of environmental objectives for example with respect to air pollution, noise or land use, which have to be complied with a specified time-frame. In order to match these environmental objectives e.g. in Los Angeles or Seattle, the U.S. railways were required to re-design terminals. The result of the process of re-thinking terminal layout and process organisation is shown by two examples from Los Angeles in ***Figures 50-51***. Both the building of BNSF's new facility and the complete re-construction of UP's twenty year old ICTF terminal must be finalised during the next few years. The new terminal concepts are characterised as follows:

- To match the air-pollution objective, the railways have been forced to shift from diesel-driven handling equipment to electrically-powered rail-mounted gantry cranes (RMG), and reduce or even eliminate terminal-internal tractor movements.
- These prerequisites have led to a terminal concept featuring a fairly compact layout of handling modules composed of wide-span cantilever gantry cranes and a set of handling tracks under the crane portal .
- Basically, the indirect process organisation shall be maintained. However, lorries will now have direct access to cranes. Trailers can be parked under the cantilevers of gantry cranes, while the new concept provides an interim storage area for containers under the portal. Containers can even be stacked, which raises the efficiency of land use and also contributes to improving the environmental footprint of intermodal traffic.
- Owing to the direct access of trucks to handling, yard live-lifts can also be carried out.
- The BNSF facility features so-called nested gantry cranes. They perform the transfer between lorries and interim storage space for containers. The large gantry cranes move the container between this area and the wagons. Live lifts can also be performed off the backside cantilever.

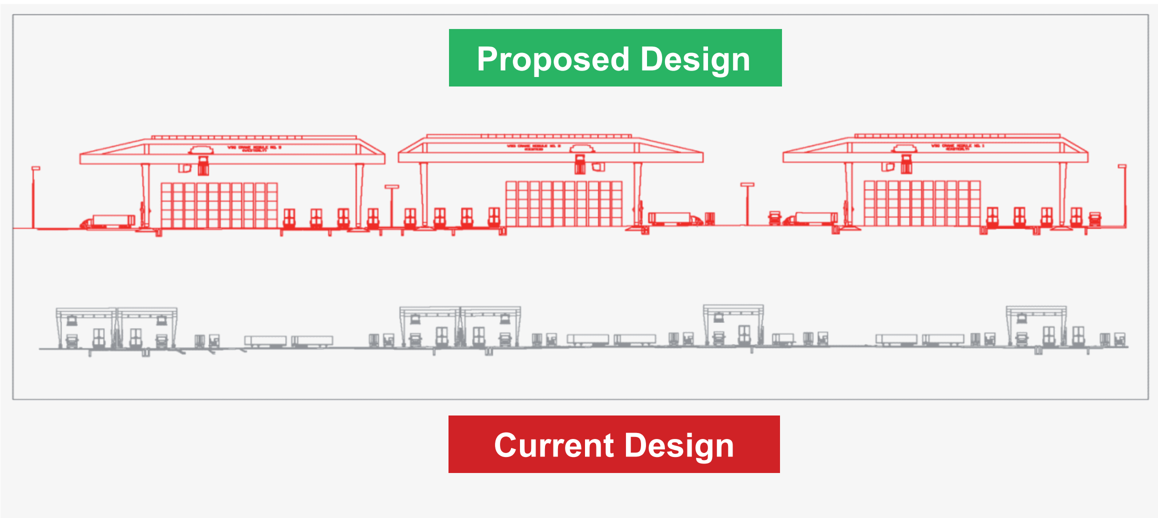
However, what in the first place was driven by environmental objectives can also improve the economics of intermodal traffic. According to BNSF experts, these objectives will translate into a 20% minimum saving on investment and a saving in excess of 20% through application of the new terminal concept. Against this background, BNSF is set to install this concept not only in west-coast sea ports such as Seattle and Los Angeles where environmental policy is rather strict, but also at inland terminals like Memphis or Kansas City.

Figure 51. BNSF terminal Southern California International Gateway (SCIG) in Los Angeles (CA): cross-section of facility



Source: Port of Los Angeles

Figure 52. Redesign of UP's intermodal terminal ICTF Los Angeles (CA)



Source: Port of Los Angeles

10.2.4 Customer's intermodal "life cycle"

This section explains, from the customer perspective, the processing or "life cycle" of an intermodal shipment at intermodal terminals in the U.S.

The central IT reservation systems are actually the "heart" of intermodal traffic with all major U.S. railways. This ensures an efficient management of all processes related to shipping intermodal units and, in particularly, accelerates terminal procedures while guaranteeing a very high level of safety and security. Any shipment for carriage by an intermodal service, must be booked with the railway in question. Railways attempt to convince their customers to book electronically. According for example to Norfolk Southern officials, 95 % of all bookings are processed via electronic data interchange (EDI) today. Those customers who continue to book via fax are billed an extra fee, which is justified given the additional cost entailed.

A delivery lorry arriving at a terminal with an intermodal shipment, which has not been booked, will not be cleared at the check-in-gate. Either the lorry must leave immediately, or the driver is ushered to a help desk where he/she can clarify the issue with the company which ordered him/her. U.S. railways also recommend advance-submission of the bill of lading (waybill) electronically. At some terminals there are "fast tracks" ensuring an accelerated clearing process for those lorries. On the other hand, the check-in process requires more time if drivers provide a paper version of the bill of lading.

The check-in process includes the following procedures:

- check of bill of lading and other documents, if applicable;
- cross-check of booked (!) versus actual equipment (container, trailer) identity;
- registering of chassis identity, if applicable;
- damage inspection of equipment, inspection of seals;
- instructions for the driver as to which parking lot he/she shall take the intermodal shipment.

Usually the railways do not check immediately whether the driver has deposited the equipment on the right spot. The driver of the terminal tractor who brings the shipment to the handling yard must however cross-check with the database.

During the last 20 years the U.S. railways have heavily invested in state-of-the-art technology to improve and accelerate the gate clearance process. Since about ten years, virtually all new terminals are fitted with Automated Gate Systems (AGS), and older facilities are being modernised in this respect. Even if the systems in operation are different, they have common features as follows (see also ***Figures 53 & 54***):

- Lorry drivers do not have to leave their vehicles anymore. Based on advanced booking data – as a prerequisite - they proceed directly to check-in posts equipped with special computers with screen and simplified keyboard, plus a microphone (see also ***Figures 52 & 53***). This is the only connection to the gate house, where an operator is charged with controlling and managing all processes and eventually communicating with drivers.
- To start the clearance process, drivers typically must indicate a booking reference code and the identity code of the intermodal unit to be shipped.
- Damage inspection and identification of shipments are carried out automatically. Lorries drive through a camera portal designed to record damage to the equipment. Nowadays OCR (optical character recognition) cameras are frequently installed as well. The software application is able to "read" the identity code of containers, trailers and chassis automatically. The rate of correct readings is claimed to be 85 to 95 %. The operator, however, obtains the pictures from the video cameras and is thus able to cross-check the results provided by the OCR-based software.
- When the shipment has been cleared, a paper slip will be printed containing information on the parking lot to which the shipment should be driven.

Figure 53. Automated Gate System: driver clearance post

Source: CN

Figure 54. Automated Gate Systems at CN intermodal facility in Brampton

Source: CN

10.2.5 Size of intermodal terminals

In Europe, large intermodal terminals handle about 200,000 to 300,000 units annually. In the U.S. there are many facilities handling between 250,000 and 500,000 units per year. The largest terminals are in the "hot spots" of American intermodal traffic, in Chicago and Los Angeles. BNSF's largest terminal actually is in L.A. with an annual capacity of about 1.5 million lifts. ***Figure 55*** represents the top ranking terminals of Union Pacific showing that eight of ten terminals are in the range of the biggest European terminals.

Over the last few years, the U.S. railways have tended to build large and central terminals in key economic centres called "megapolitan areas" and close to smaller sites, the aim being to boost the efficiency of rail transport. According to customers, the effect of this policy is that road distances to terminals have increased and drayage costs reached a comparatively high ratio. This evolution is regarded as critical since it might raise the resistance to using intermodal services.

Figure 55. Handling volume of Union Pacific' major intermodal terminals: 2007

Top 10 Intermodal Terminals	Annual Lifts 2007
ICTF (Los Angeles), California	719,000
Marion (Memphis), Tennessee	414,000
East Los Angeles, California	360,000
Global II (Chicago), Illinois	353,000
Global I (Chicago), Illinois	310,000
Dallas, Texas	292,000
Seattle, Washington	250,000
Yard Center (Chicago), Illinois	238,000
Oakland, California	236,000
Englewood (Houston), Texas	214,000

Source: UP website

10.3 - Financing of intermodal terminal investments

10.3.1 Financing of intermodal terminal investments in the U.S.

Up to now, the U.S. railways have financed their intermodal terminal investments completely from their own resources.

They are all the more “irritated” to observe projects initiated by cities or regional development agencies securing public funds or a 25 % tax discount for establishing intermodal facilities.

There are also some projects which may be categorised as public-private partnerships. Public administrations or related companies build and own a terminal presumably to promote regional development. They strike a deal with a railway that commits to serving the facility with intermodal trains. NS has given the example of a West Virginia terminal in this respect.

10.3.2 Financing of intermodal terminal investments in Europe

In Europe, intermodal terminals are wholly privately financed very seldom. Usually the investor can obtain public funds, though the extent and also the scope of funded components varies considerably. Since the funding schemes are intended for implementation on a national scale, the system is not very transparent. Given that, we can distinguish the following schemes:

(1) Financing of investments in national state railways terminals:

- States cover full cost or cost of infrastructure, while operator pays for superstructure.
- Terminal operations had often been entrusted to national intermodal operators or railways.
- Owing to EU legislation requiring non-discriminatory access, operations are now integrated into infrastructure manager companies or in joint ventures with other companies.

(2) Financing of investments in private terminals:

- Very few such schemes.
- Most of them not “really” private: e.g. Investment by local port or railroad authority (shares held and financed by city administrations).
- Regional subsidies.

(3) Investment by private companies in public terminals fostered by a range of subsidies across Europe:

- EU basically allows up to 50 % funding of infrastructure and 30 % of handling equipment
- France & Italy: regional authorities give approximately 30 % grants towards investment in handling equipment, IT systems, etc.
- Netherlands: up to 50 % state and region grants
- Switzerland (non-EU): up to 80 % grant or zero-interest loan on total investment
- Germany: up to 85 % state grant on total investment

Source: CN

11. REGULATORY FRAMEWORK

11.1 - Regulatory framework for intermodal traffic in the U.S.

The regulatory framework for intermodal traffic in the U.S. can be divided into the following sections:

(1) Regulatory policy

The deregulation of the U.S. railway industry since the Staggers Act has brought economic freedom for intermodal traffic. Basically speaking, intermodal traffic is no longer subject to the regulation of prices and quantities or to the provision of coverage for a certain area .

(2) Infrastructure financing

For the time being, the U.S. railways finance their infrastructure investments on their own. This applies both to the rail network and intermodal terminals.

However, rail infrastructure increasingly seems to be becoming an issue of public concern. This has already led to a slight modification of the principle whereby railways, because they are private companies, should not be entitled to funding of their infrastructure by the administration. Nowadays the public authorities consider certain rail-related investments necessary to ensuring their policy objectives such as reduction of environmental pollution, improved transport safety, relief of congested highways, promotion of regional development, ports and the domestic economy.

Against this background, more and more public-private partnerships have been initiated or have already been realised such as:

- Alameda corridor in Los Angeles
- Heartland corridor of NS in the eastern U.S.
- Chicago city project

- Patriot corridor (NS)
- Regional subsidies

The environmental benefits rail traffic generates for the public has become a major argument for the U.S. railways when they call on the Federal Administration to support railways in ensuring the necessary infrastructure investments. They do not demand funds, preferring instead a tax credit of about 25 %.

(3) Environmental policy

Environmental policy increasingly impacts on intermodal traffic. On the one hand, its implementation will lead to stricter pollution-reduction schemes for lorries and higher diesel prices. On the other, intermodal traffic is also subject to more severe environmental standards as shown above for intermodal terminals.

11.2 - Regulatory framework for intermodal traffic in EU Member States

EU regulatory policy has had the following major impacts on intermodal traffic:

- Intermodal service providers are allowed to determine prices independently (no price regulation).
- No quota regulation
- Free market access to the intermodal services market both on domestic and international trade routes
- Free access to rail haulage services

In addition to the liberalisation of intermodal and railfreight traffic in the European Union, the EU and most European countries have implemented permanent or temporary legal or administrative measures governing intermodal transport. Some of them like Austria, Germany, Switzerland or the UK even, have developed an extensive framework of regulations. Basically, each of the measures deployed is intended to promote intermodal traffic – in practically any combination of transport modes – by giving incentives for an increased utilisation or offsetting “system disadvantages” compared with through-road traffic such as the necessity for intermodal transhipment. Where the Member States of the European Union (EU) are concerned, the instruments applied are generally safeguarded by EU legislation or the results of implementing EU regulations.

In addition to this, the European Commission has launched proprietary funding schemes such as the PACT and Marco Polo Programmes which are beneficial to intermodal services.

The incentives for intermodal transport are focused on four main areas:

- Terminal infrastructure
- Intermodal rail transport
- Road pick-up and delivery services (drayage)
- Intermodal technology and organisation

Figures 56 & 57 present a general overview of instruments currently applied. The detailed rules of application, the selection criteria or the scope and financial instrument of funding, however, may differ from country to country.

The implementation of beneficial actions for the intermodal industry is based on an extraordinarily broad political consensus across almost all political parties, professional organisations and the majority of populations in Europe, whereby a “modal-shift policy” should contribute to ensuring a “sustainable” logistics and freight transport system addressing the following issues:

- de-congesting motorways
- relieving congested container ports
- reducing the environmental impact of freight transport: sodium dioxide, carbon monoxide, unburned hydrocarbons, particulates
- fighting global climate change and reducing carbon-dioxide emissions
- raising the efficiency of freight transport and logistics by facilitating modal transfers and employing for every purpose the most appropriate mode
- strengthening the competitiveness of the domestic or respectively European economy

Public consent to this policy has even strengthened in recent years despite the predominance of the market economy paradigm in economic policy. This attitude is motivated mainly by concerns over global climate change.

Source: CN

Figure 56. Incentives for intermodal transport in Europe: infrastructure- and rail-transport-related instruments

Area	Regulatory scheme	Impact on CT	Who can benefit?
Infrastructure	State grants for building new intermodal terminals or enlarge existing sites	Reduction of terminal handling cost and thus total intermodal supply chain cost	Private and public companies
	EU grants for improving intermodal terminals or procuring handling equipment	Reduction of terminal handling cost and thus total intermodal supply chain cost	Private companies
Intermodal rail traffic	State grants for starting up domestic intermodal services	(1) Reduction of economic risks of start-up phase; (2) reinforcement of domestic networks	Private companies
	State grants for existing domestic intermodal services:	Reduction of operational and, consequently, total intermodal supply chain cost	Private companies; state-owned railways
	State grants for intermodal services considered as public transport services (tender process)	Reduction of operational and, consequently, total intermodal supply chain cost	Private companies; state-owned railways
	EU grants for starting up international intermodal services	(1) Reduction of economic risks of start-up phase; (2) reinforcement of European network	Private companies

Source: KombiConsult

Figure 57. Incentives for intermodal transport in Europe: road-transport- and technology-related instruments

Area	Regulatory scheme	Impact on CT	Who can benefit?
Intermodal road transport (drayage)	Exemption from road vehicle tax	Reduction of drayage and total cost of intermodal operations	Owner of truck which is exclusively deployed for intermodal drayage services
	Reimbursement of road vehicle tax	Reduction of drayage and total cost of intermodal operations	Owner of truck, which is employed at least partly for intermodal drayage services
	Increased maximum gross weight of road vehicles	(1) Increased payload (2) potential for increased revenues	Every company using intermodal services
	Exemption of pick-up and delivery (drayage) from weekend and/or holiday road driving bans	Pick-up and delivery of intermodal shipments during restricted periods	Every company using intermodal services
	Exemption of pick-up and delivery from restrictions on cabotage transports (= carriage of domestic freight by trucking company established in other country)	(1) Create parity with truck on cross-border traffic (2) Economies of scale (1 drayage truck conveys several loads)	Every company using intermodal services
Technology	State grants (contribution to cost of investment) or loans with reduced interest rates for purchasing equipment (loading units)	(1) Reduction of equipment and total intermodal logistics cost; (2) facilitation of market access and procurement of special equipment	Every company using intermodal services
	State grants (contribution to investment) or loans with reduced interest rates for purchasing intermodal wagons	(1) Reduction of equipment and total intermodal logistics cost; (2) facilitation of market access and procurement of special equipment	Private companies; state-owned railways
	State grants for mode-integrating IT systems and external training costs	(1) Facilitation of market access; (2) improved cooperation between road and rail; (3) optimization of traffic flow	Every company using intermodal services

Source: KombiConsult

12. KEY DRIVERS OF INTERMODAL GROWTH

12.1 - Key drivers of intermodal growth in the U.S.

(1) Deregulation of rail freight traffic:

- Productivity gains;
- Mergers: economies of scale; reduction of interfaces

(2) Clear, easy to understand and rather standardised business models and distribution channels

(3) Intermodal service innovations

- Dedicated intermodal services
- Service levels
- Guaranteed services
- Partnerships with logistics service providers: parcels & motor carriers, steamship lines

(4) Outstanding improvement of performance of service; goal: 92% rate of punctuality.

(5) Technological innovations

- Double-stack wagons
- Shuttle trains
- IT-based central booking/reservation systems
- RFID and OCR identification technologies at terminal
- Standardised intermodal equipment

(6) Heavy investments in rail and intermodal traffic:

- Enlargement of network from single to double or triple track line
- Raising of clearance (double-stack)

- Advanced signalling systems (capacity increase)
- Terminals
- Intermodal wagons
- Locomotives

(7) Strong U.S. domestic economy

(8) Growth of maritime container traffic particularly since 2001: elimination of trade barriers for Chinese products

(9) Soaring price level in road transport since about 2005:

- Diesel price increase
- Reduction of lorry-driver workforce

12.2 - Key drivers of intermodal growth in Europe

(1) Growth of foreign trade and cross-border freight volumes between Member States of the European Union (EU):

- Elimination of trade barriers (European Single Market)
- Deregulation of freight transport sector
- EU enlargement

(2) Growth of global trade and maritime container traffic

(3) National port strategies: promotion of rail hinterland transport of seaborne containers

(4) Beneficial regulatory framework and/or dedicated subsidies to promote intermodal transport in some European countries (environmental policy; modal shift policy)

(5) New business models of intermodal operators (IO):

- Block-train services: IO define service parameters; train capacity risks shifted from railways to IO
- Stronger involvement in intermodal value chain (terminals, wagons, rail haulage, road pick-up and delivery)
- Downstream" and "upstream" extension of logistics service providers

(6) Restructuring of intermodal service supply:

- Cut-down of extensive networks serving every station, especially in domestic traffic
- Strengthening of competitive, viable trade routes

(7) Development of international intermodal networks following "Europeanisation" of freight and logistics

(8) Innovative and improved production systems such as shuttle trains, gateway or hub operational schemes

(9) Enhanced timetables matching customer requests

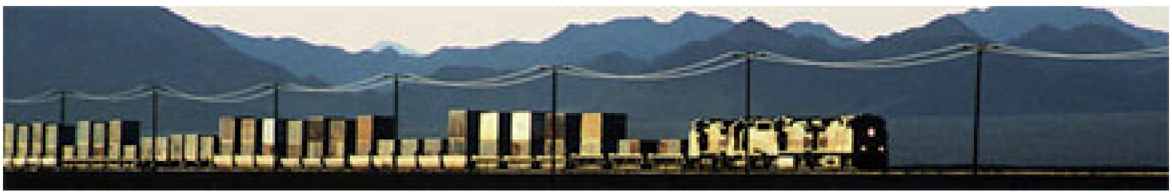
(10) Cost and service competition at railway and operator level

(11) Only rail – and barges for Antwerp & Rotterdam – were able to move the increasing volumes of containers

(12) Leading manufacturers e.g. from the chemicals, automotive or paper industry requesting intermodal solutions (cost + safety, supply chain, environment)

(13) Soaring price level in road transport since 2006:

- Diesel price increase
- Reduction of lorry-driver workforce
- More stringent EU regulation of lorry drivers' driving and resting hours
- Decreasing price pressure from Eastern European road-haulage companies



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