Decarbonization Transport Railfreight and Intermodality

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Why Railfreight?

How many Horse powers do you need to move 1000 t by Rail?

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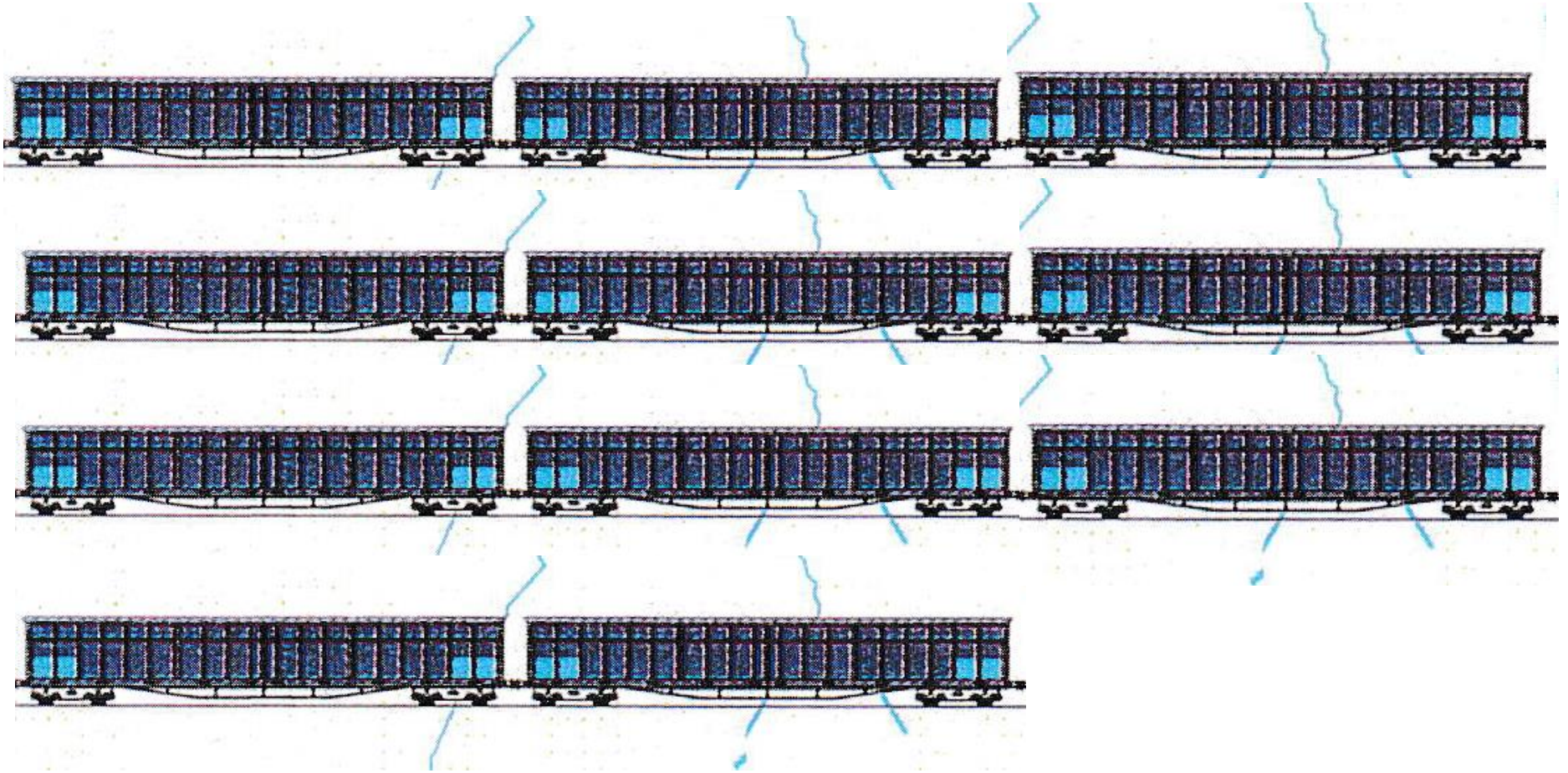

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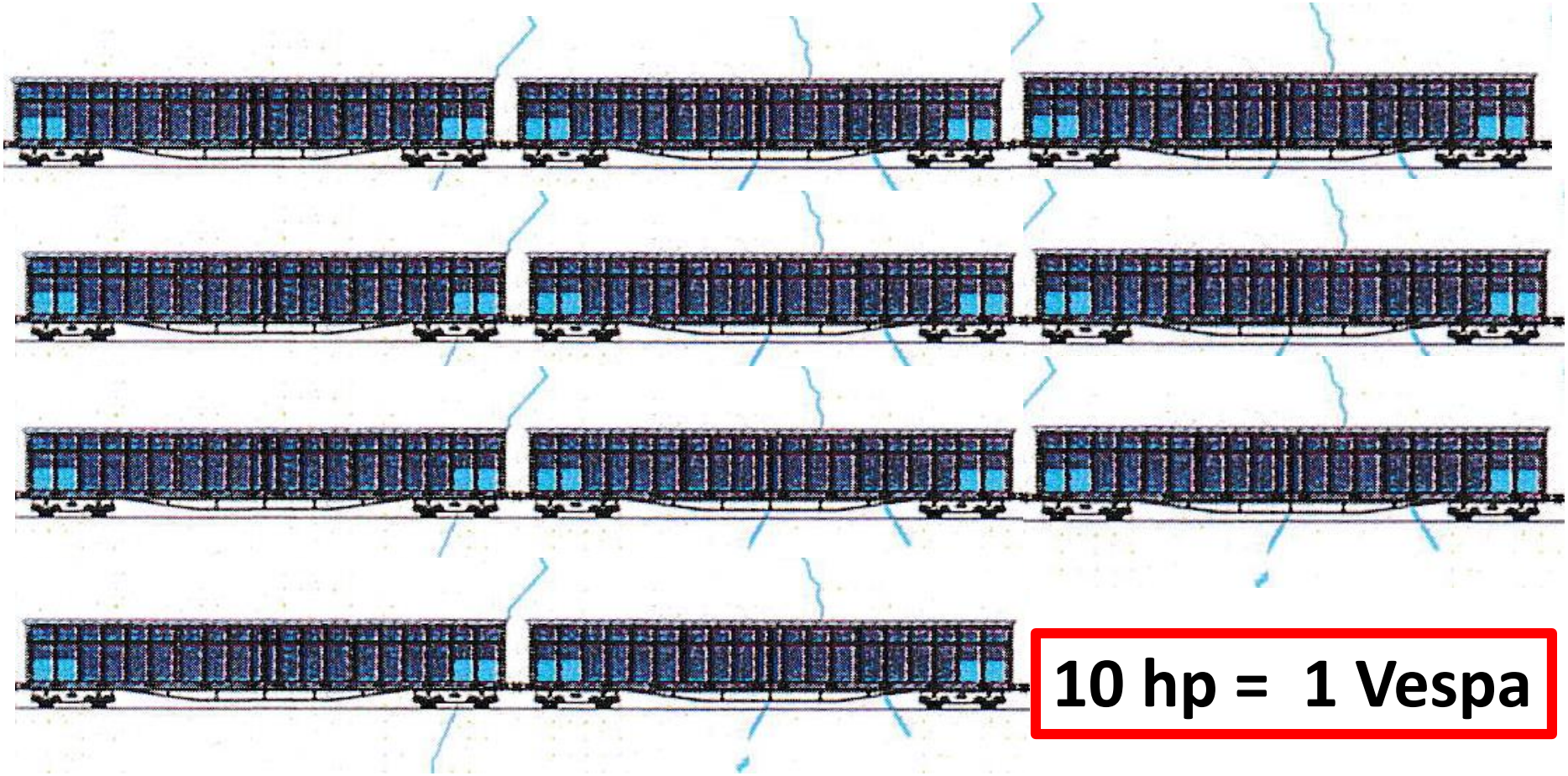
How many Horse powers do you need to move 1000 t by Rail?

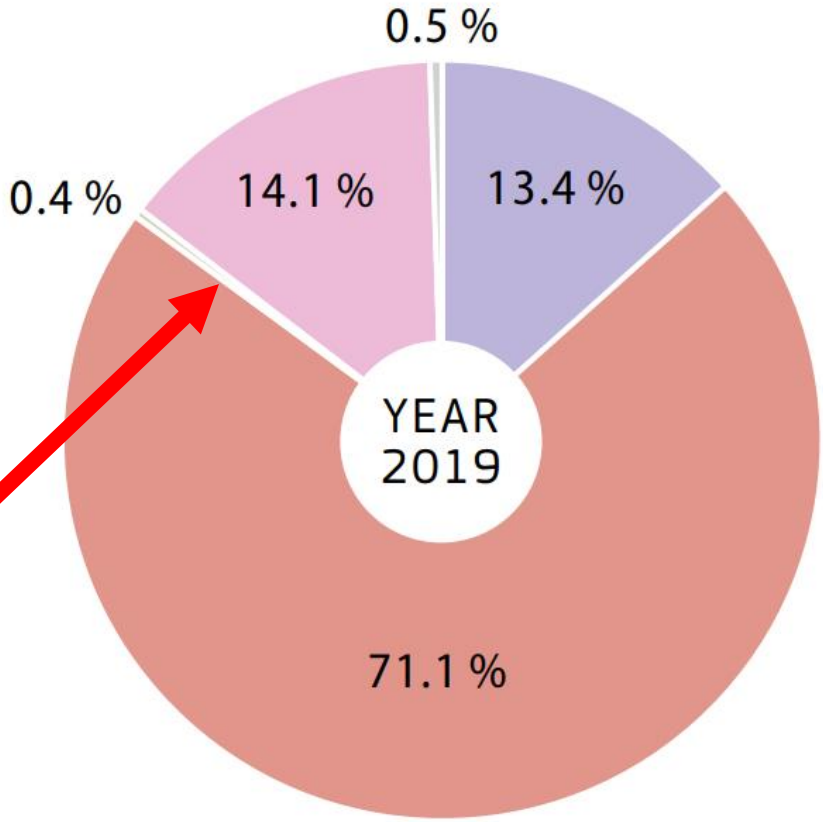


10 hp = 1 Vespa

Why Railfreight?

2019 <u>0,4 %</u> share: GHG-emissions

- TOTAL CIVIL AVIATION
- ROAD TRANSPORTATION
- RAILWAYS (***)
- TOTAL NAVIGATION
- OTHER



EU Transport in Figures, Statistical Pocketbook 2021

Why Railfreight?

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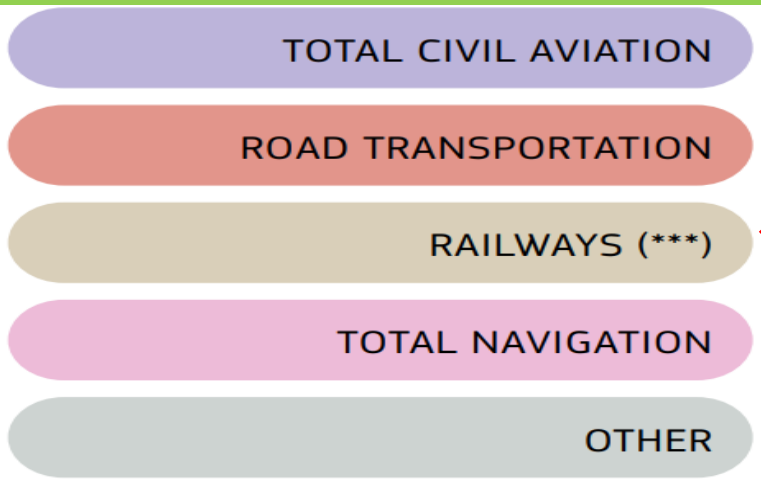
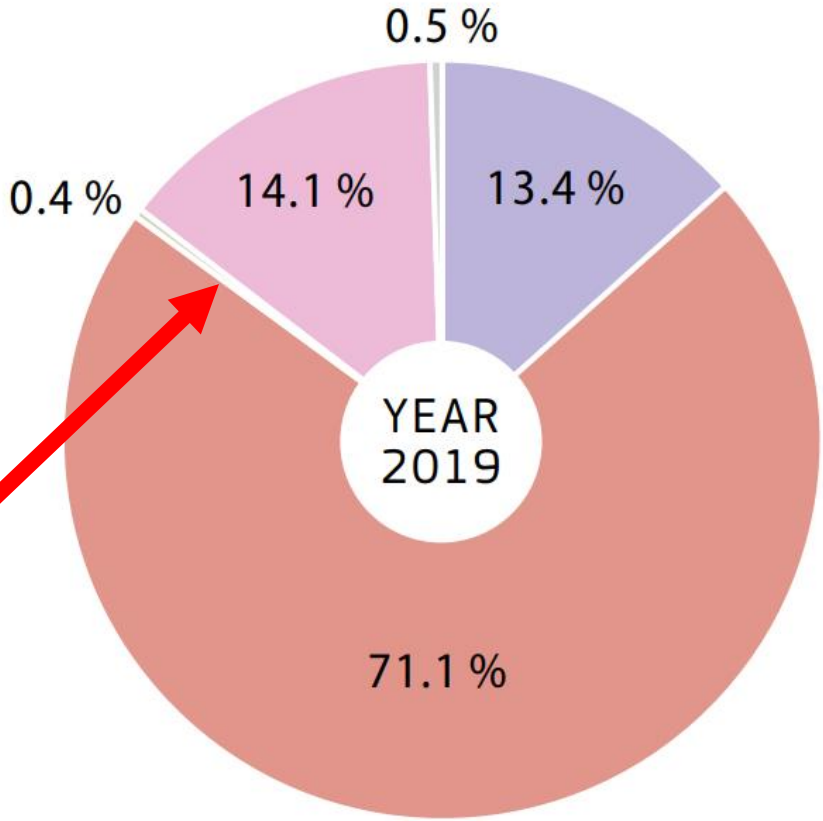
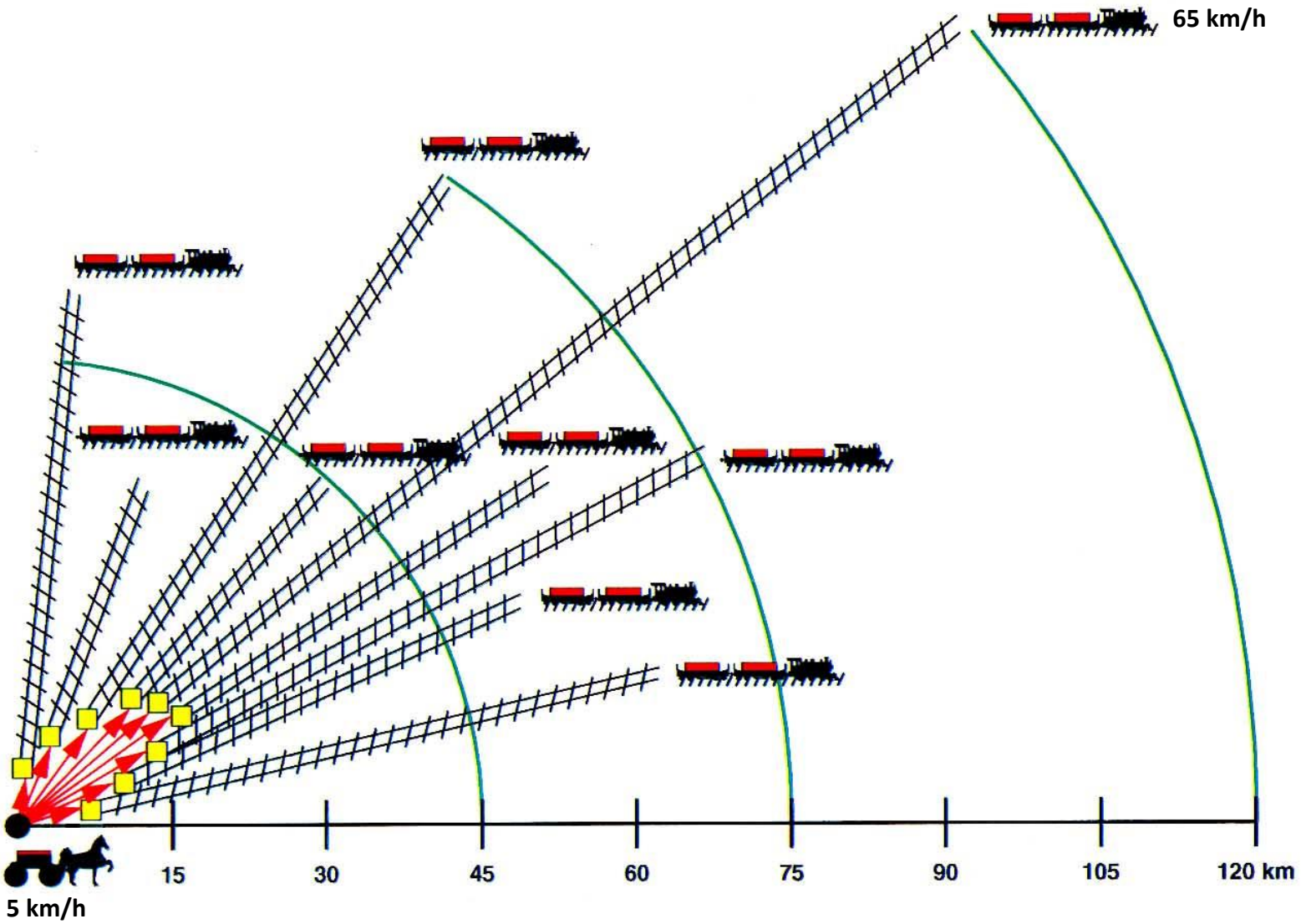




EU Transport in Figures, Statistical Pocketbook 2021

2019: BUT: <u>18 %</u> of tkm Modal-Share !

Europe at the turn of the 19th to the 20th century: Rail the dominant mode



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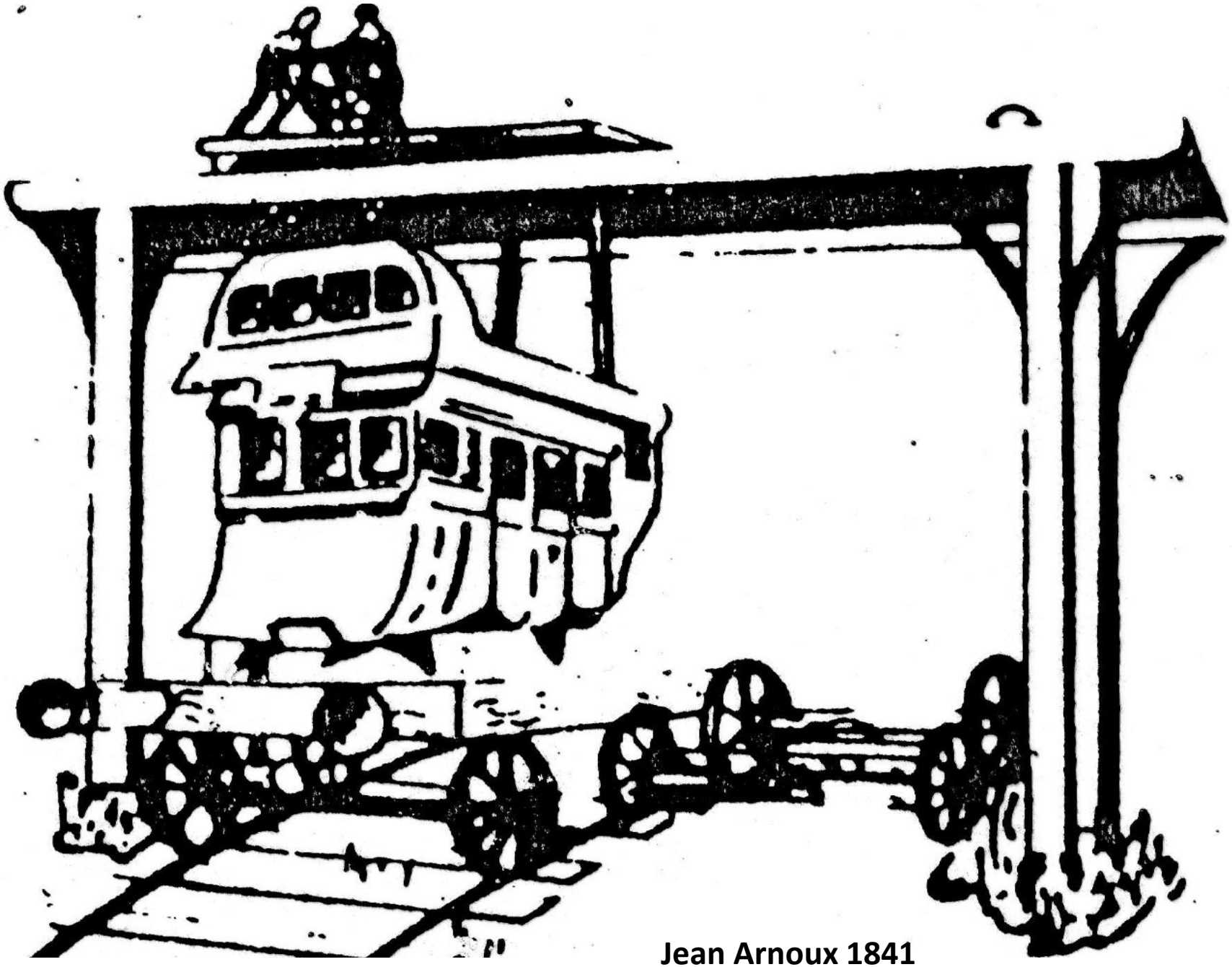
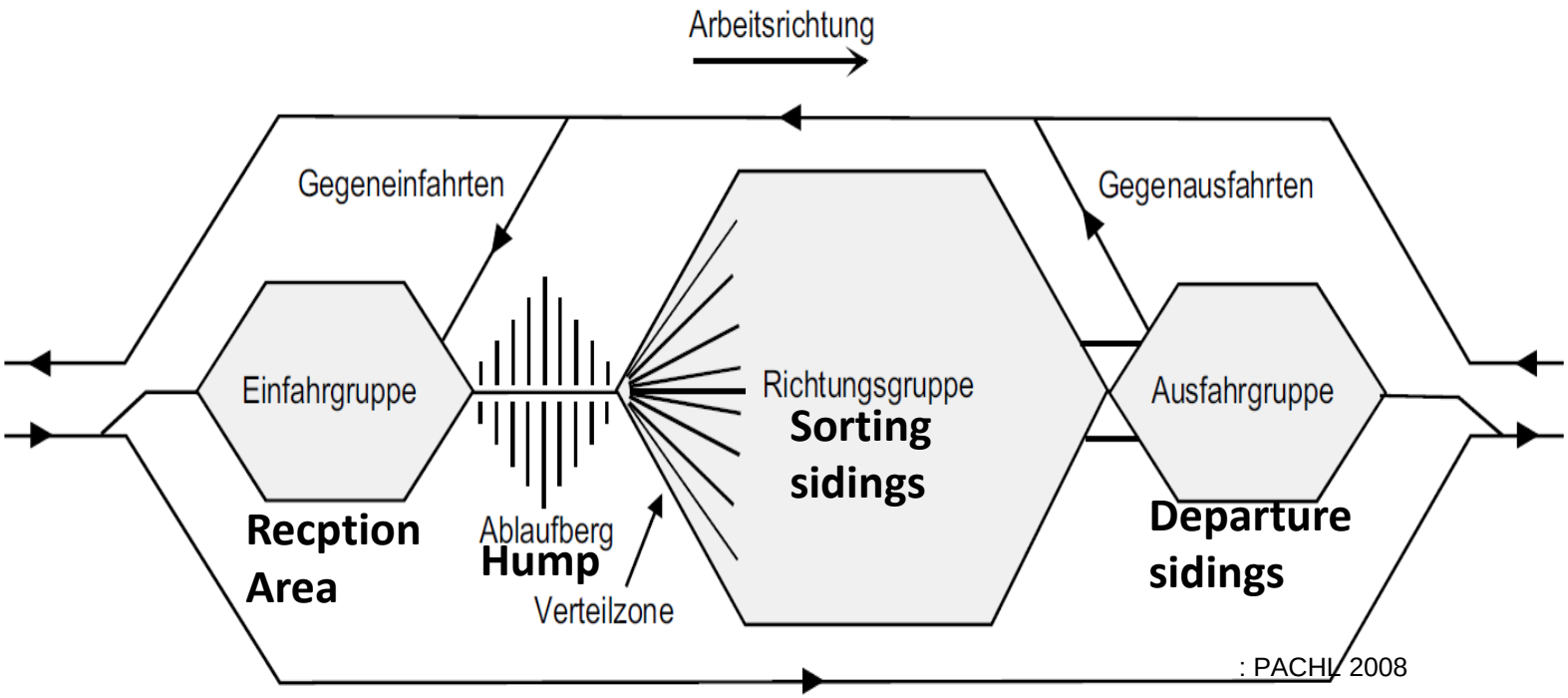


Jean Arnoux 1841

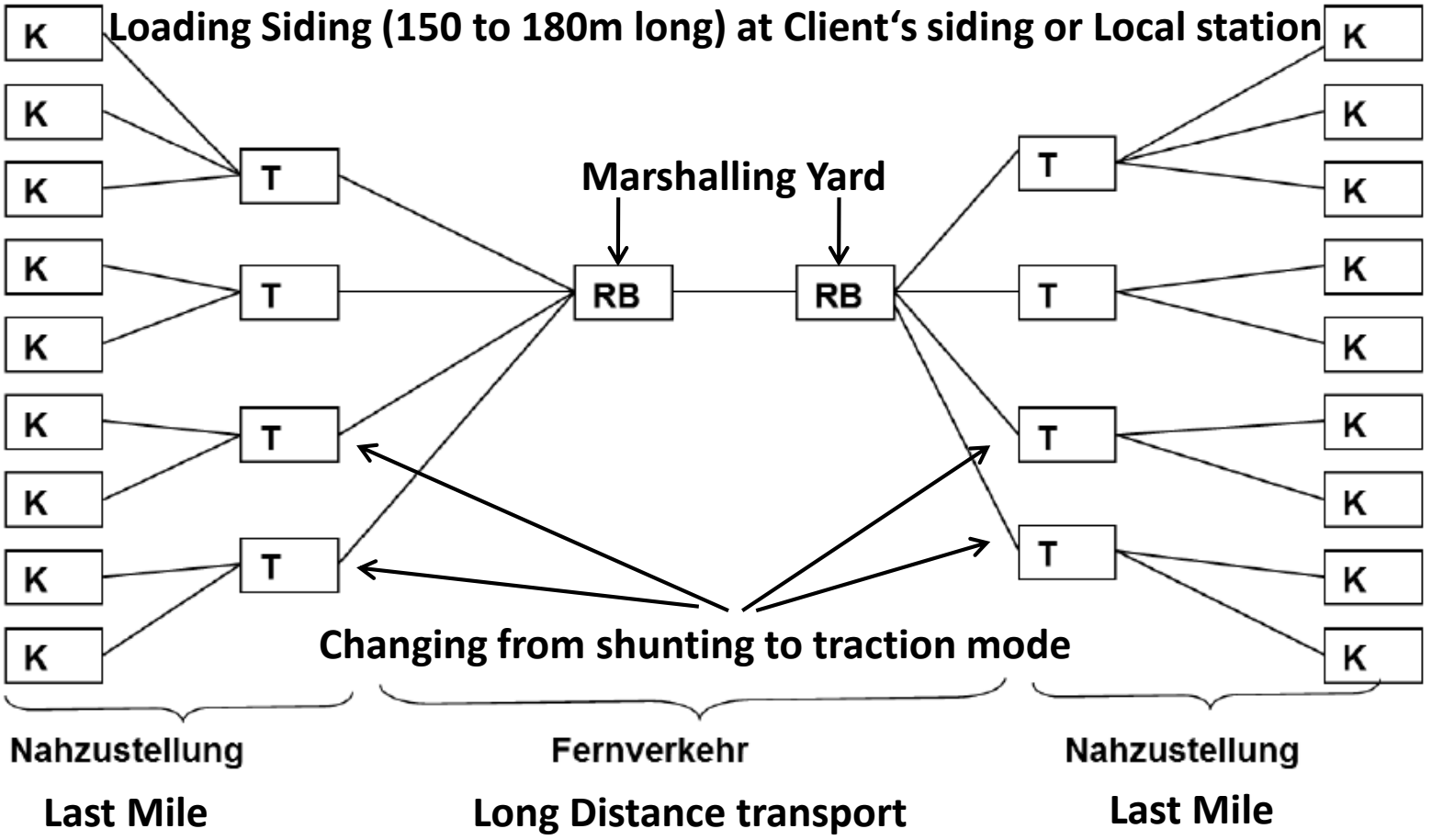
THE invention for Sigle Wagon Load-Railfreight: The classification Yard with Hump



First invented in Duisburg Speldorf 1876. Other Production schemes for Single Wagon Load:
Maximum potential capacity of the hump: + Switch Back (25-50 Wagons/h
300 Wagons/h + Push back (50 – 100 Wagons/h)

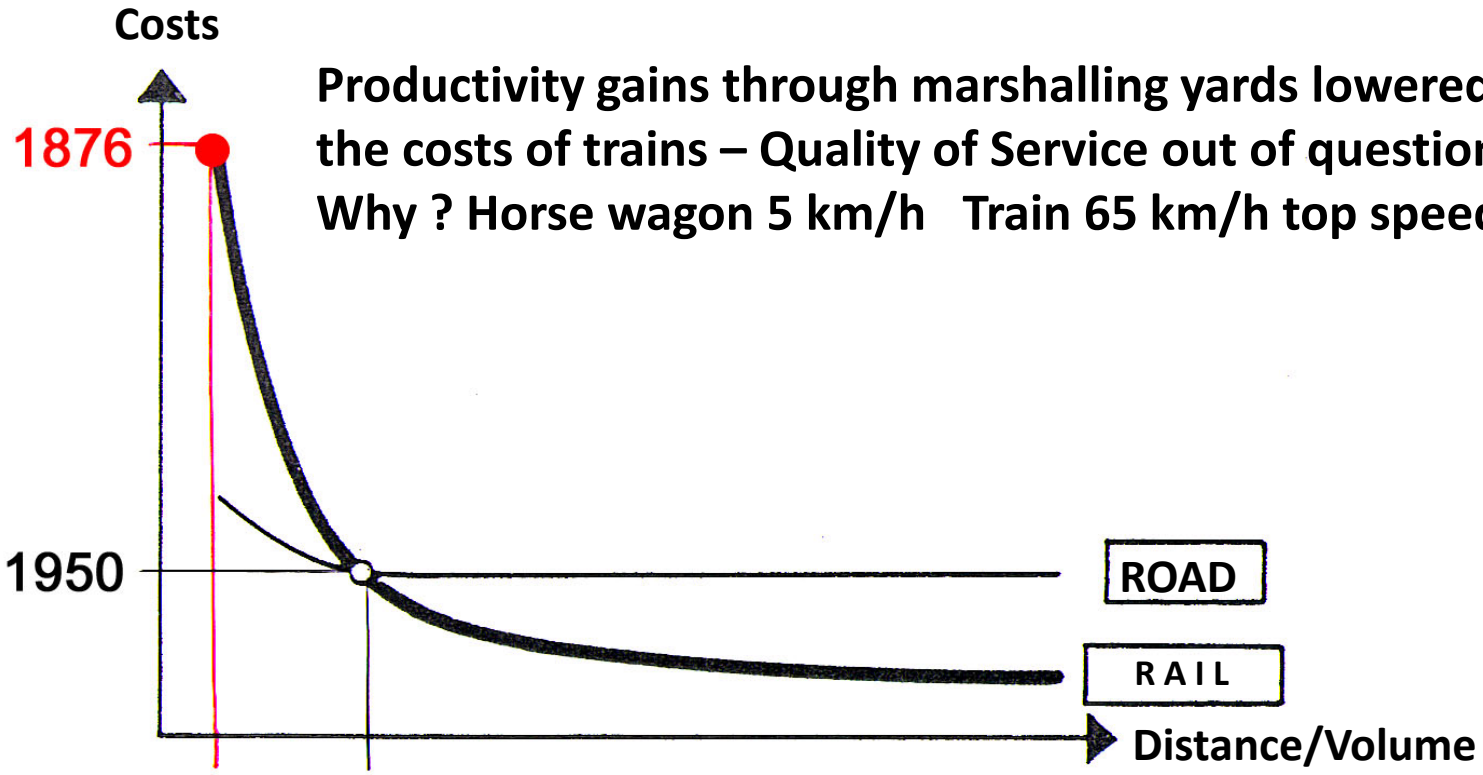
Source: coll. Hebeler

Problem of marshalling yards: Time consuming processes because of the spacial Seperation of access point to the rail system and train formation:



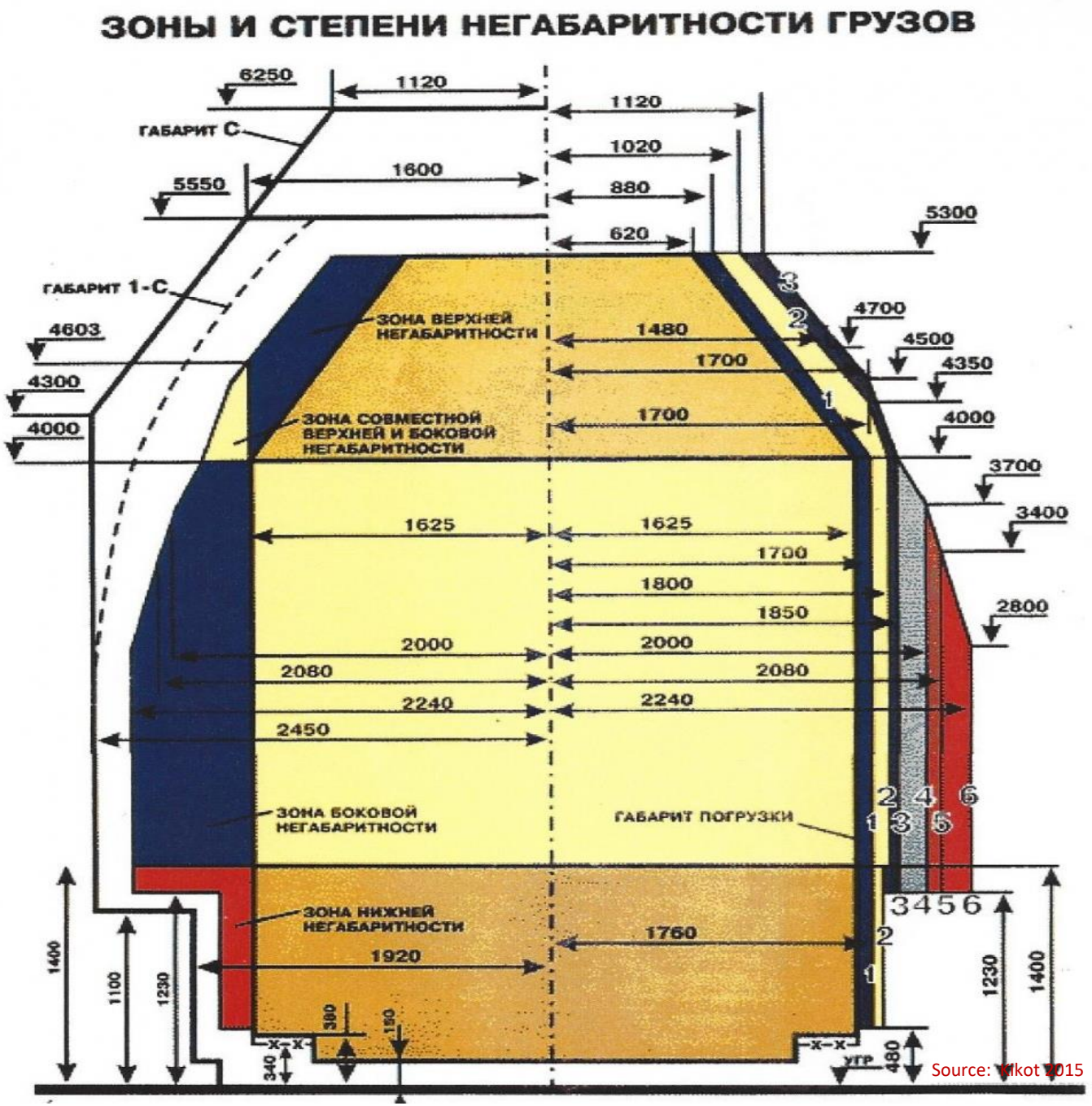
Source: Hoffmann

MONOPOLIST‘s STRATEGY:



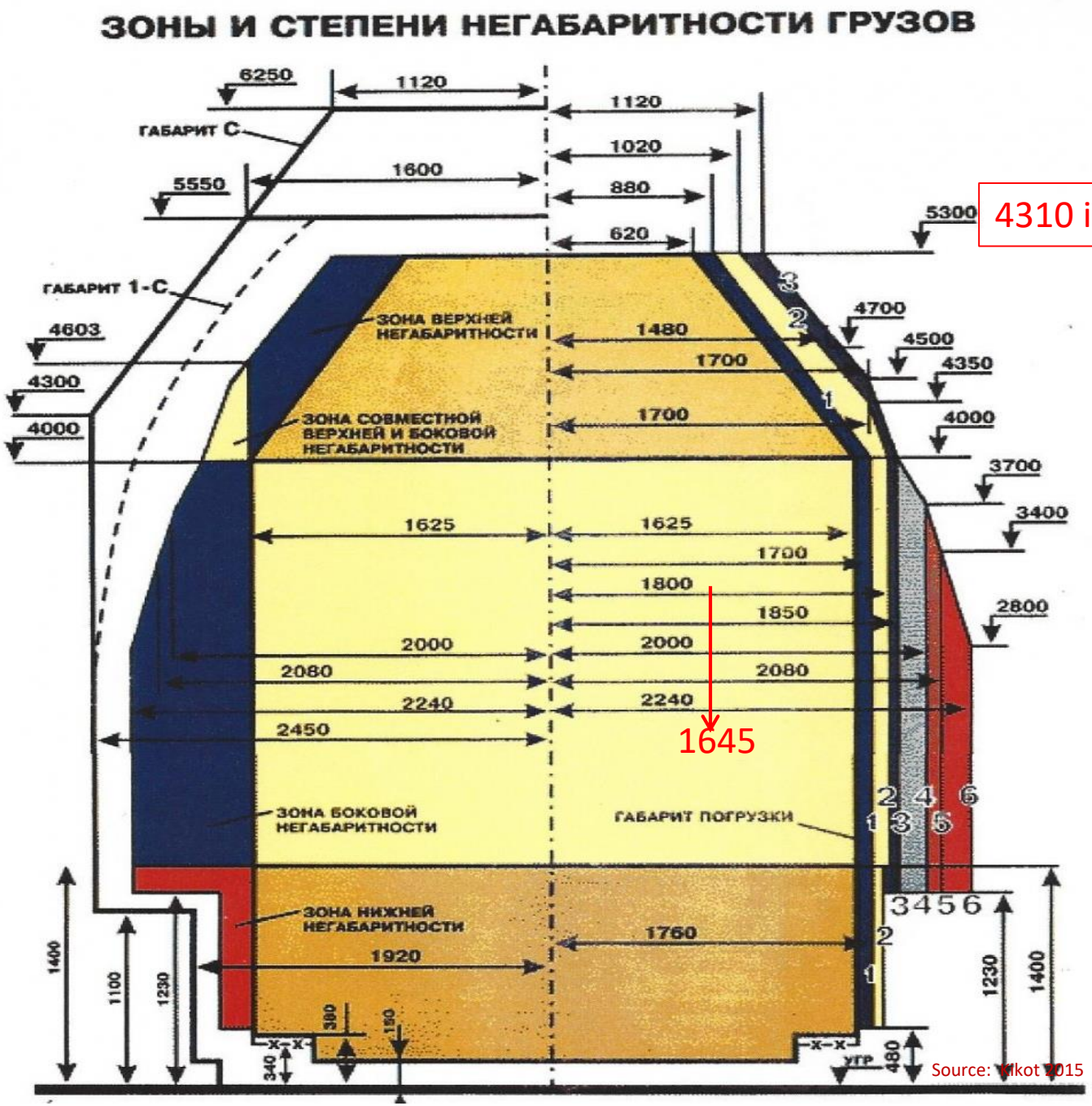
Productivity gains through marshalling yards lowered the costs of trains – Quality of Service out of question:
Why ? Horse wagon 5 km/h Train 65 km/h top speed

The longer the distance or the more the volume the railway is the cost-efficient mode compared to the truck (Nebelung 1951)



Source: Vikot 2015

Clearance and
Loading Guage 1520mm
Gauge network:
Much more productive
Because of more cross-
Section capacity leading
to shorter 4-axle waggons
Because of axle pressure
Restrictions and
71 waggons per train –
up to 1650 m train lengths.


ЗОНЫ И СТЕПЕНИ НЕГАБАРИТНОСТИ ГРУЗОВ
6250
1120
1120
ГАБАРИТ С
1020
1600
5550
880
620
5300
4310 international
ГАБАРИТ 1-С
4603
ЗОНА ВЕРХНЕЙ НЕГАБАРИТНОСТИ
1480
4700
4500
4350
4300
1700
ЗОНА СОВМЕСТНОЙ ВЕРХНЕЙ И БОКОВОЙ НЕГАБАРИТНОСТИ
1700
4000
4000
3700
3400
1625
1625
1700
1800
1850
2800
2000
2000
2080
2080
2240
2240
2450
1645
ЗОНА БОКОВОЙ НЕГАБАРИТНОСТИ
ГАБАРИТ ПОГРУЗКИ
ЗОНА НИЖНЕЙ НЕГАБАРИТНОСТИ
1760
1920
1400
1100
1230
380
150
340
480
1230
1400
Clearance and
Loading Guage 1520mm
Gauge network:
Much more productive
Because of more cross-
Section capacity leading
to shorter 4-axle waggons
Because of axle pressure
Restrictions and
71 waggons per train –
up to 1650 m train lengths.
Source: Vikot 2015

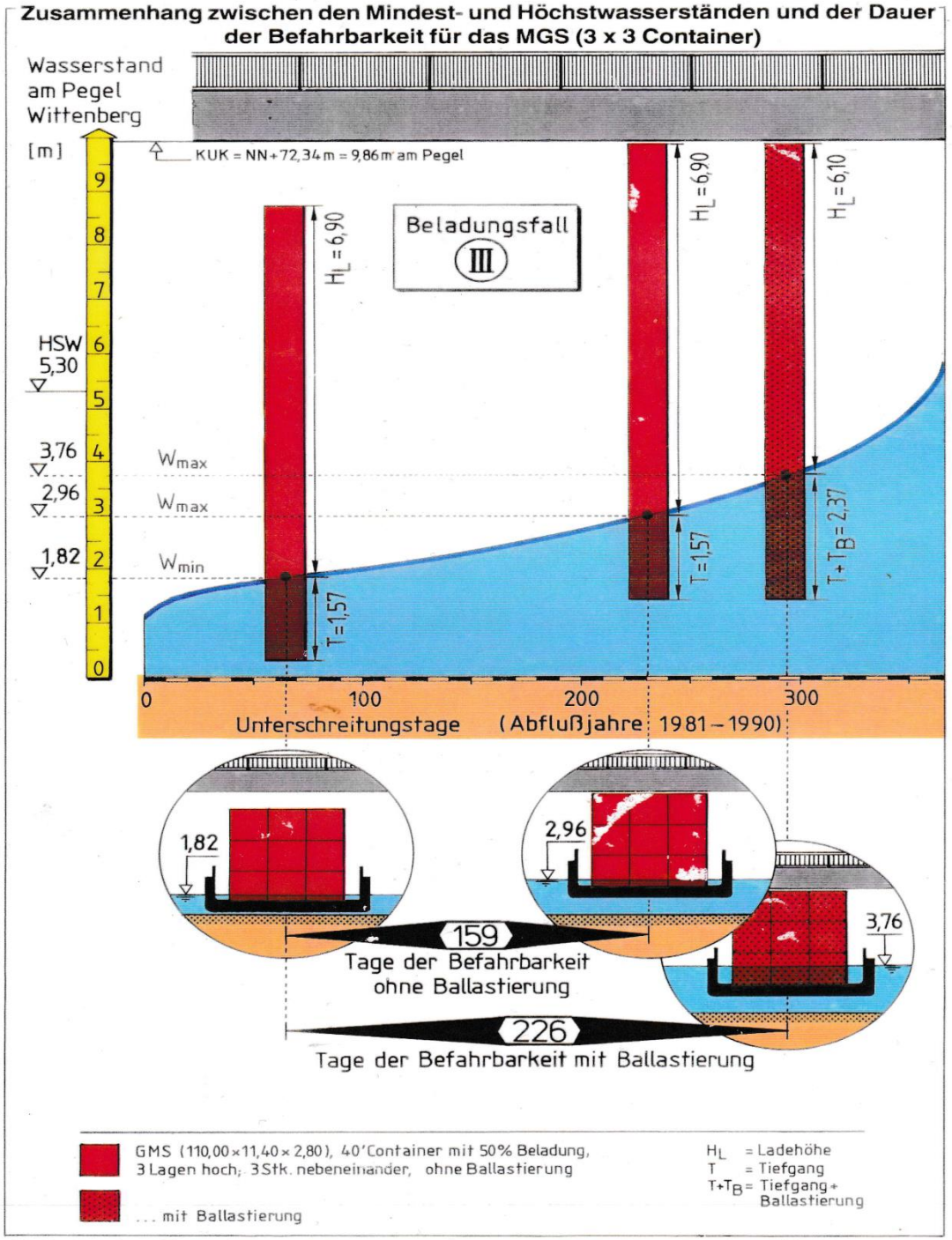
CEMT – Classification of Inland Waterways:

Typ der Binnenwasserstraße		Klasse der Binnenwasserstraße	Motorschiffe und Schleppkähne Typ des Schiffes: Allgemeine Merkmale					Schubverbände Art des Schubverbandes: Allgemeine Merkmale					Brückendurchfahrtshöhe[2]
			Bezeichnung	maxim. Länge L (m)	maxim. Breite B (m)	Tiefgang d (m)[7]	Tonnage T (t)	Formation	Länge L (m)	Breite B (m)	Tiefgang d (m)[7]	Tonnage T (t)	
1		2	3	4	5	6	7	8	9	10	11	12	13
von regionaler Bedeutung	westlich der Elbe	I	Penische	38,5	5,05	1,8–2,2	250–400						4,0
		II	Kempenaar	50–55	6,6	2,5	400–650						4,0–5,0
		III	Gustav Koenigs	67–80	8,2	2,5	650–1 000						4,0–5,0
	östlich der Elbe	I	Gross Finow	41	4,7	1,4	180						3,0
		II	BM-500	57	7,5–9,0	1,6	500–630						3,0
		III	[6]	67–70	8,2–9,0	1,6–2,0	470–700		118–132[1]	8,2–9,0[1]	1,6–2,0	1 000–1 200	4,0
von internationaler Bedeutung		IV	Johann Welker	80–85	9,50	2,5	1 000–1 500		85	9,50[5]	2,50–2,80	1 250–1 450	5,25 od. 7,00[4]
		V a	Große Rheinschiffe	95–110	11,40	2,50–2,80	1 500–3 000		95–110[1]	11,40	2,50–4,50	1 600–3 000	5,25 od. 7,00 od. 9,10[4]
		V b							172–185	11,40	2,50–4,50	3 200–6 000	
		VI a							95–110	22,80	2,50–4,50	3 200–6 000	7,00 od. 9,10[4]
		VI b	[3]	140	15,00	3,90			185–195[1]	22,80	2,50–4,50	6 400–12 000	7,00 od. 9,10[4]
		VI c							270–280[1]	22,80	2,50–4,50	9 600–18 000	9,10[4]
									195–200[1]	33,00–34,20[1]	2,50–4,50	9 600–18 000	
		VII							285	33,00–34,20[1]	2,50–4,50	14 500–27 000	9,10[4]

Clearance and low water problems

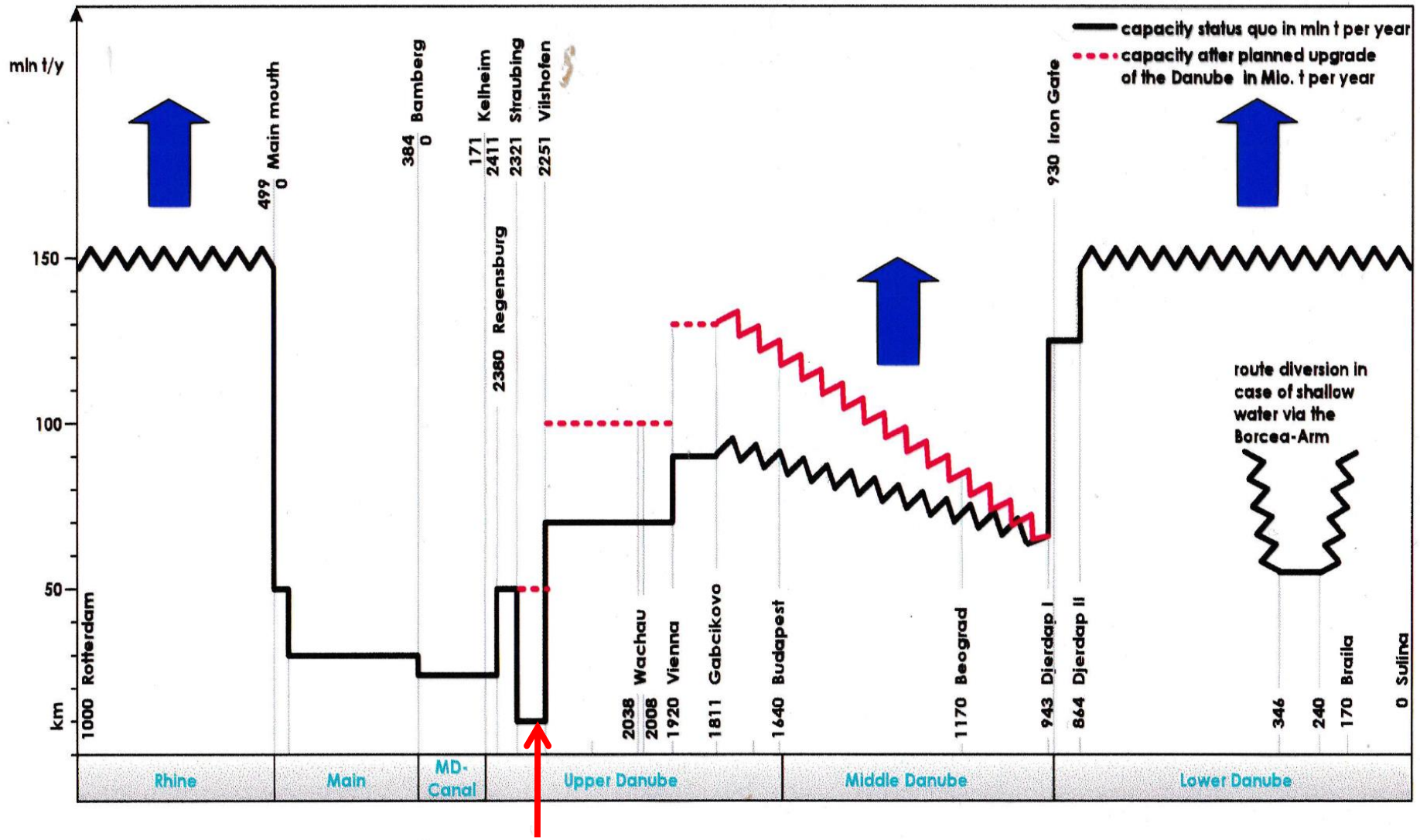
hinder regular services on inland

Waterways:



Quelle: A.Dohms, Binnenschiffahrt - ZfB - Nr. 4 - Feb. 1994; Auf der Elbe können Containerschiffe fahren.

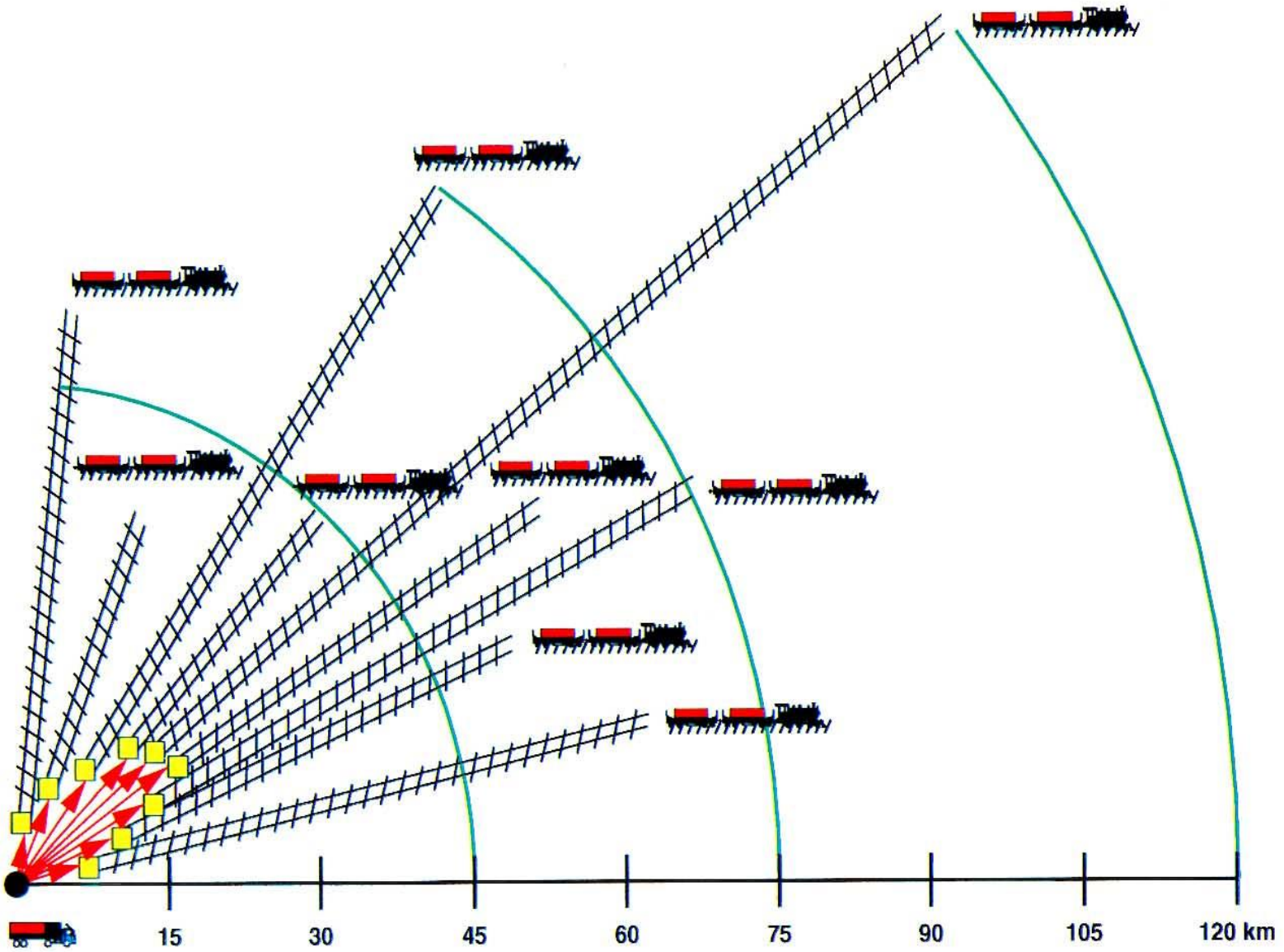
Actual and planned capacity of the Rhine-Main-Danube Waterway



Bottleneck Straubing – Vilshofen in Bavaria (Germany) prevail….

© via donau 2003

How did Rail react towards the emergence of the truck after World War I ?



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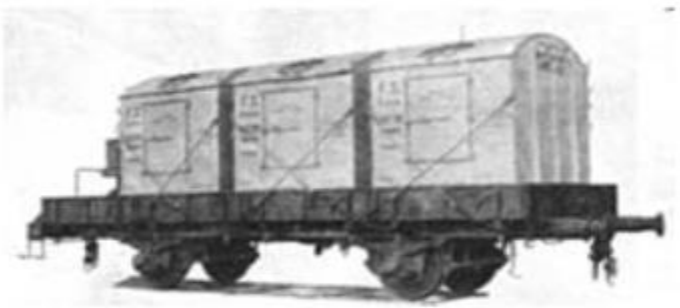
Railways tried to keep- the truck in C & D services to Rail by protective laws in industrialized countries: Showcase Rail can Road:

- World Congress 1928 held in Rome
  - Container Commission established
- 1933 replaced by International Container Bureau **(BIC)** joint body of:
  - International Chamber of Commerce
  - Union of Railways (UIC)
  - Meet 4 times a year (except war years)
- Largely concerned with European railways



Source: http://contents.kocw.or.kr/contents4/document/lec/2013/Chungang/Jeffreymartin1/4.pdf 01-09-23 17:12

1930s: Used mainly for furnitures by Deutsche Reichsbahn Gesellschaft (DRG)….

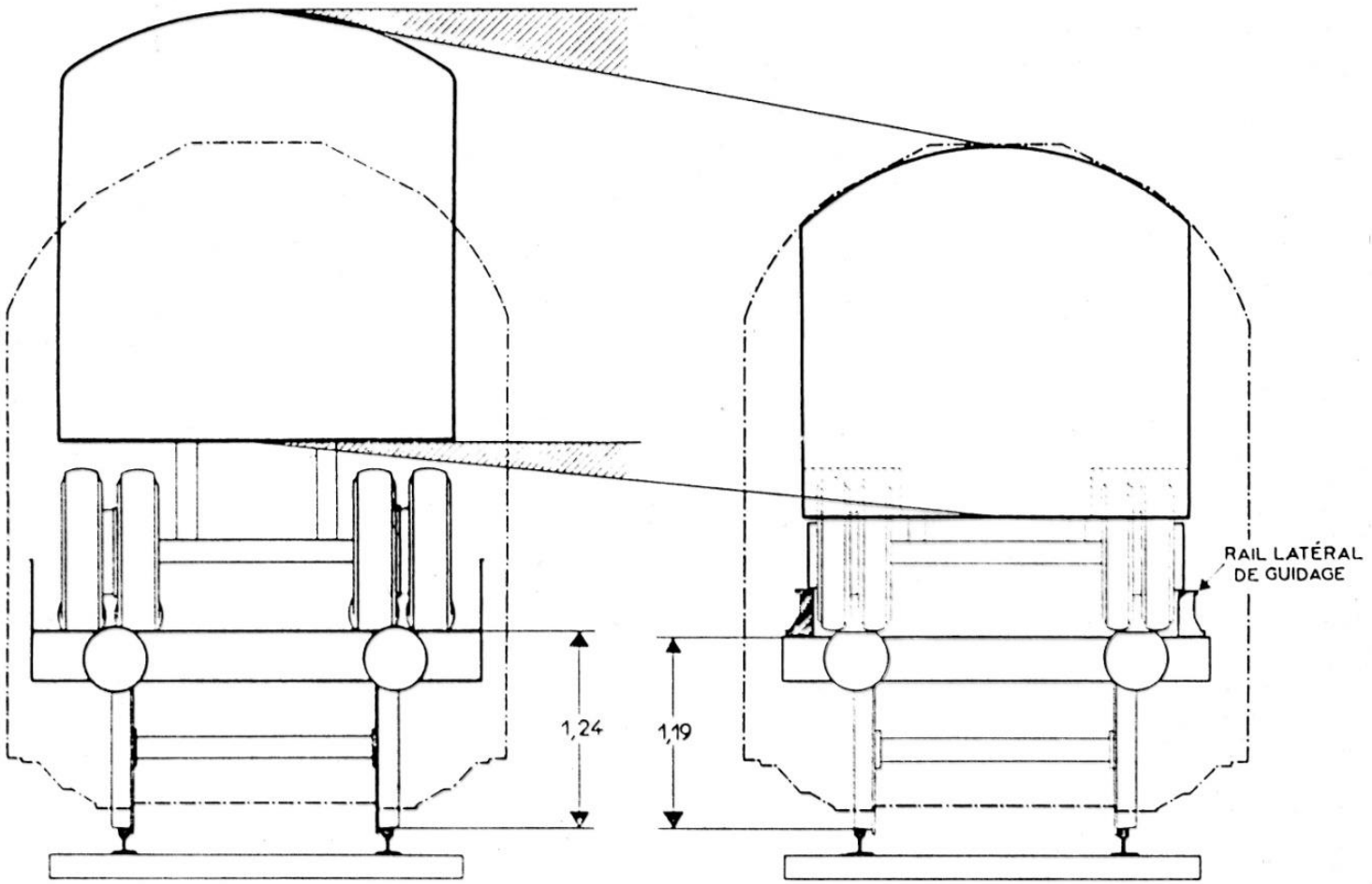
Source: Crespi 1934

But why Furnitures ?

BILD 110 GROSSBEHÄLTER DER DEUTSCHEN REICHSBAHN, MÖBELWAGENTYP.

Source: Crespi 1934

Horse waggon compared to rail



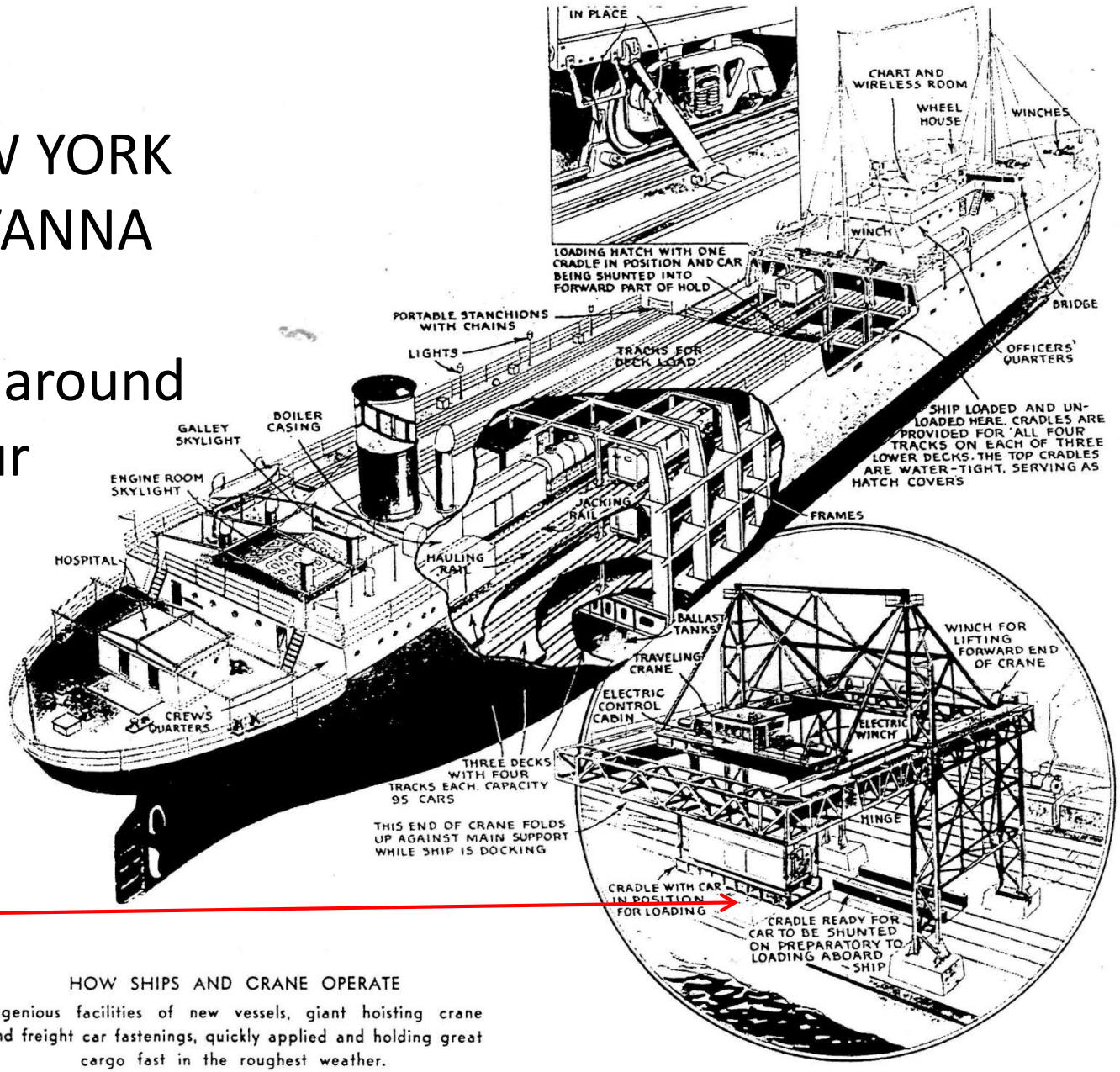
Principe de la solution U.F.R. (wagon plat ordinaire, surbaissement de la caisse de la semi-remorque, encastrement des roues).

Source: Delacarte 1960

1932:
SEATRAIN NEW YORK
SEATRAIN HAVANNA

Reducing turn around time in harbour from 6 days to 10 hours

because of transfer of Box Cars



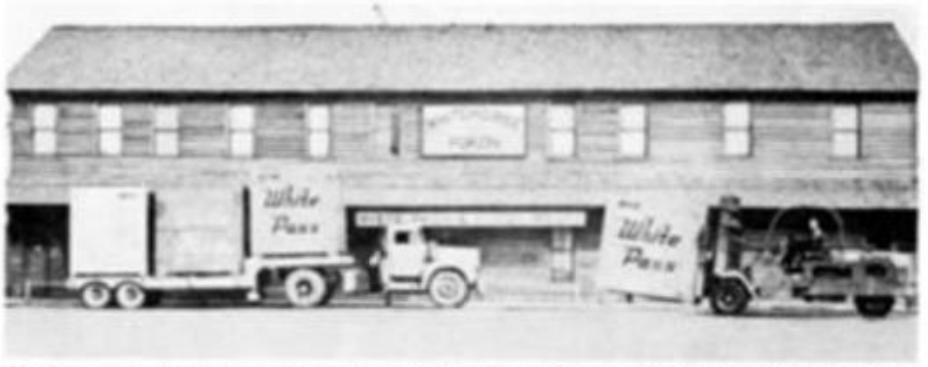
HOW SHIPS AND CRANE OPERATE

Ingenious facilities of new vessels, giant hoisting crane and freight car fastenings, quickly applied and holding great cargo fast in the roughest weather.

In 1932 Seatrain service had arrived and was ready for New York-Havana weekly sailings — 100 freight cars loaded in ten hours. Source: *The Port of New York.* Cit. After Muller 1995

White Pass & Yukon 914 mm narrow guage line
Skagway (Alaska) to Whitehorse (Yukon)
North Vancouver – Skagway ship // Skagway – Whitehorse rail

- Clifford J. Rodgers
  - Purpose built continer ship (Montreal 1955)
  - 600 steel containers
    - 8ft by 8ft (ordinary truck width)
    - 5 tons capacity
- November 26, 1955 - Intermodal container system
  - North Vancouver, British Columbia to Skagway, Alaska
  - Transported on purpose built rail wagons and trucks
  - Transport north inland to the Yukon
  - Transported to consignee without opening



Containers were loaded by fork-lifts to specially-designed low-bed trailers for movement from Whitehorse as early as 1953.

Source: http://contents.kocw.or.kr/contents4/document/lec/2013/Chungang/Jeffreymartin1/4.pdf 01-09-23 16:57

Matson: From 8ft cubic boxes to 24 ft rectangular dimensions from Mainland USA to Hawaii

- Matson Navigation
  - 1882 first service San Francisco to Hilo (Hawaii)
  - Operated cargo ships, passengers ships and terminals
- 1956 researched introduction of containers
- 1958 Hawaiian Merchant
  - Converted a C3 type 1945 built general cargo ship
  - Carry 20 containers on deck (24ft containers)
  - Breakbulk under deck

Source: http://contents.kocw.or.kr/contents4/document/lec/2013/Chungang/Jeffreymartin1/4.pdf 01-06-23 16:57

Macolm Mc Lean

-Maximum Road size

-Maximum Road weight

-Stackable 6 fold

- Converted a 1944 T-2 tanker ship (Ideal X)
  - Deck added with slots to secure 58 units (
  - Also able to carry 15,000 tons of petroleum
- Gateway City first cellular container ship
  - Length 137m
  - Beam 22m
  - Draft 7.6m
  - Speed of 15 knots
  - Capacity of 226 units (35 ft) = 395 TEU
- 5 Sister ships also converted in 1957
  - Azalea City
  - Bienville
  - Fairland
  - Raphael Semmes
  - Beauregard

- 26 April Ideal X's first sailing
- Port Newark (New Jersey) to Houston
- Deck had slots for 58 units (35ft long)
- Arrived in Houston 6 days later
  - Units unloaded onto chassis on quay
  - Existing port cranes were used
  - No handling of cargo by longshoremen (US port workers)
- Cost of stowage
  - Breakbulk ship = US$ 5.80 per ton
  - Ideal X = US$ 0.16 per ton
  - 36 times less

Source: http://contents.kocw.or.kr/contents4/document/lec/2013/Chungang/Jeffreymartin1/4.pdf 01-09-23 19:01

MS Fairland

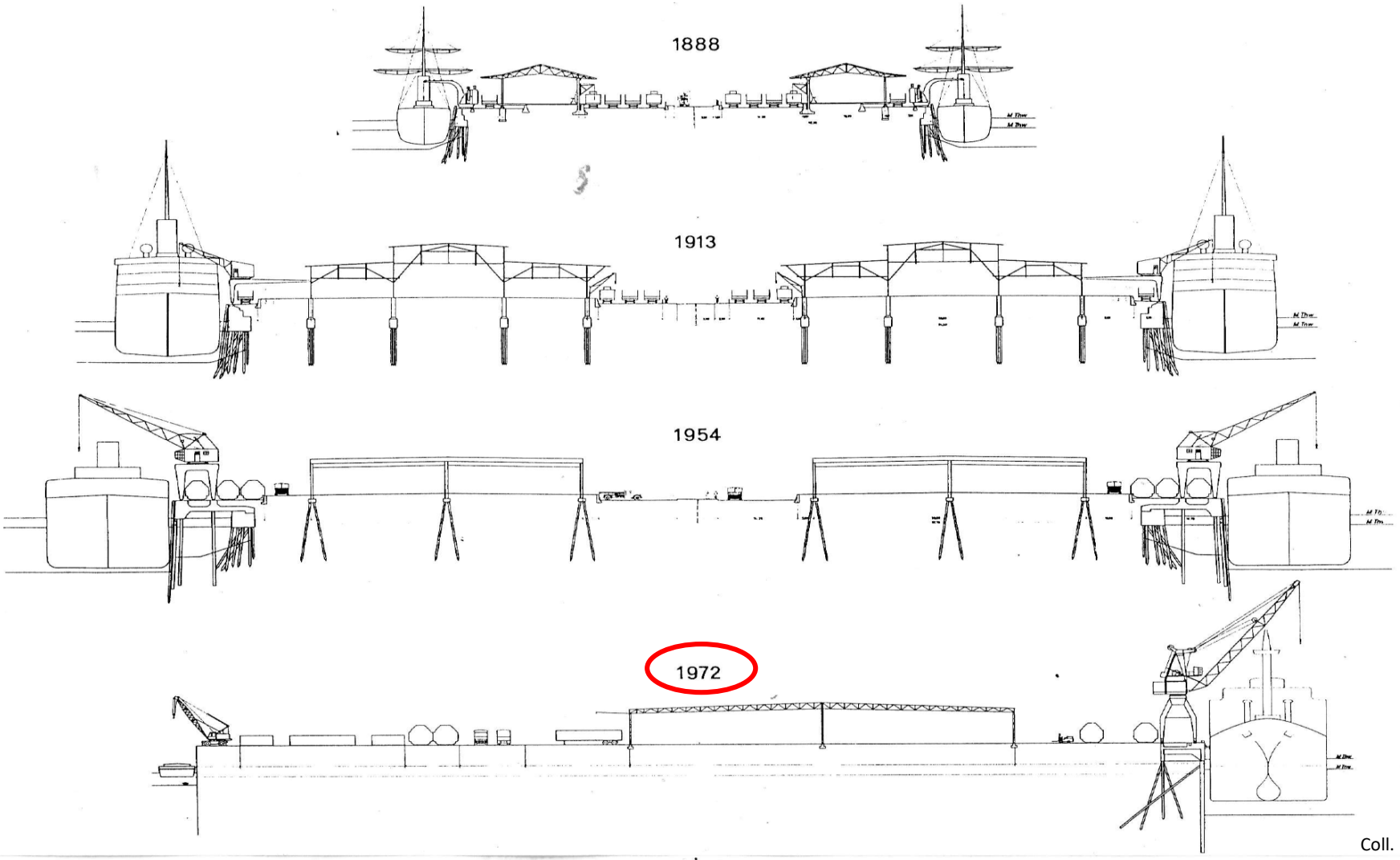
- Crew (25)
  - 1 Captain
  - 1 Chief Engineer & 1 radioman
  - 1 Pursar
  - 6 Able-bodied & 3 ordinary seamen
  - 1 Bosun & 1 maintenance man
  - 3 Firemen & 1 wiper (engine room)
  - 1 Cook & 2 stewards
  - 3 Mates (1st, 2nd and 3rd)
- First sailing Port Newark to Miami
  - 165 units Newark to Houston
  - 61 units Newark to Miami
  - 3 units Miami to Houston
  - At Houston
    - 08:18 first unit unloaded
    - 08:20 first unit left port
    - 08:30 first unit delivered to shipper in Miami
- Regular service
  - Newark – Miami – Houston – Tampa
  - Loading & unloading = 264 tons of cargo an hour

Source: http://ravenofferings.blogspot.kr/2010/05/notes-from-ss-fairland.html

MS Fairland first call Rotterdam May 3, 1966 – first Container set down…
and then weekly sailings also calllling in GB and Bremen in Germany

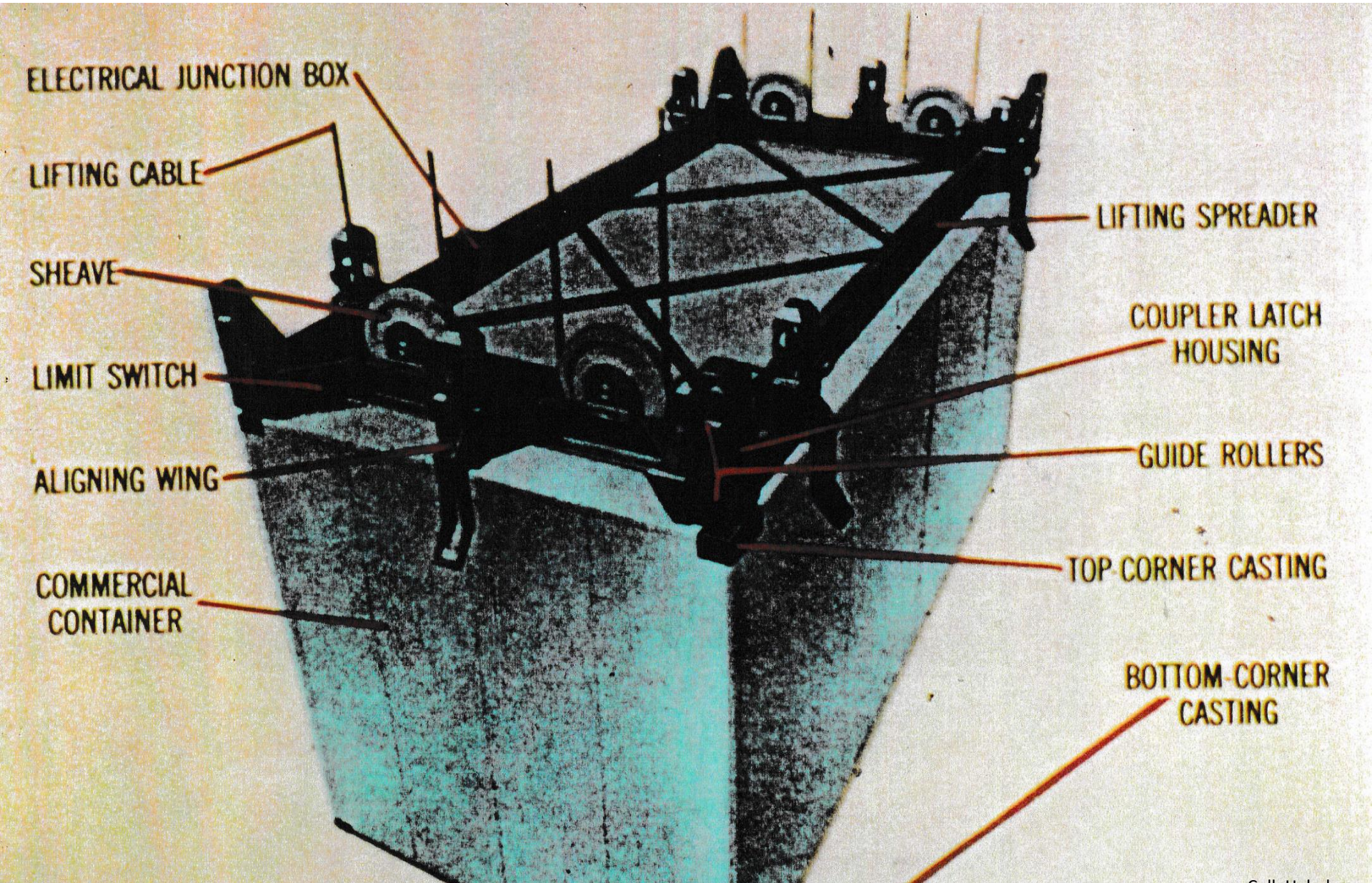
Coll. Hebeler

What was the answer to the Container in other ports?
Conventional sites expansion:



Coll. Hebeler

Macolm Mc Lean‘s patented top-lift device with corner castings on the container



First Attempt to regulate Container dimensions by American Standards Association ASA 1958

- 1958 American Standards Association (ASA)
  - 2 committees held separate meetings to agree container dimension standards
  - Held in November 1958 over 2 days
  - Materials Handling 5 (MH-5)
- Membership dominated by
    - Trucking companies
    - Railroads
    - Trailer manufacturers
  - Sea-Land and Matson only shipping lines using "containers"
    - Were not part of the discussions
    - Resisted MH-5 standard
- Agreed family of acceptable standards for US domestic containers
  - 8ft width based on road regulation
    - At the time this was too wide for many European railways
  - Height maximum of 8½ ft agreed
    - Maritime members favoured 8ft
    - Trucking members favoured 8½ ft
  - Agreed 3 pairs of container lengths
    - 20/40 ft (40 ft based on railway maximum)
    - 12/24 ft - based on west coast USA shipping line Matson)
    - 17/35 ft – based on trailer length allowed in all states **???**

Meaning „truck size"Ct. 24 ft and 35 ft long

Alaska State Marines and White Pass & Yukon RR

1965: ISO Comittee 104: Modular Regulation of Containers

Standard container

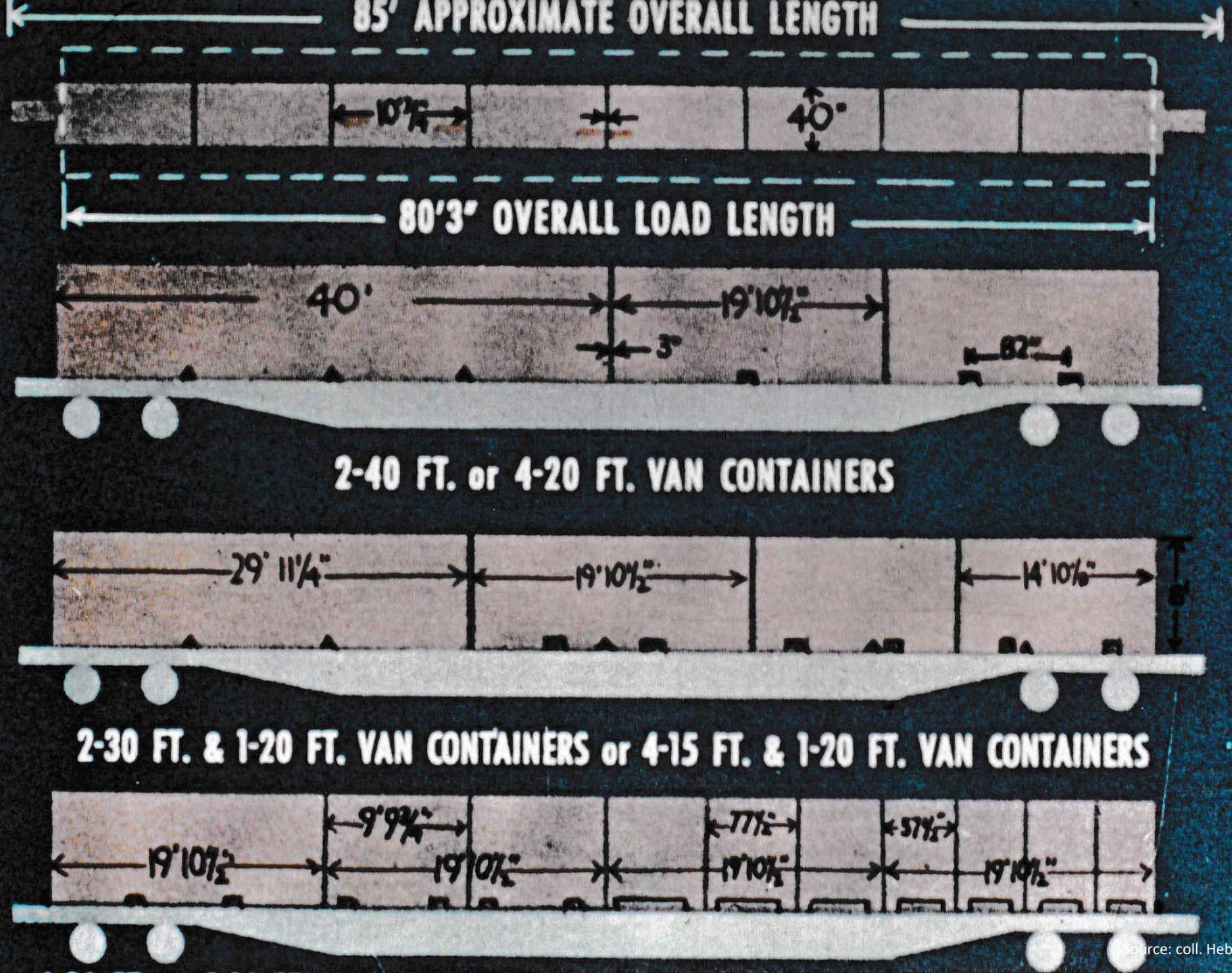
- Max gross weight of about 30 metric tonnes
- Corner posts designed for 190 metric tonnes load under G force of 1.8
- Bottom container can support 6 containers
- Stack height of 7 fully loaded containers

Container structural inspections

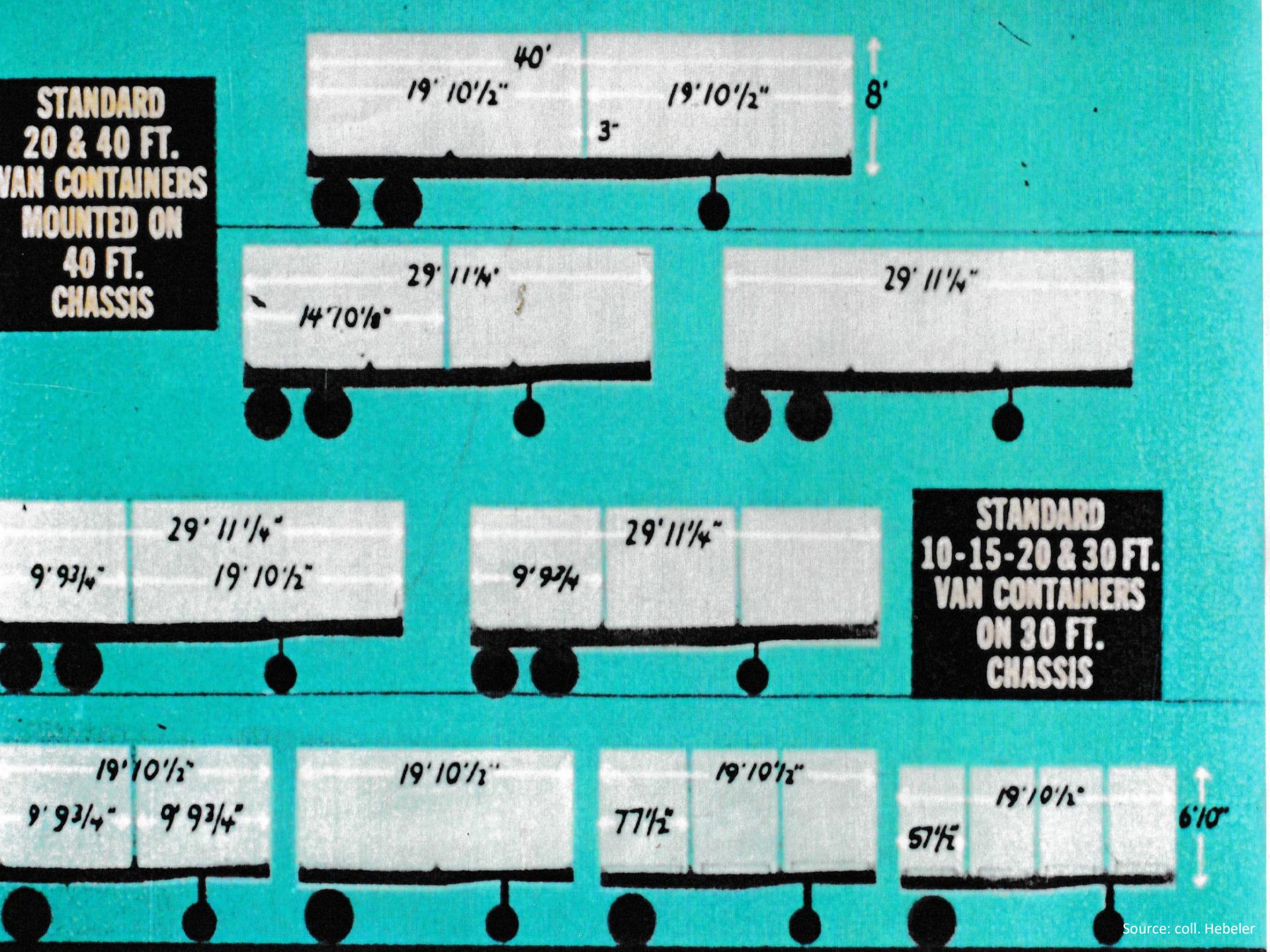
- Once container is 5 years old
- Every 3 years after

NOMINAL SIZES	OVERALL ACTUAL SIZES & TOLERANCES			END DOORWAY SIZES	
	LENGTH	WIDTH	HEIGHT	WIDTH	HEIGHT
40′ x 8′ x 8′	40′-0″	8′-0″	8′-0″	90″ MIN.	85″ MIN.
30′ x 8′ x 8′	29′-11¼	8′-0″	8′-0″	90″ MIN.	85″ MIN.
20′ x 8′ x 8	19′-10½	8′-0″	8′-0″	90″ MIN.	85″ MIN.
10′ x 8′ x 8	9′-9¾	8′-0″	8′-0″	90″ MIN.	85″ MIN.

Source: coll. Hebeler



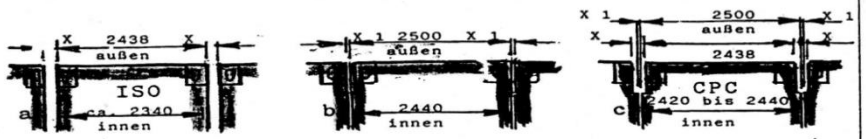
Source: coll. Hebeler



Source: coll. Hebeler

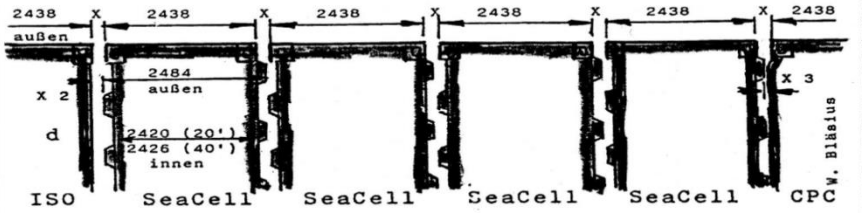
Bisher übliche ISO-Container

Sektoral in der Küstenschiffahrt eingesetzte 2,5 m breite Container

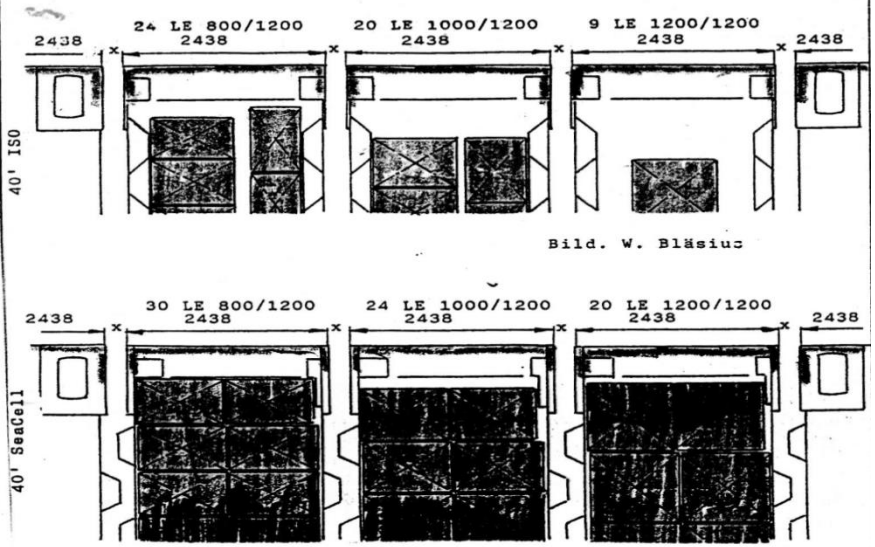


Auf den großen Übersee-Containerschiffen und den Feederschiffen sind die seitlichen Abstände X zwischen den genormten ISO-Containern von vornherein nicht größer als unbedingt notwendig (Bild a). Auf Küstenmotorschiffen dagegen müssen hin und wieder auch schon einmal bedingt palettenbreite, also außen 2,5 m breite Container befördert werden (Bild b und c), sofern der vorhandene Abstand X 1 dafür noch reicht. Bei außen 2,55 m breiten Containern, wird alles noch weit ungünstiger.

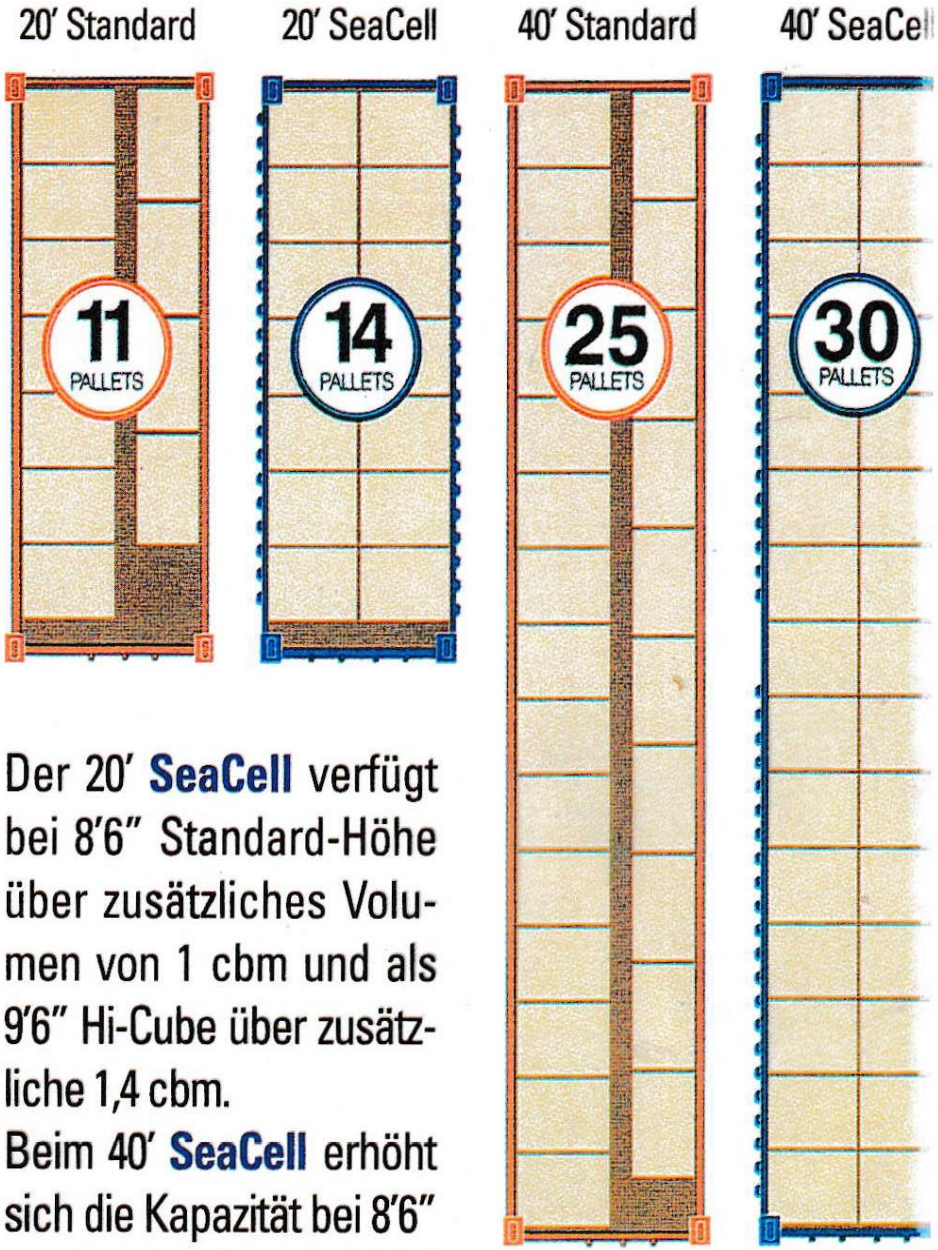
EU- und ggf. weltweit einsetzbare, palettenbreite 20'- und palettenkompatible 40 '-SeaCell-Container



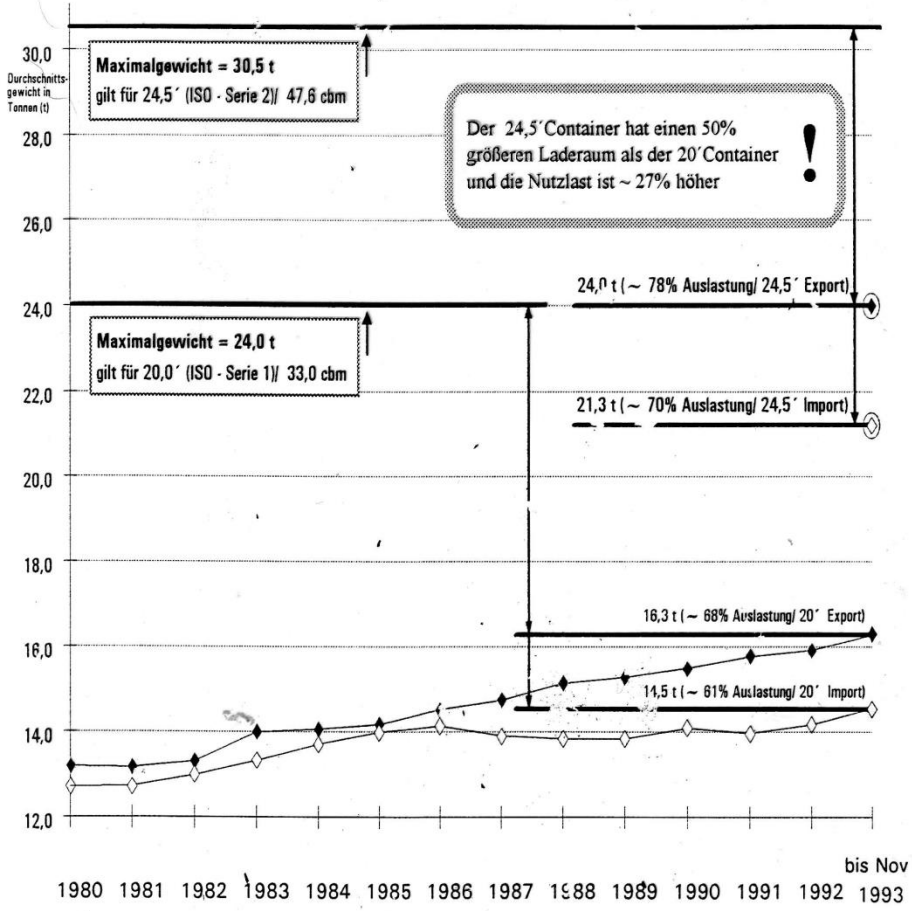
Durch die versetzte Anordnung der trapezförmig gesickten Seitenwände passen SeaCell-Container in der Regel auch dort, wo der Abstand X ursprünglich nur für ISO-Container vorgesehen war. Eine Kombination mit ISO-Containern, wie links in Bild d gezeigt, ist möglich, wenn der Abstand X nicht ungewöhnlich klein ausgelegt wurde. Wie groß der Mindestabstand X 2 sein muß, wäre generell festzulegen. Sollen SeaCell-Container aber mit außen 2,5 m breiten Containern kombiniert werden, wie rechts in Bild d gezeigt, dann dürfte der Abstand X 3 dafür oft nicht reichen.



Der Vergleich des ISO-Containers mit dem SeaCell zeigt besser als viele Worte, warum der SeaCell für bestimmte genormte LE weit günstiger ist. Der Abstand x zwischen den Containern sollte mindestens 25 mm betragen.



Der 20' **SeaCell** verfügt bei 8'6" Standard-Höhe über zusätzliches Volumen von 1 cbm und als 9'6" Hi-Cube über zusätzliche 1,4 cbm.
Beim 40' **SeaCell** erhöht sich die Kapazität bei 8'6" um 2,4 cbm bzw. bei 9'6" um 2,9 cbm.

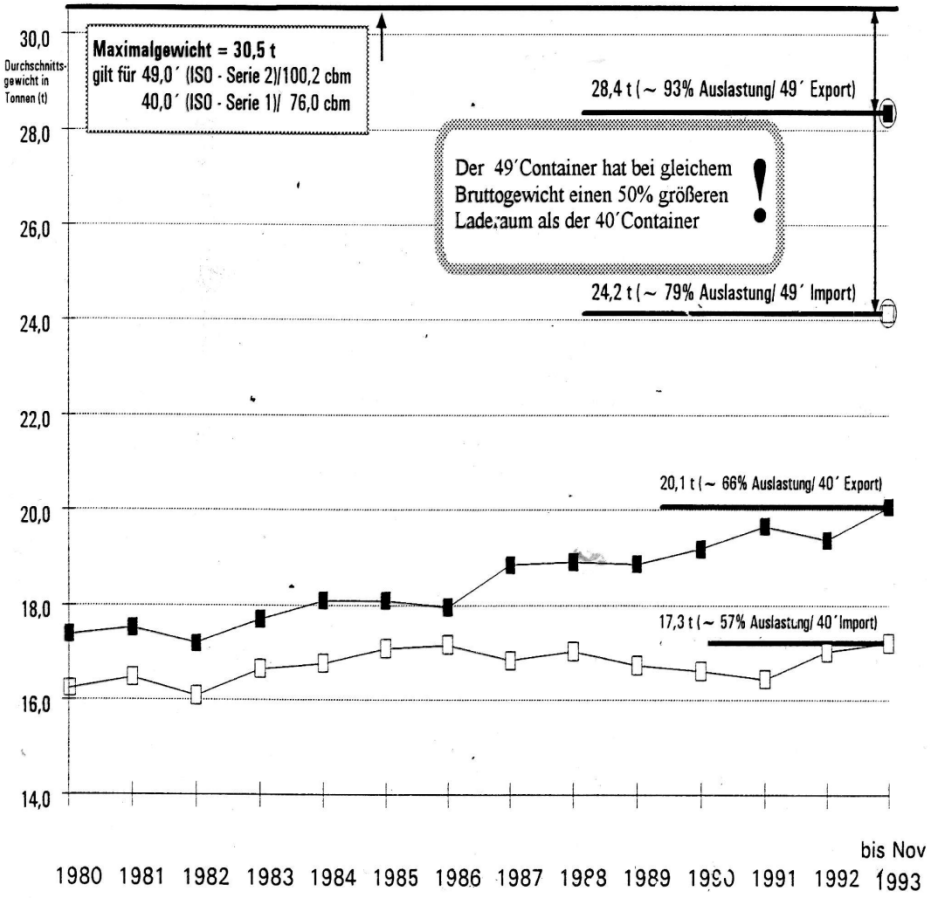


Hafen Hamburg

20´ Ausgehend (Export)
20´ Einkommend (Import)
} aktuelle Auslastung

24,5´ Auslastung (Export)
24,5´ Auslastung (Import)
} mögliche Auslastung

(bei gleichen Gütern in den Großvolumen-Containern)



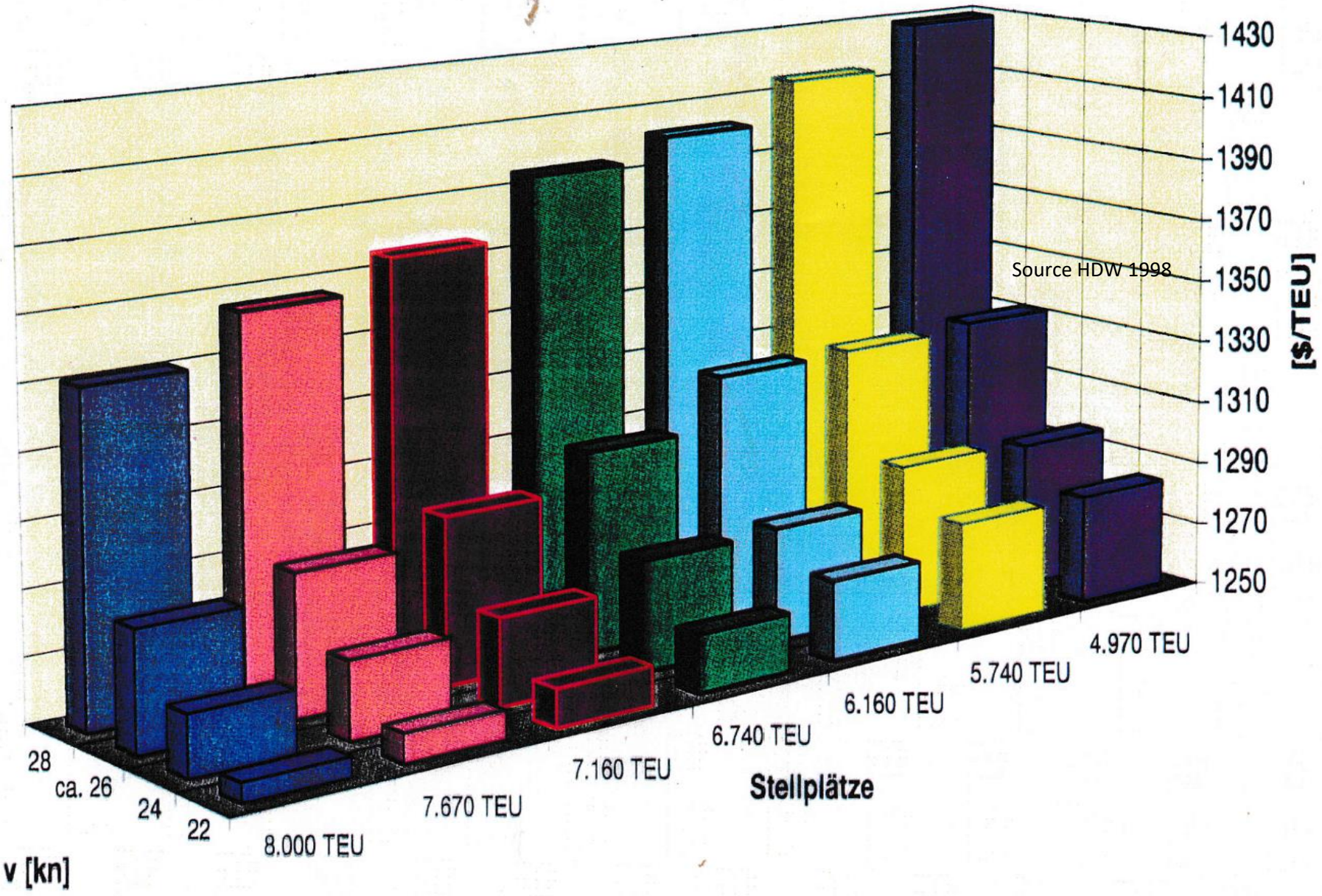
Hafen Hamburg

40´ Ausgehend (Export)
40´ Einkommend (Import)
} aktuelle Auslastung

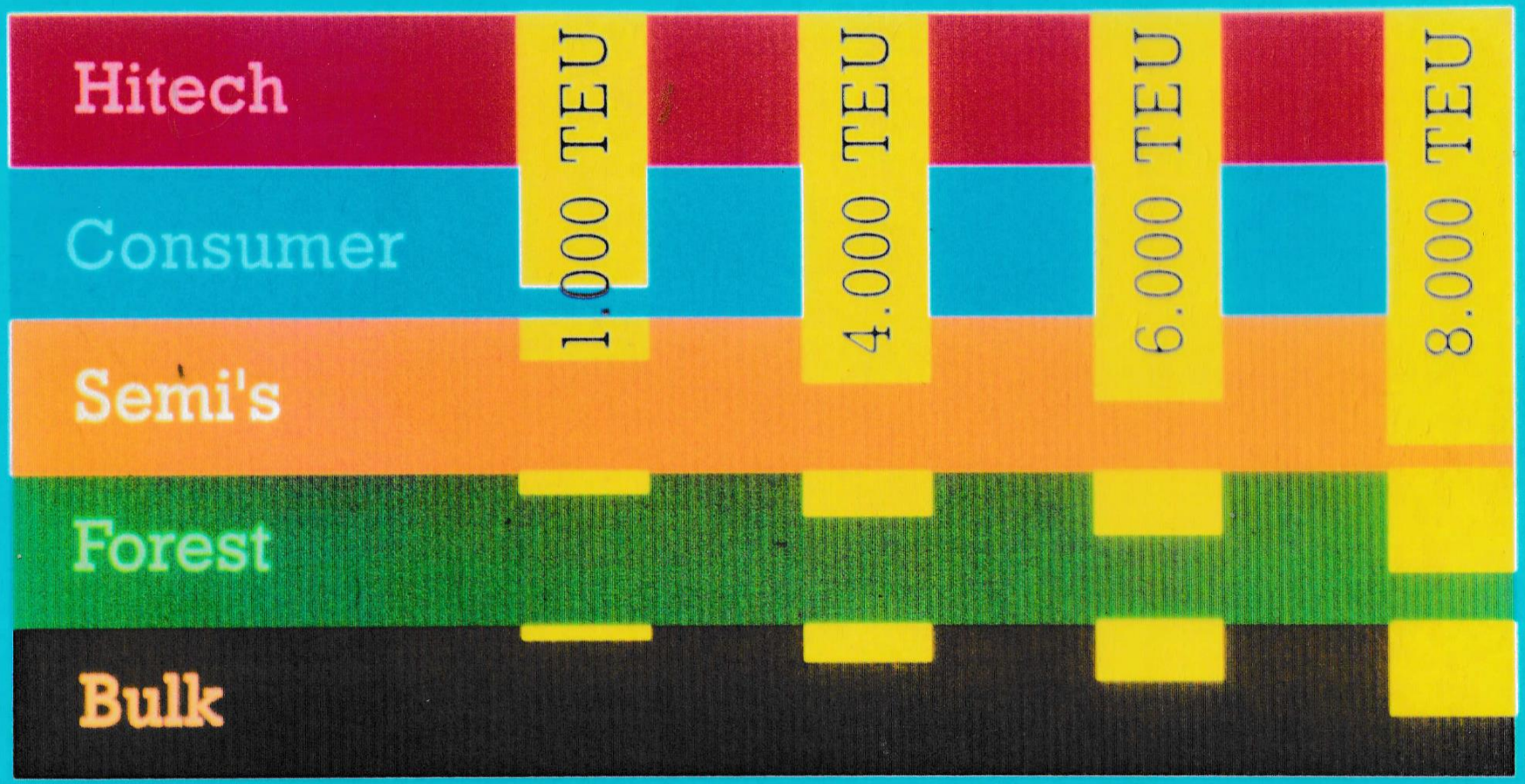
49´ Auslastung (Export)
49´ Auslastung (Import)
} mögliche Auslastung

(bei gleichen Gütern in den Großvolumen-Containern)

Growing ship sizes make transport costs fall – including Hinterland:

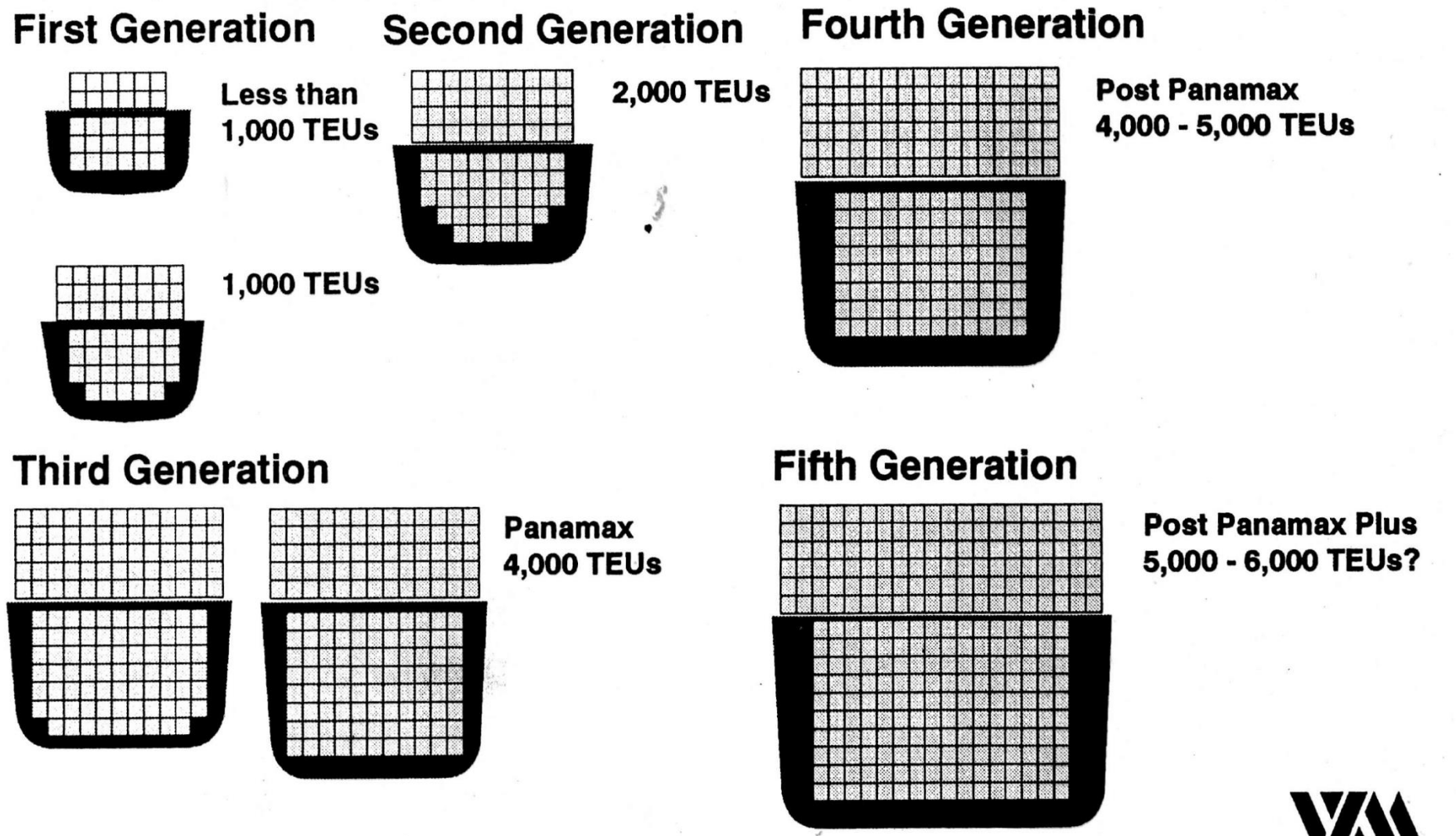


Grade of containerisation
related to vesselcapacity



CCS **The Green Transport** CCS

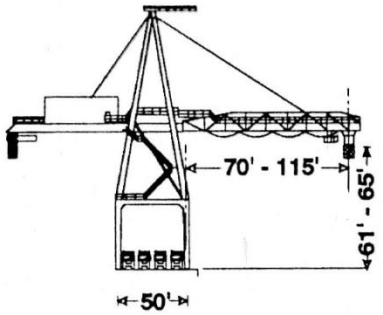
Container Ship Evolution – Capacity



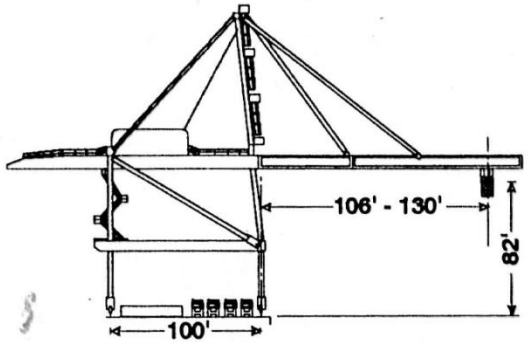
Evolution of increasing containership capacity

Source: Vickerman, Zachary, Miller

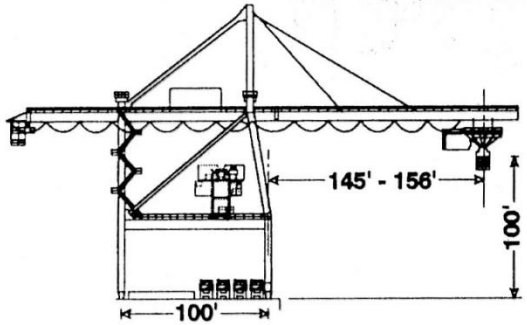
Crane Evolution



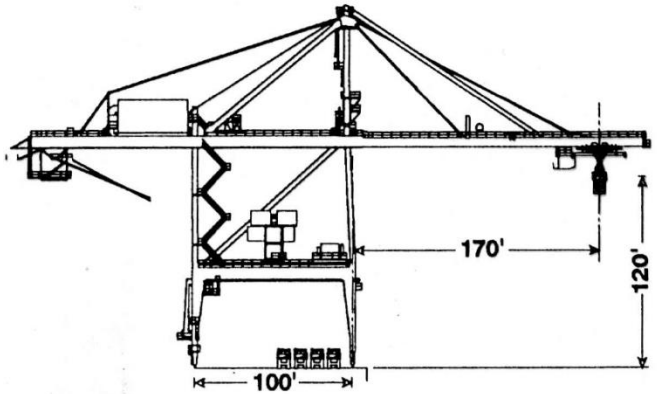
First Generation (1960s)
(Cost $750,000)



Second Generation (1970s)
(Cost $2,400,000)



Third Generation Post Panamax (1986)
(Cost in 1986 - $3,600,000-6,000,000)
(Current Cost - $5,000,000-8,000,000)



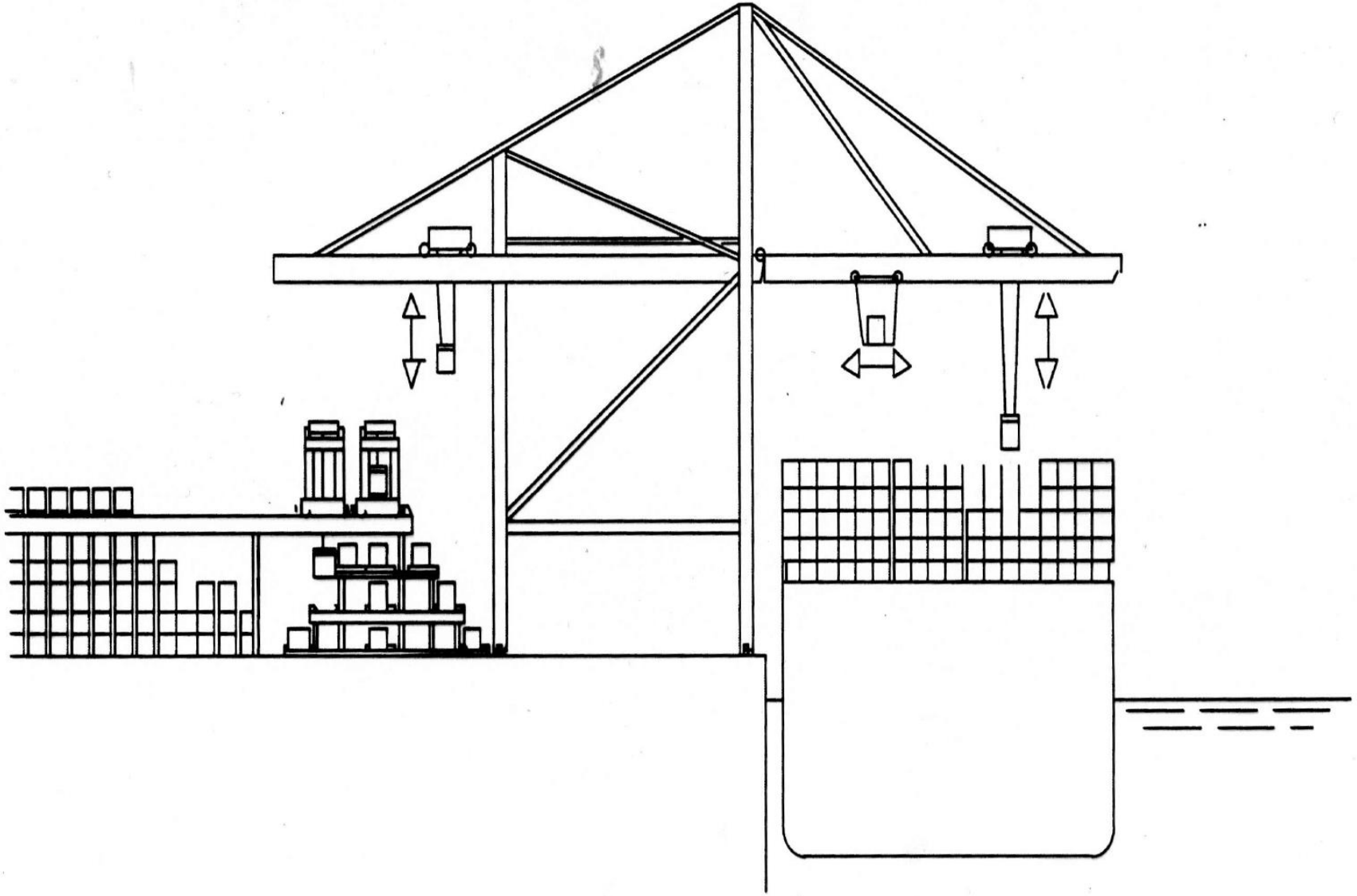
Fourth Generation
Post Panamax Plus (2000 - ?)
(Cost > $8,000,000)

Source: Vickerman · Zachary · Miller

© Copyright 1991

The size and cost of marine container terminal cranes has increased considerably since the earliest day of containerization

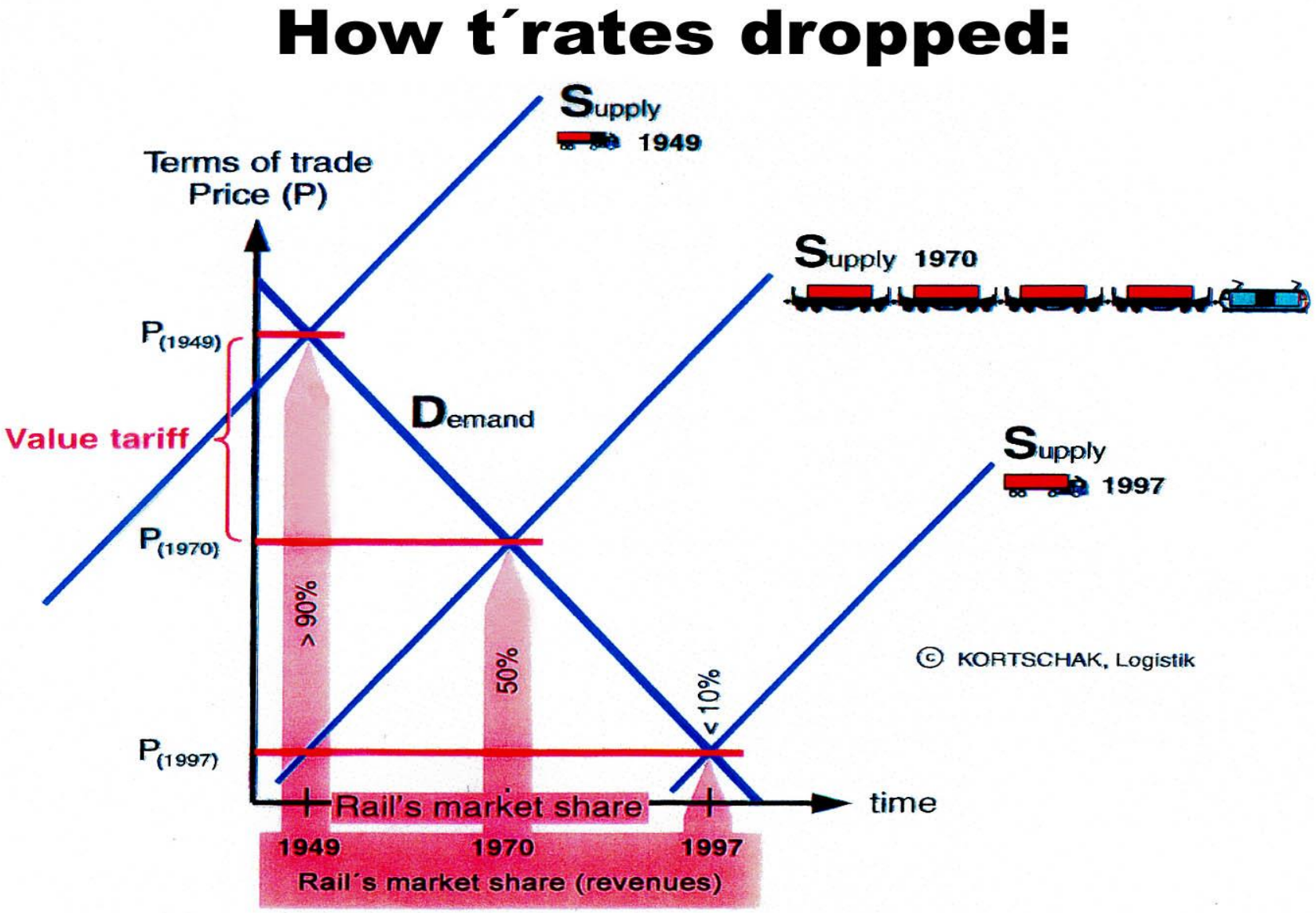
Source: Vickerman, Zachary, Miller



Container terminal of the future

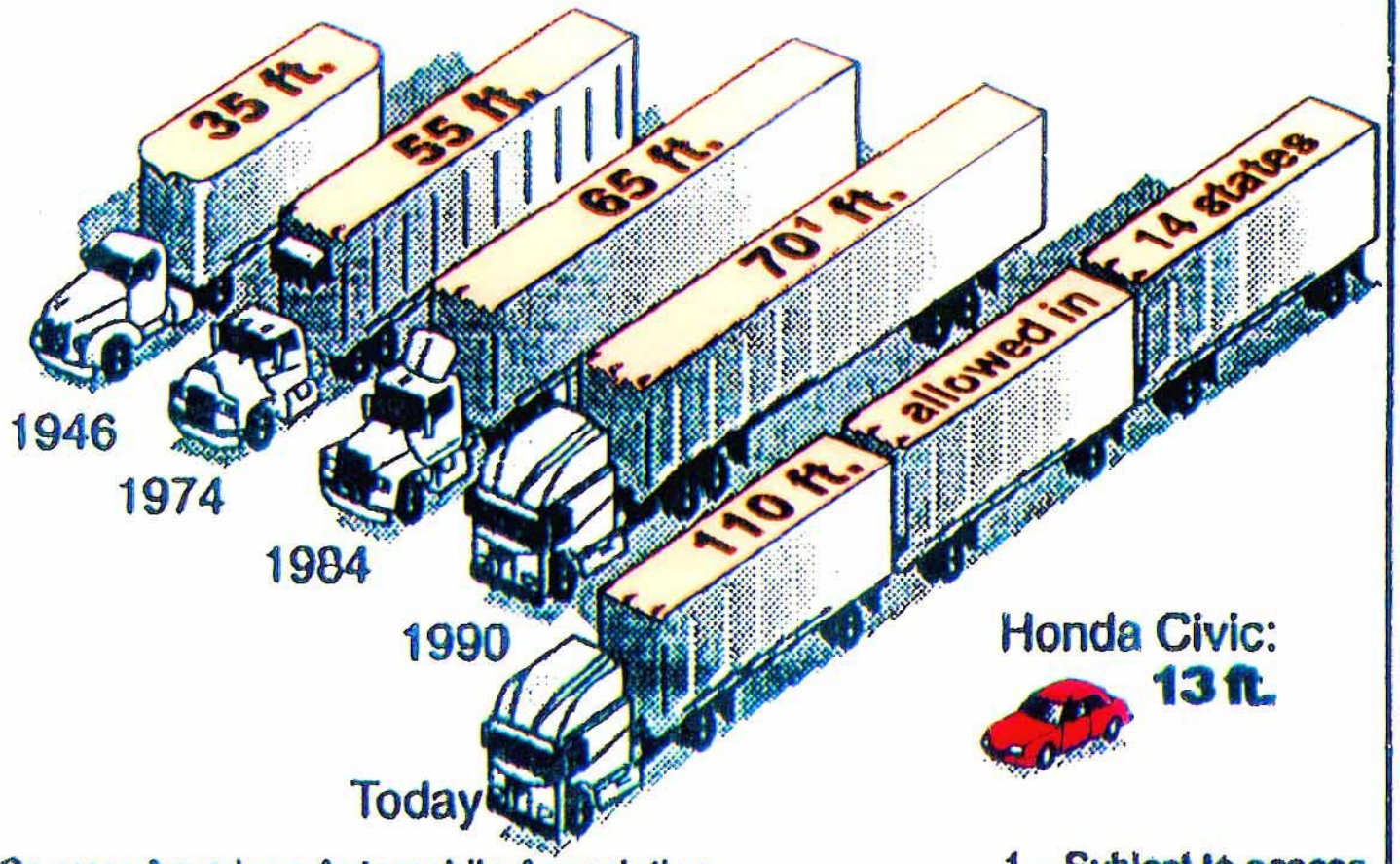
Source: HDW

The Value tariff made Railfreight Managers the „better“ monopolitsts:



How trucks have stretched

Trucks have become longer and longer since the advent of the tractor/trailer. How they've grown:

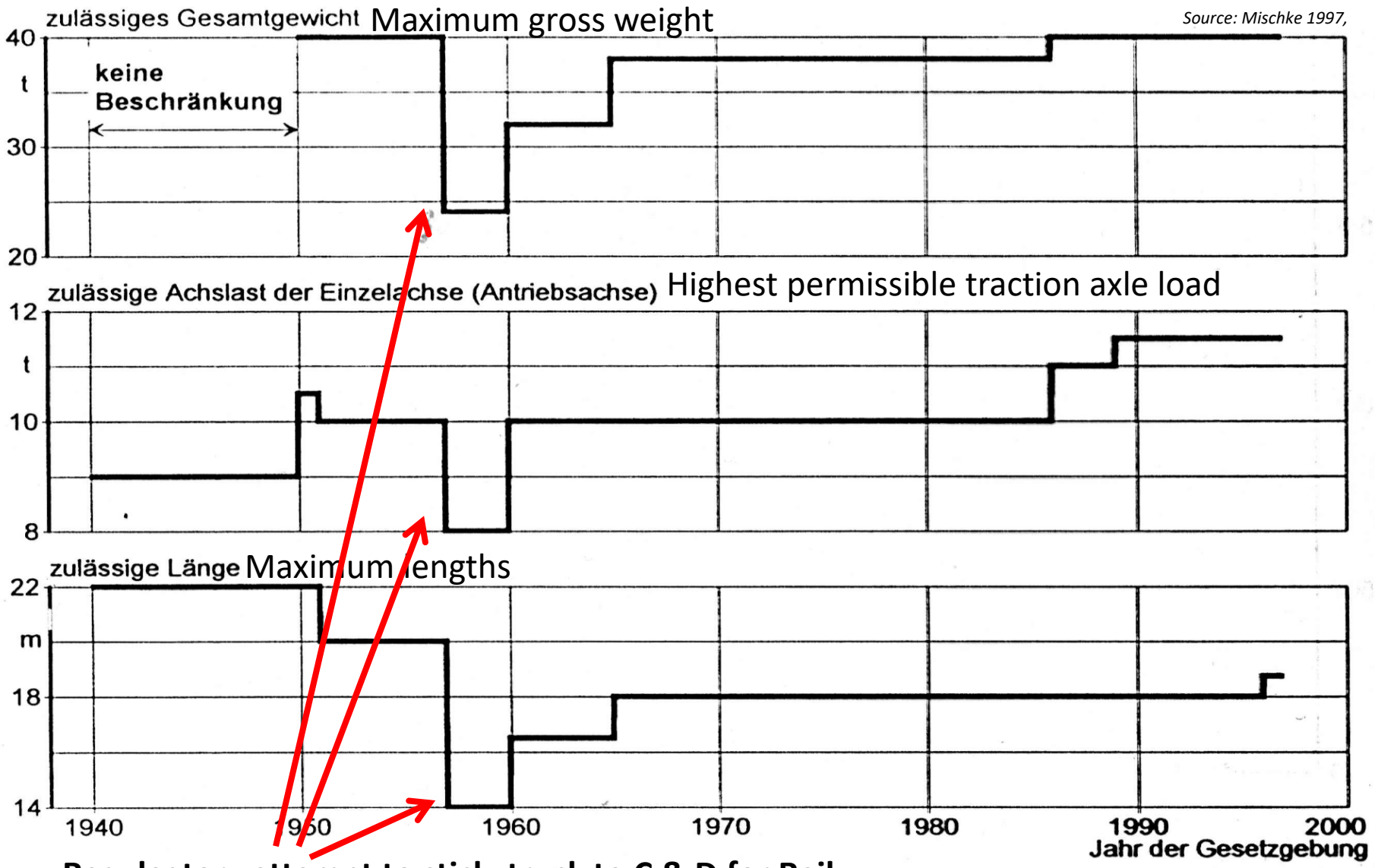


Source: American Automobile Association; American Trucking Association

1 – Subject to access restrictions in many states.

By John Sherlock, USA TODAY

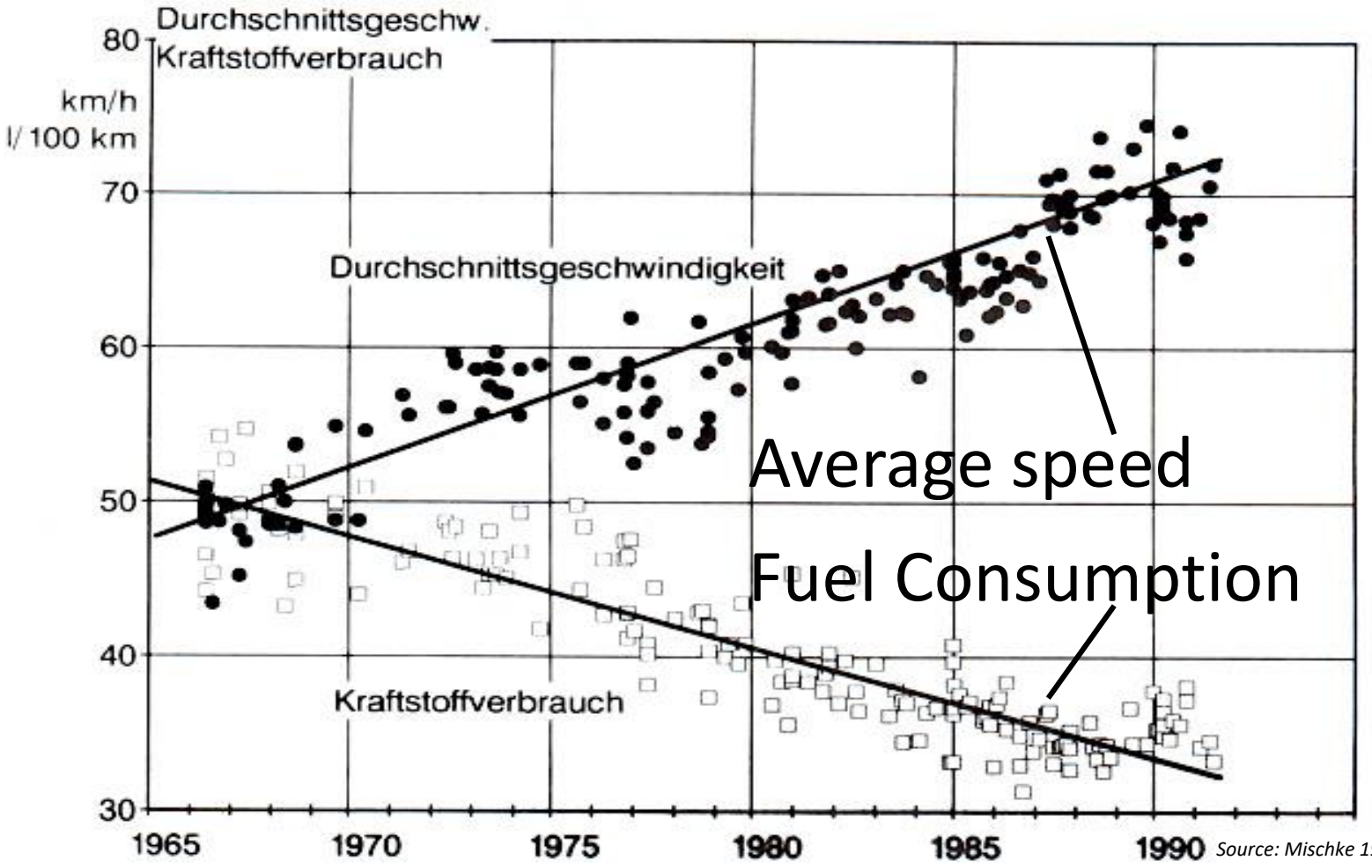
HGV Regutlation in Germany



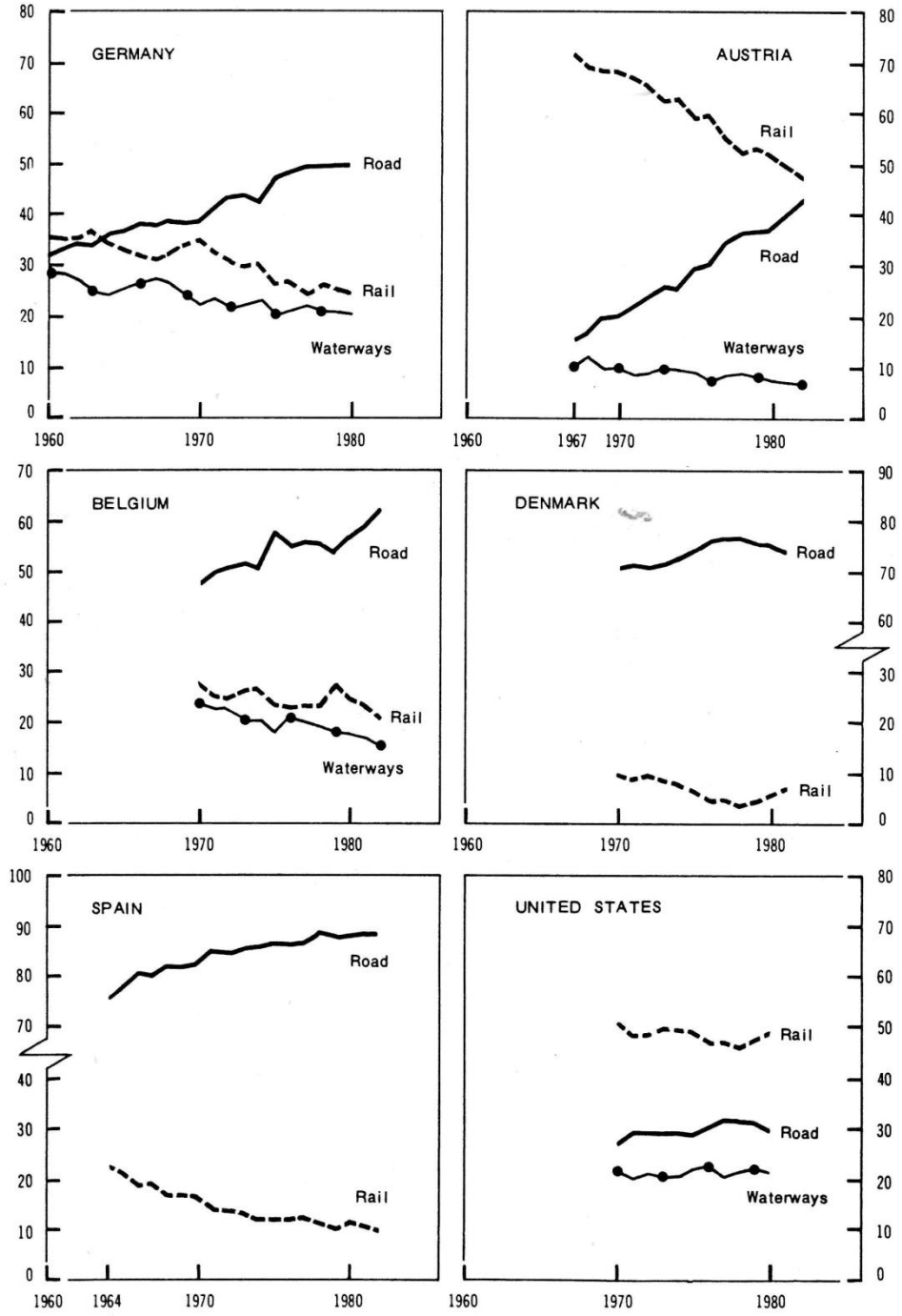
Regulagtory attempt to stick truck to C & D for Rail

Source Midche

Despite of legal constraints: The Truck grew better and better:



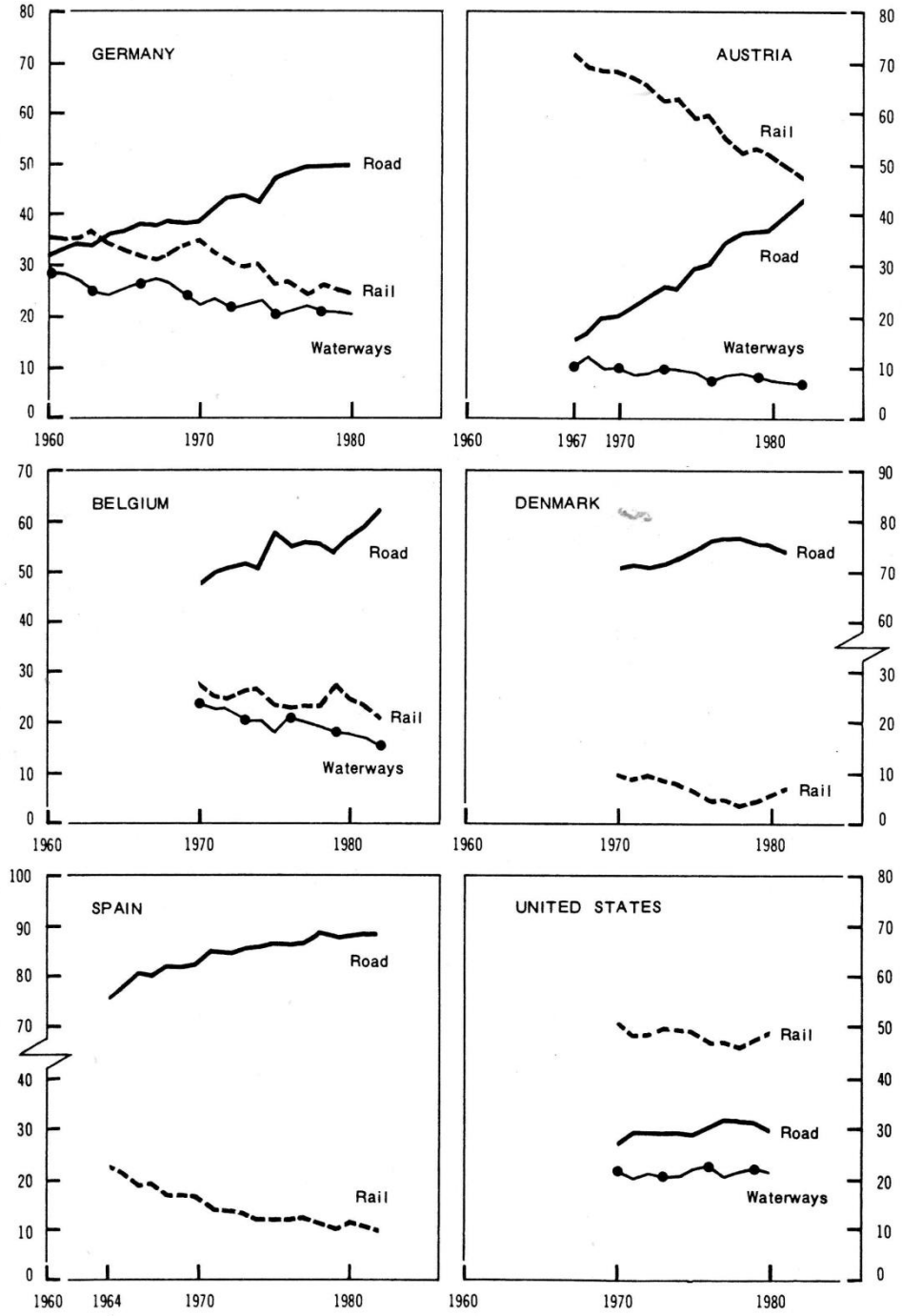
Source: Mischke 1997,



Modal share in the 20th century before deregulation:

Why remained rail share in USA constant over time?

Source CEMT



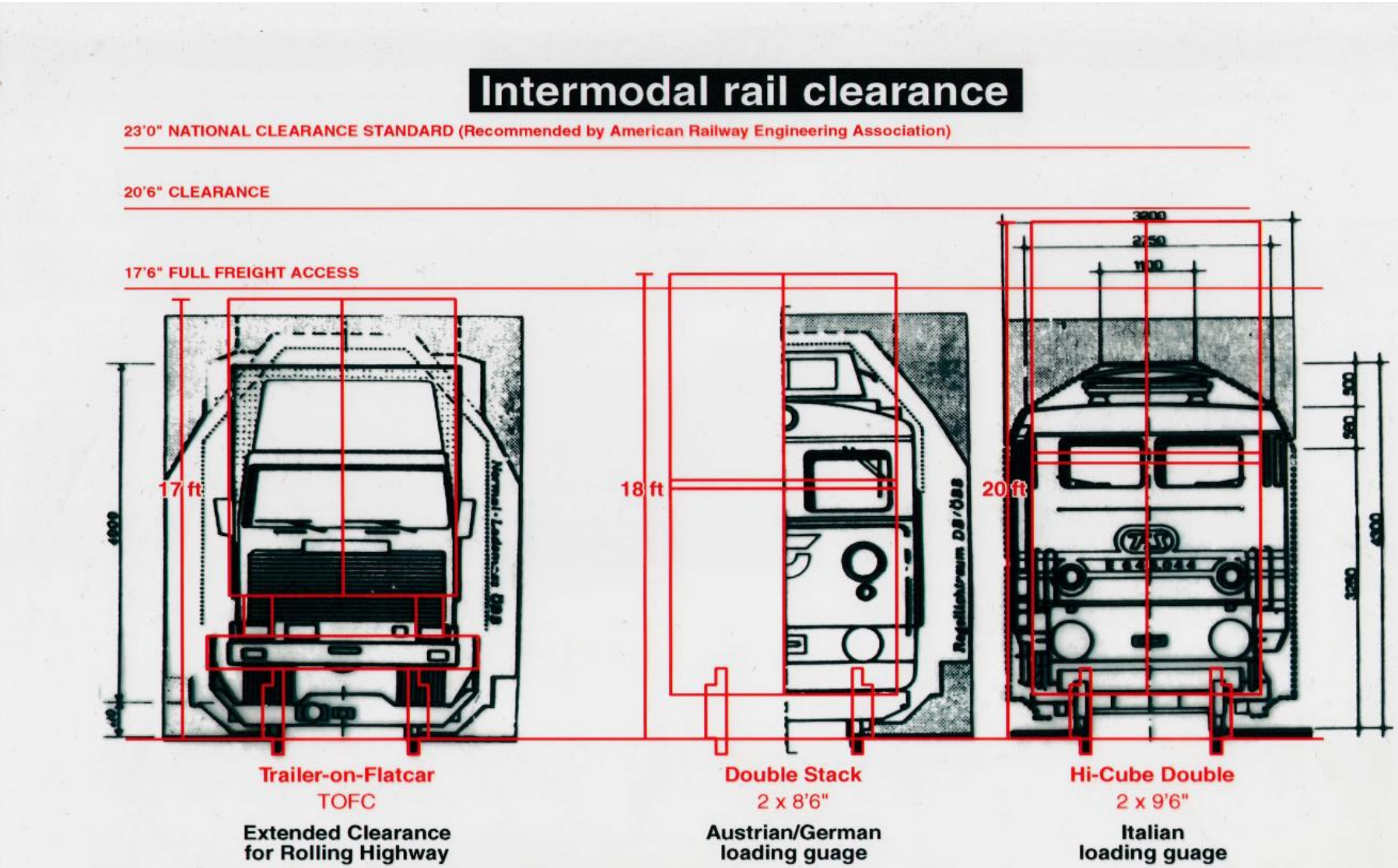
Modal share in the 20th century before deregulation:

Why remained rail share in USA constant over time?

Because of the 80.000lbs Weight limit for Heavy Gross Vehicles in the U.S- (36 tons)

Source CEMT

Gauge and Clearance US vs. Alps



Source: Port Authority of New York & New Jersey cited after MULLER, G. (1995): Intermodal Freight Transportation, 3rd ed., p.51

Source: PETROVITSCH, H., in: SCHIENENVERKEHR aktuell 3/91, S.3

The role of UIRR in Brussels: Infra Wagons Loading Units

UIRR Services

- **CESAR:** administration, support for the CESAR NEXT, recruit new operators
- **EDIGES:** promotion and dissemination, full TAF-TSI compliance
- **CODE MANAGEMENT PORTAL (CDM):** full redesign
- **ILU-CODE:** full redesign, ILU-Code Register *(TAF TSI Regulation)*, promotion and dissemination, new General Terms and Conditions
- **WASTE AND DANGEROUS GOODS PORTAL:** design, business requirements
- **RFP:** legal and market analysis completed, data collection, follow-up (RIS)
- **National Fact Sheets**: collection of transport-related rules per country and per transport mode

DIGITAL TRAIN 2.0

RAIL FACILITIES PORTAL

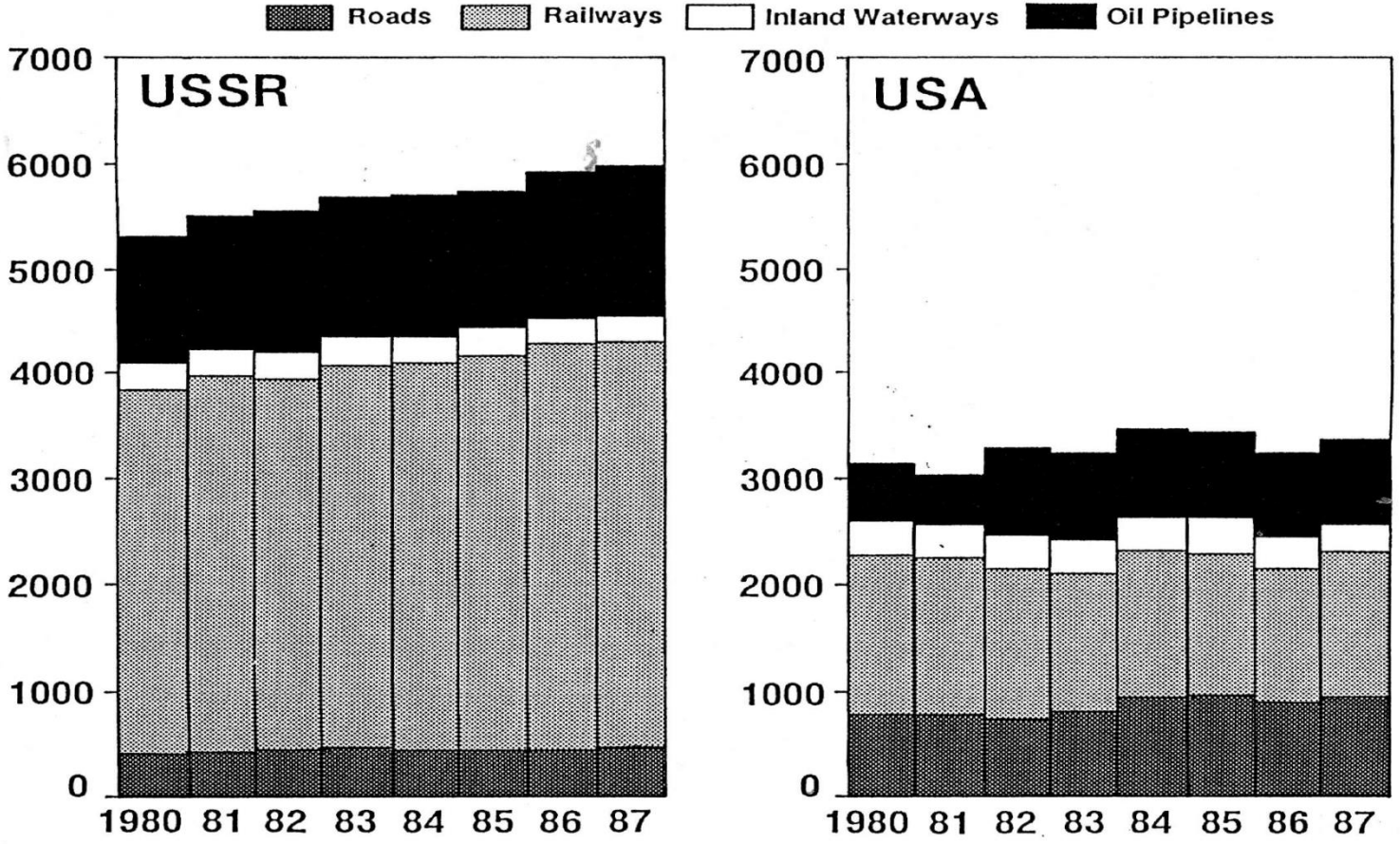
Results

- **ILU-Code reform**: new portal + visual identity, ILU-Register, revised GTC
- **UIRR EDIGES Code Management Portal**: developed under the FENIX project

Source: UIRR 2023

TRANSPORT PERFORMANCE AND MODAL SPLIT OF LONG DISTANCE FREIGHT TRANSPORT IN ECE MEMBER COUNTRIES

(in billion tonne-kilometres)

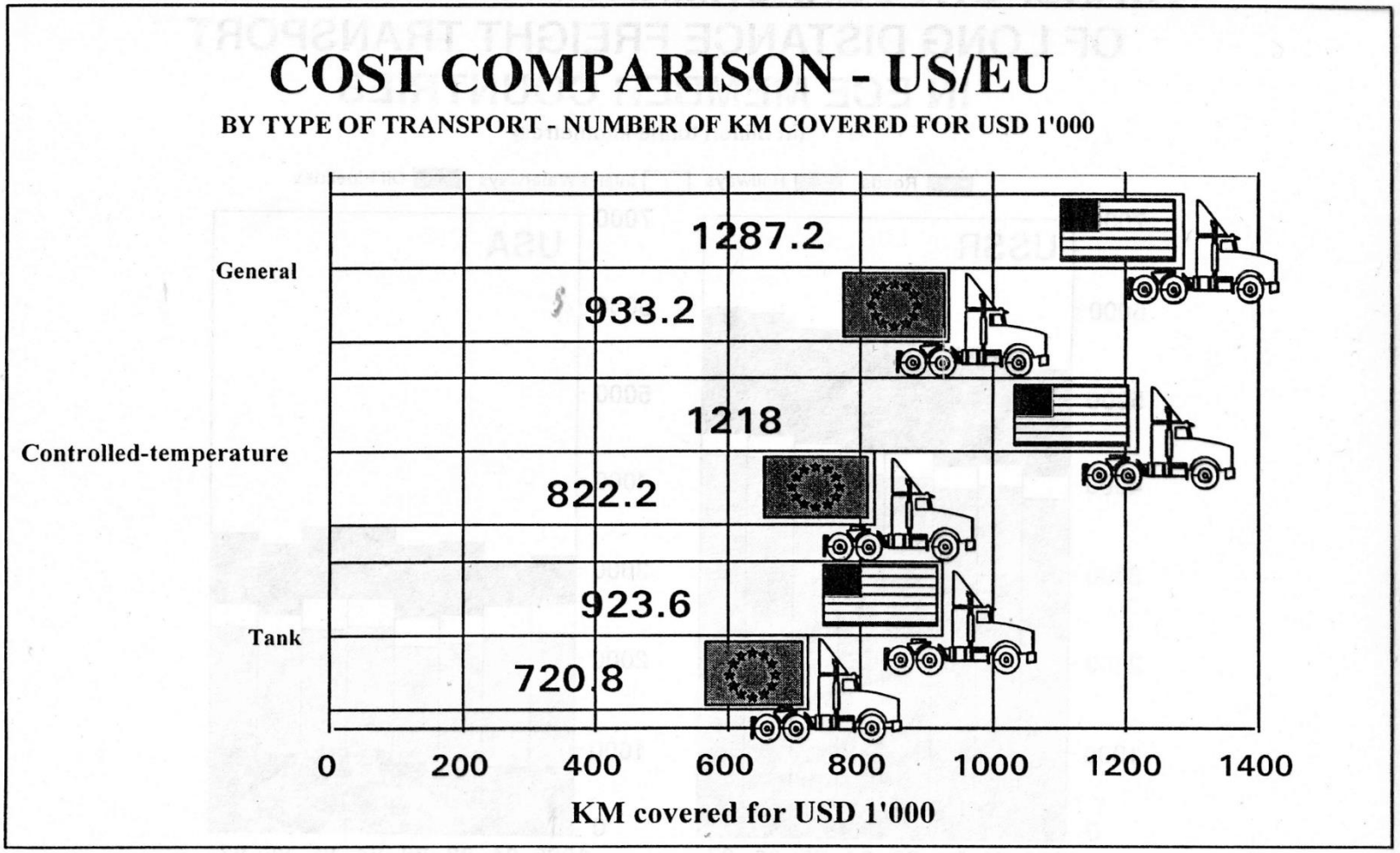


Source: Annual Bulletin of Transport Statistics for Europe and Calculations of the ECE Secretariat.

In the 80s the USSR had a higher proportion of GDP to spend on transport than the U.S.

AND: Gross Domestic Product USSR = ½ USA…

What makes European Trucks more expensive than in the U.S.?



Source : IRU

According to K-H. Narjes, former Minister for Economy and Transport, from 1981 to 1988 EU Commissioner always stated: A truck in the US runs on average 60 km/h
In Europe because of national regulation and custom procedures 18 km/h only !

The Competitiveness of Rail Freight

Rolling speed:

Rail is faster than Road:

100/120 km p h 80 km p h

on average:
80 – 100 km p h 65 km p h

The Competitiveness of Rail Freight

Loading capacity:

	Rail Wagon 4-axle	Truck
Total	90 t	40(44) t
Net-weight	**72,5 t**	**< 28 t**
track-classification	D4	Motorways
Axle-loading	22,5 tons	10/11,5 tons

Source: EN 15528, German maximum values, StVO

The Competitiveness of Rail Freight

Loading capacity – MARKET POTENTIAL:

There are still a lot of customers who want to use

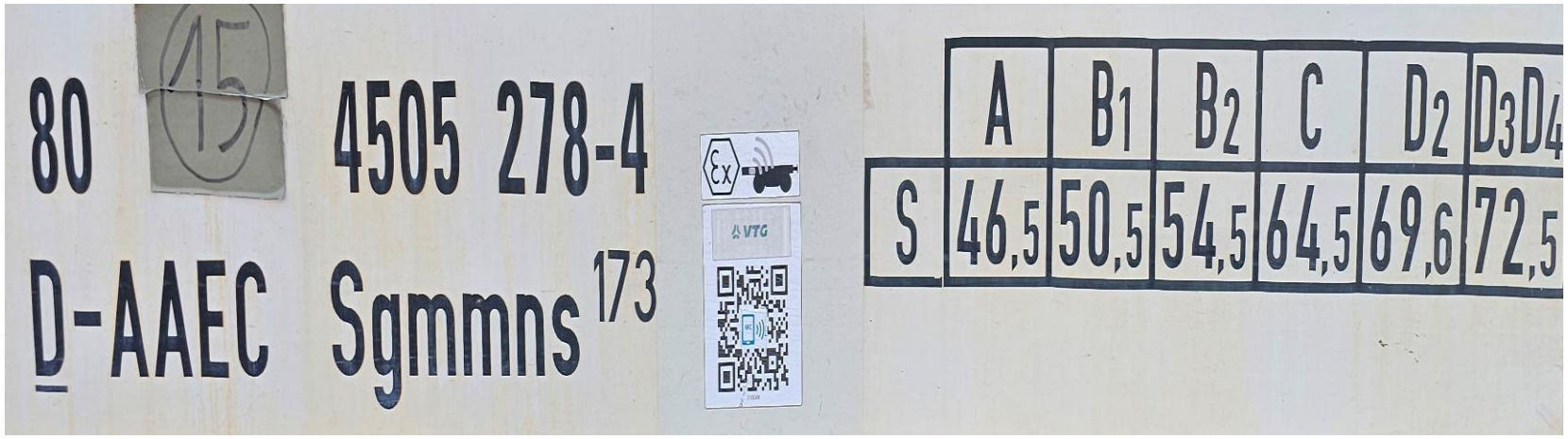
- up to **double volume**
- up to **three fold weight**

compared to the truck!

Table: Maximum Axle Loads and Meterloads:

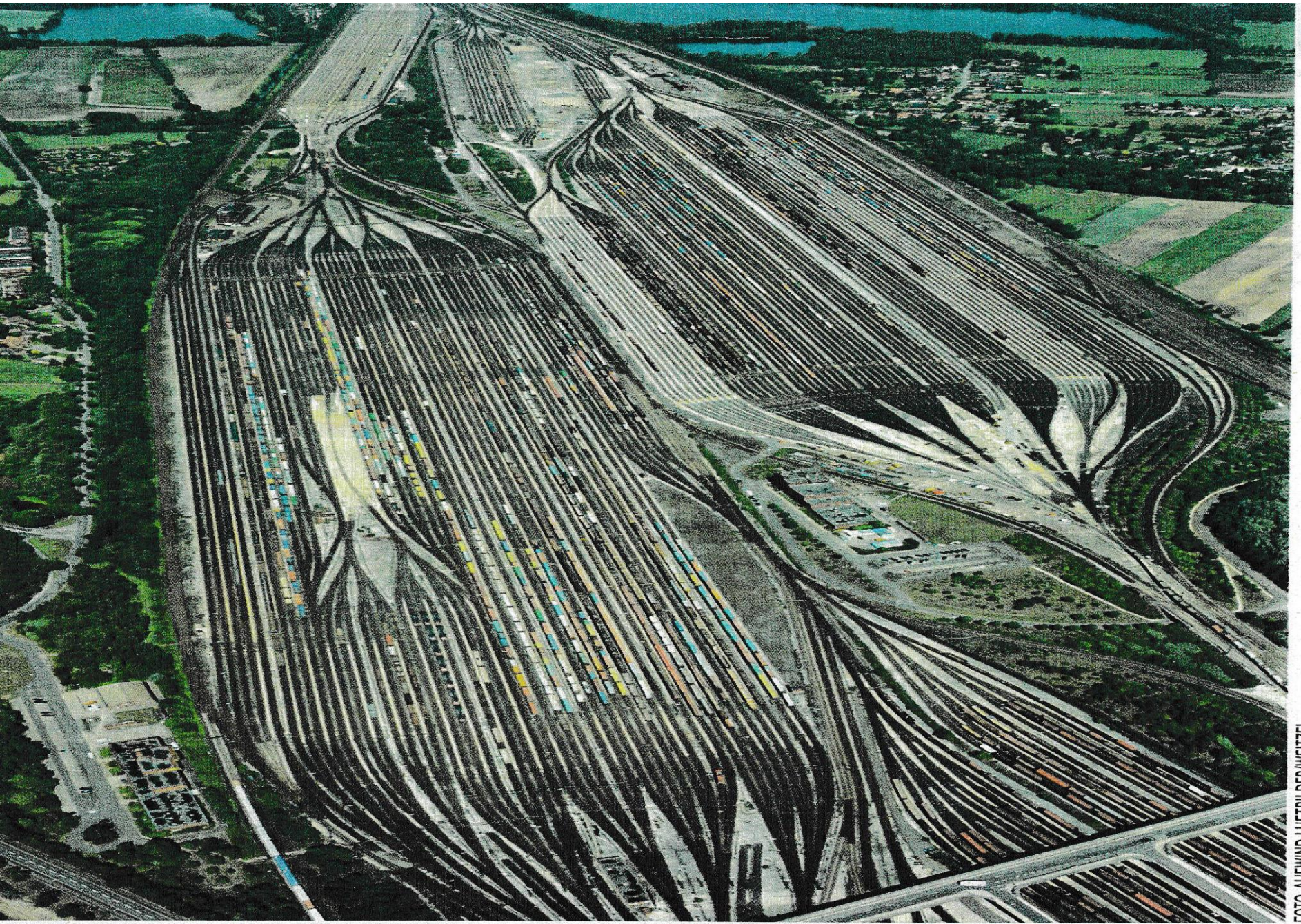
Axle-Load Meterloads	16	18	20	22,5	25
5	A	B1			
6,4		B2	C2	D2	
7,2			C3	D3	
8			C4	**D4**	E4
8,8					E5

Source: DIN EN 15528



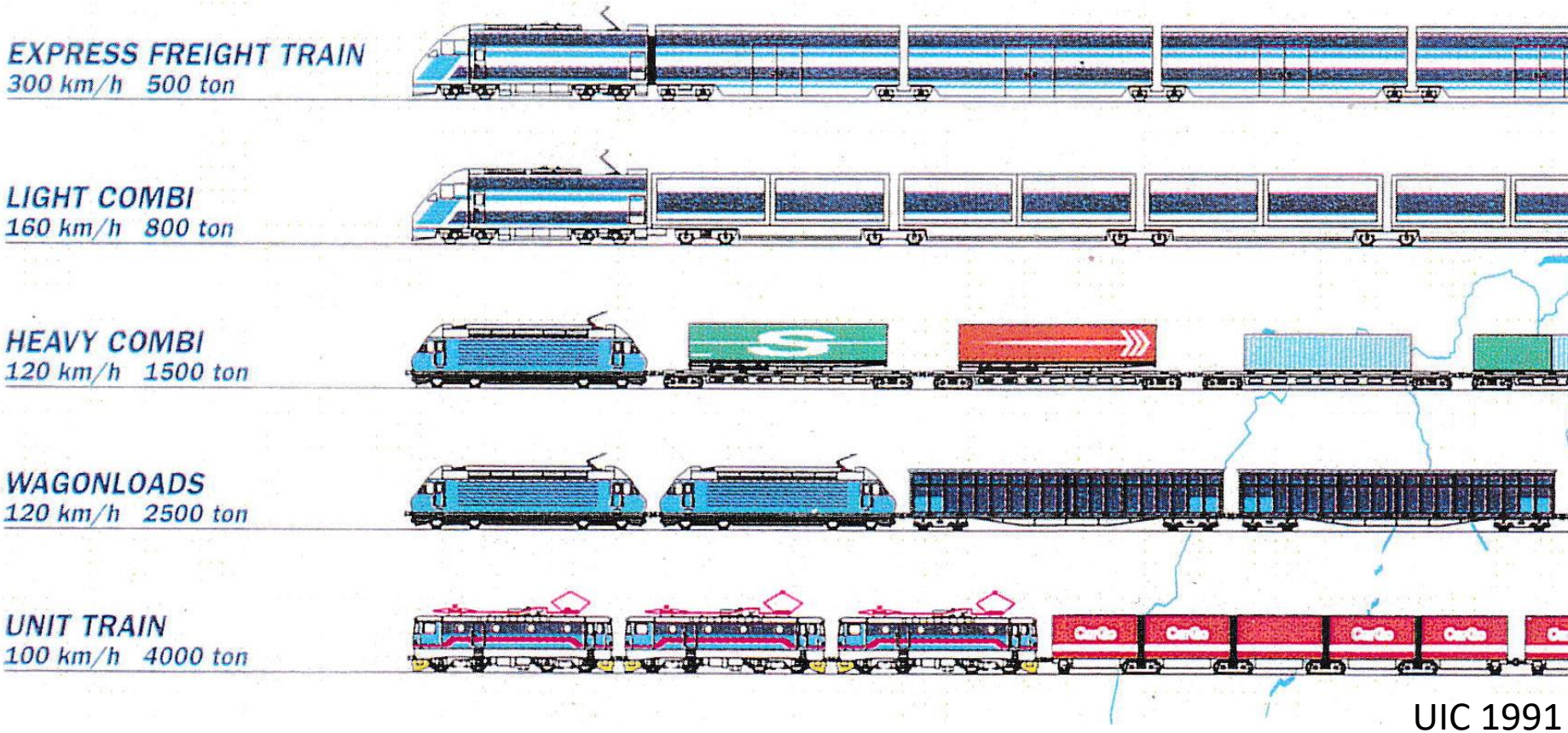
Picture Kortschak 2023

But why is rai loosing markket share – even if you have such efficient marshalling yards?



POSSIBLE FUTURE INTERNATIONAL FREIGHT TRAINS

Trains may appear under different names and in different combinations (total maximum train weight and speed).

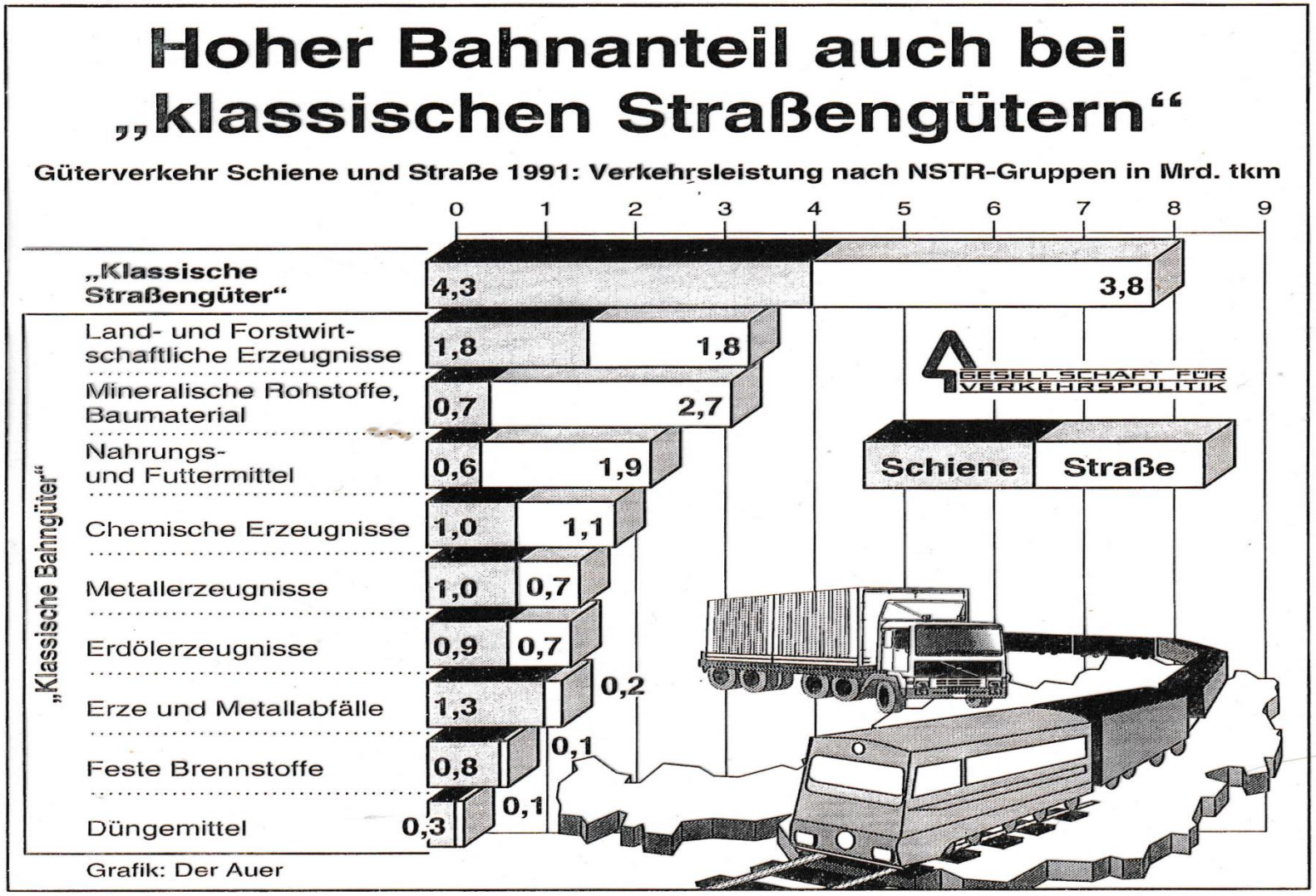


UIC 1991

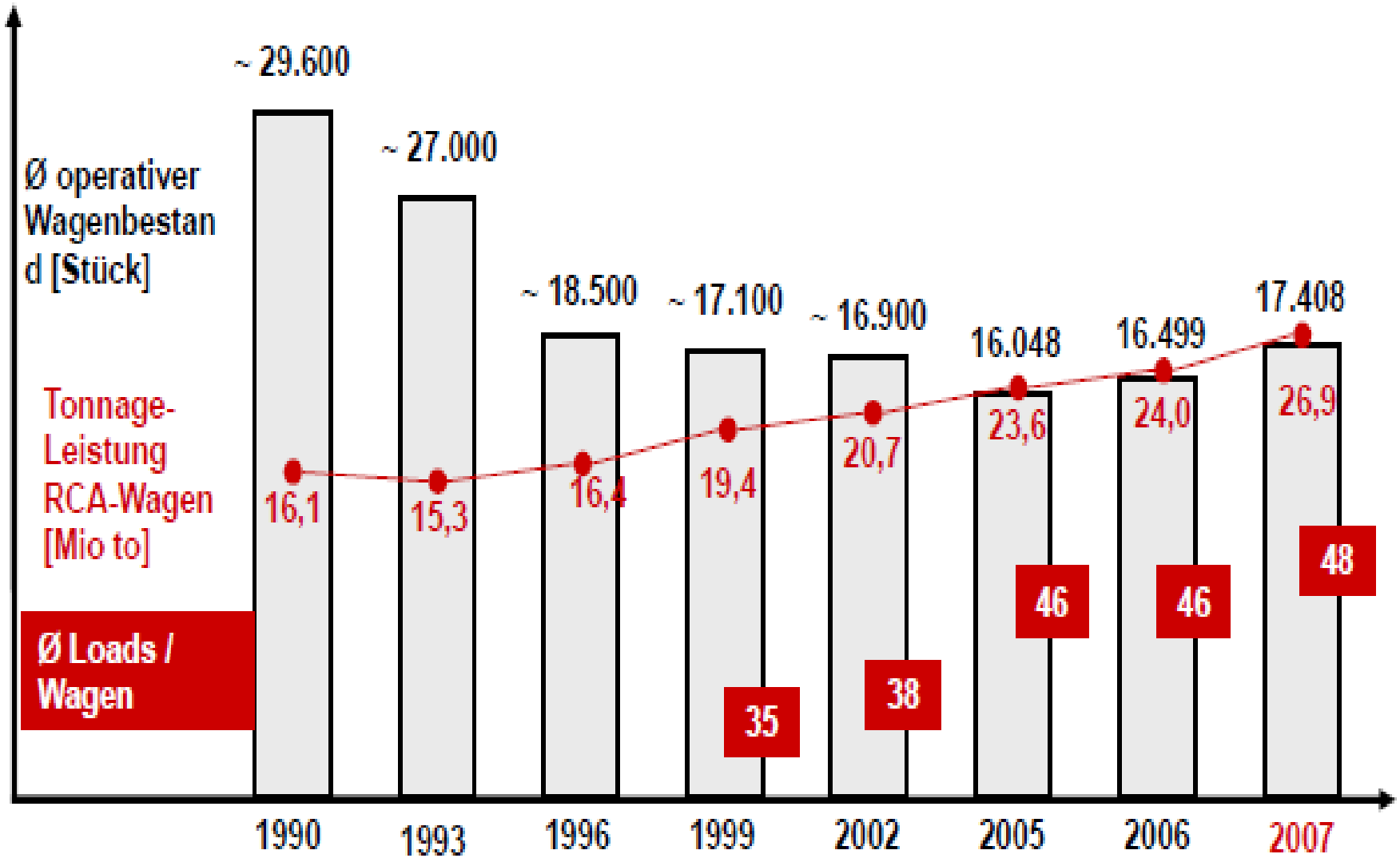
How Austria maintained a High Modal-Share position so far?

GESELLSCHAFT FÜR VERKEHRSPOLITIK

Because of Day 1 18h dep – Day 3 6h arr. In siding in Single Wagon Load Service throughout the country

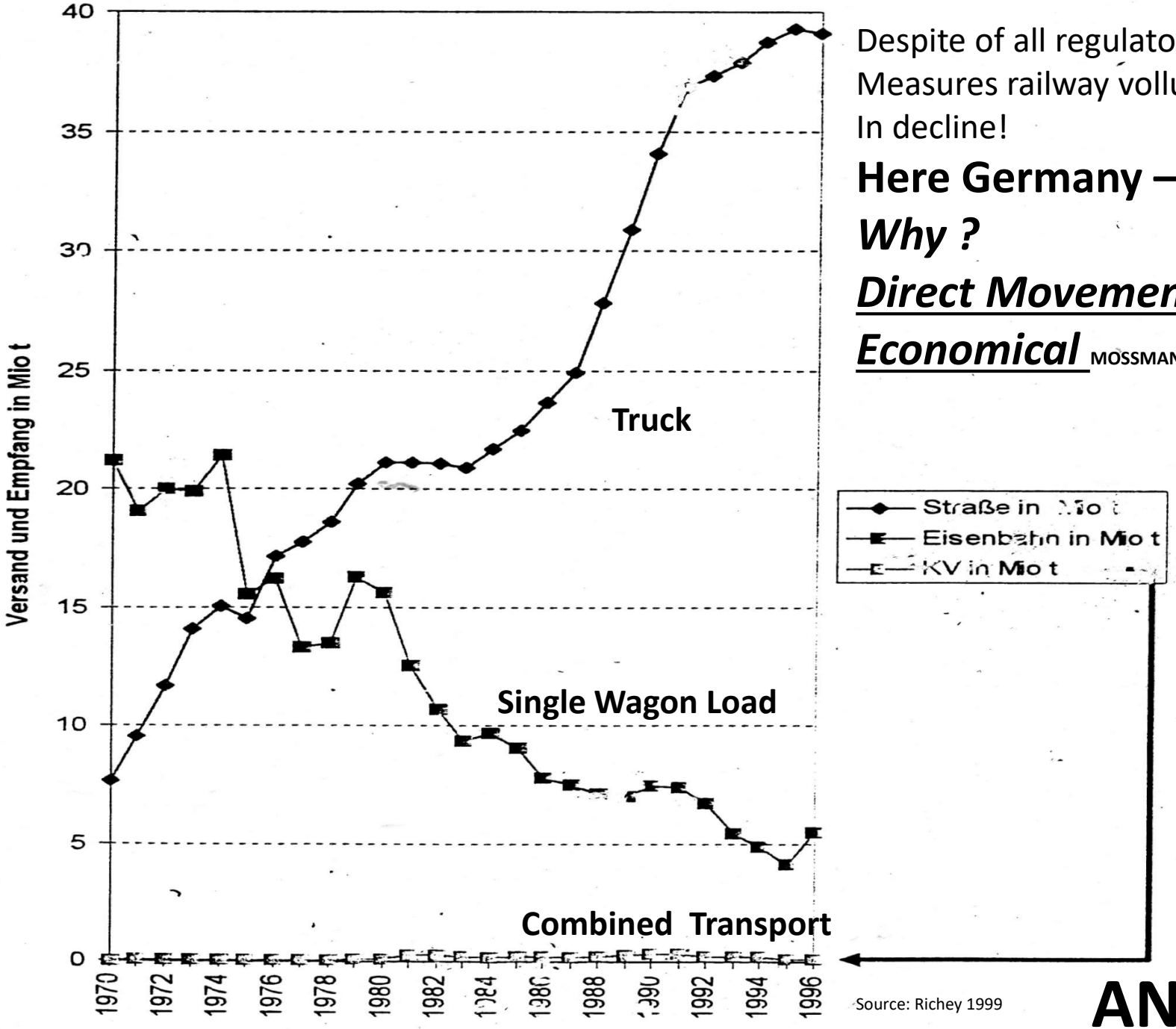


What was it good for? The number of loaded haulls per annum increased to 48 in 2008 (RCA):



Source: Schmidt, F. (2008): Strategische Bedeutung des Wagenmaterials für die Rail Cargo Austria – Anforderungen an die Industrie, 38. Schienenfahrzeugtagung Graz 14.-17.09.2008, slide 19 – the respective German figure for 1994 is 27 loads only per year and wagon – in Austria about the same. See N.N. (1995): Weiterhin schwierige Situation im Güterverkehr der DB AG, in: Internationales Verkehrswesen 47 (1995) 10, p.587

Bilateral Volume in Mio. tonnes



Despite of all regulatory
Measures railway vollume
In decline!

Here Germany – France:

Why ?

Direct Movement is most Economical **MOSSMAN/MORTON 1965**

Source: Richey 1999

AND… ./.

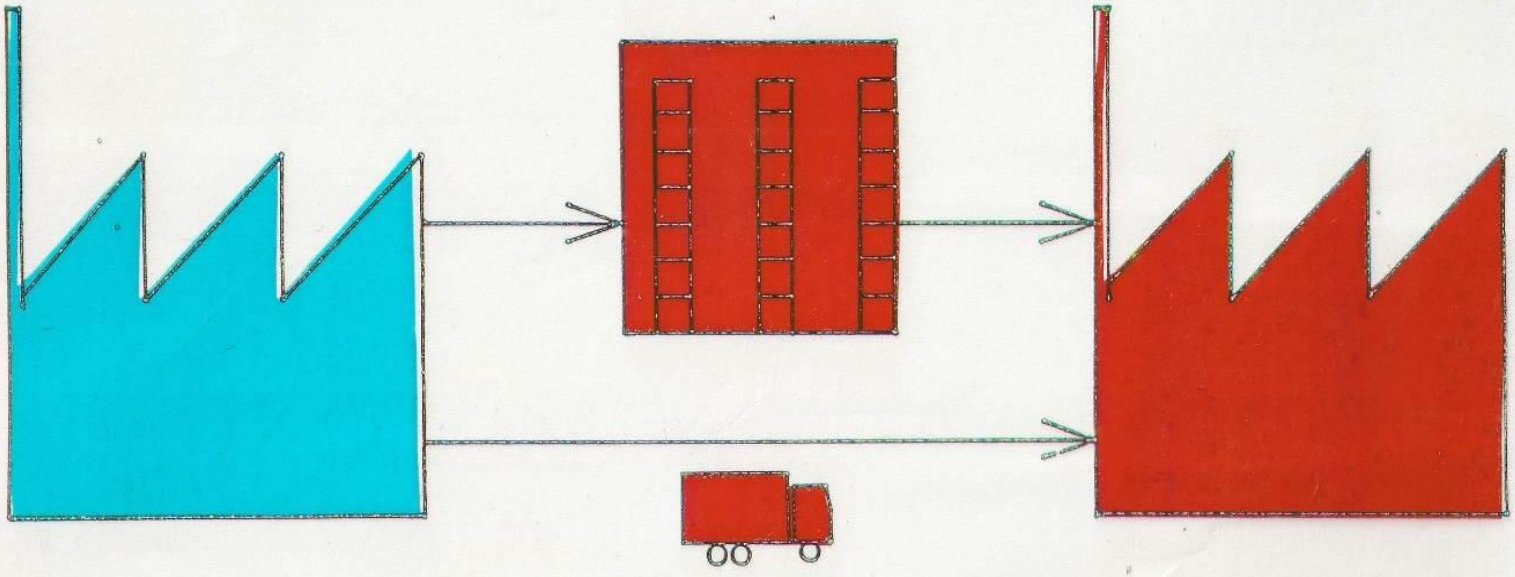
Punctual Freight Trains – a Logistics‘ Necessity!

BOSCH

Logistische Informationsspanne (Soll)

Tag 10/85

Robert Bosch‘s Vision in 1985: no stock keeping at industry:



BOSCH

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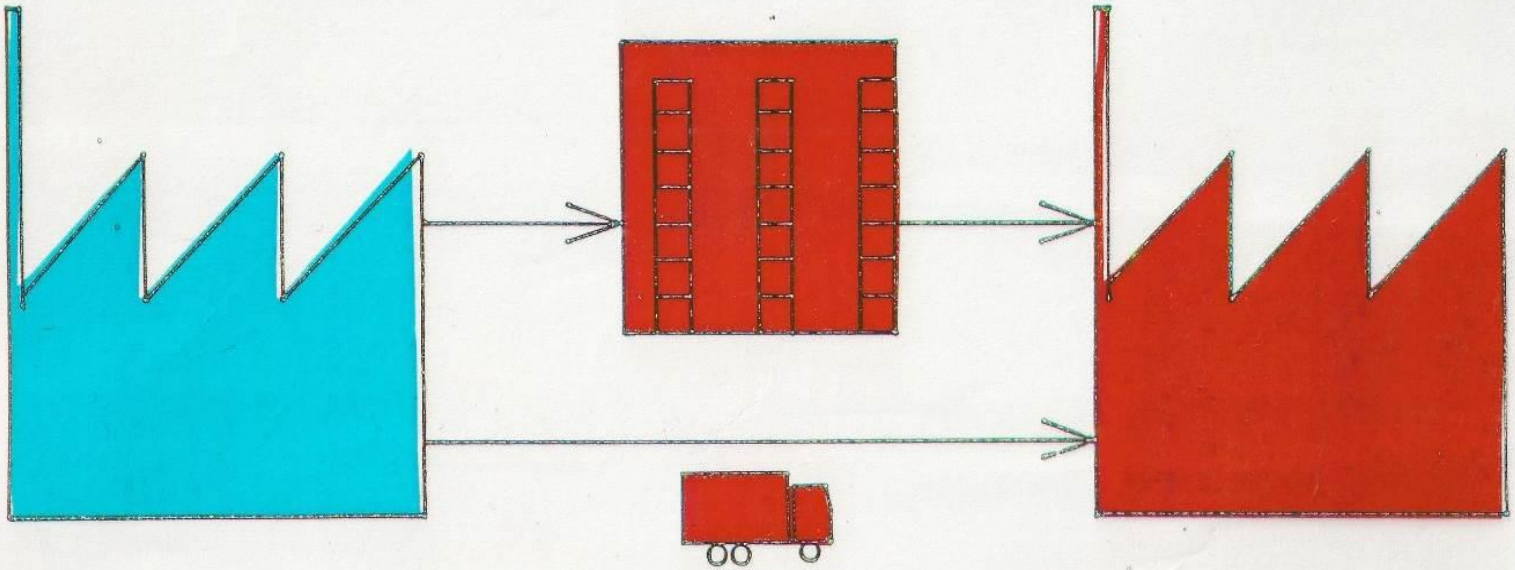
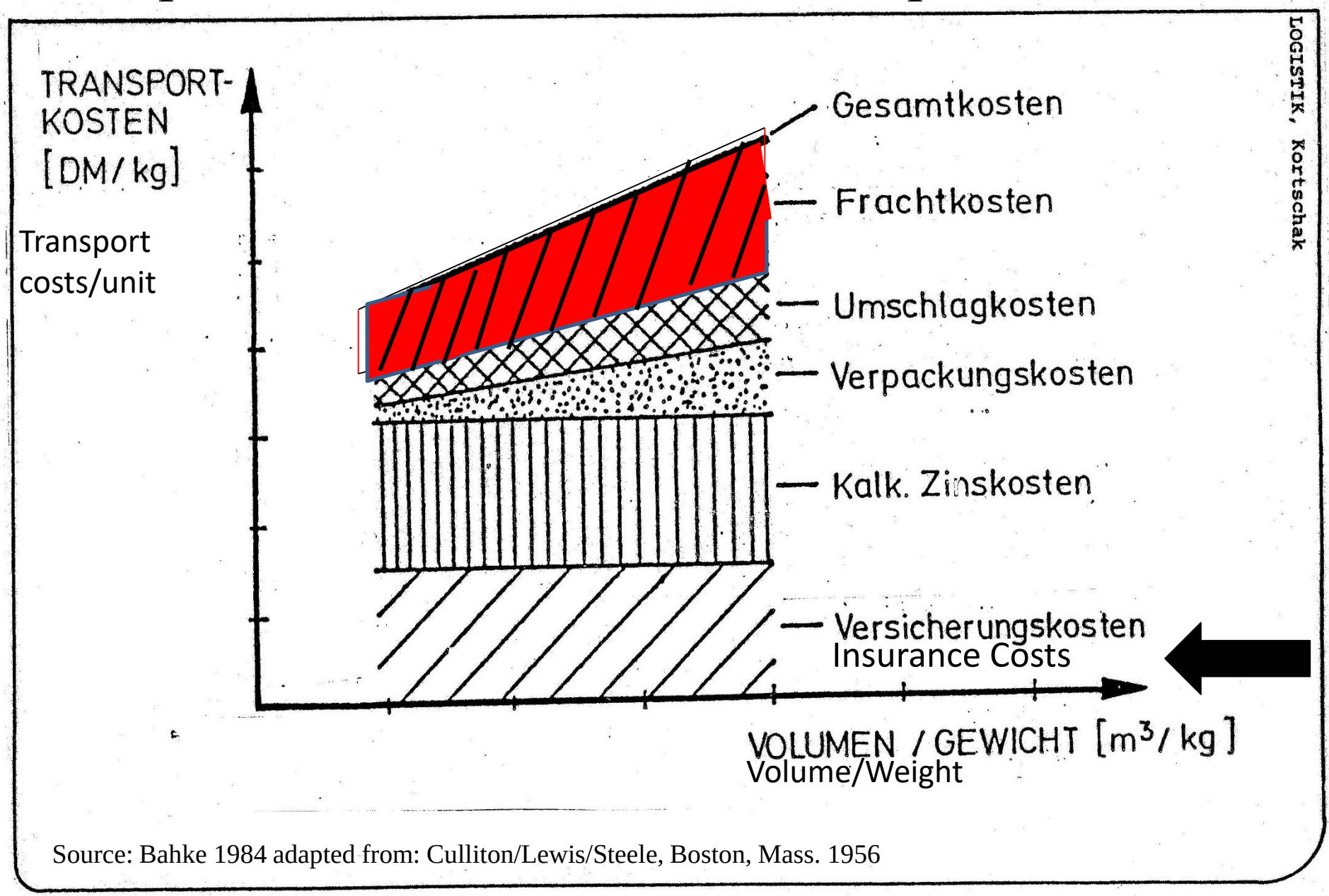


…due to logistics‘optimisation – now called Supply Chain Management!

In reality: Buffer stock is unavoidable – but should be kept at a minimum!

Transport costs from the customer‘s point of view:



Source: Bahke 1984 adapted from: Culliton/Lewis/Steele, Boston, Mass. 1956

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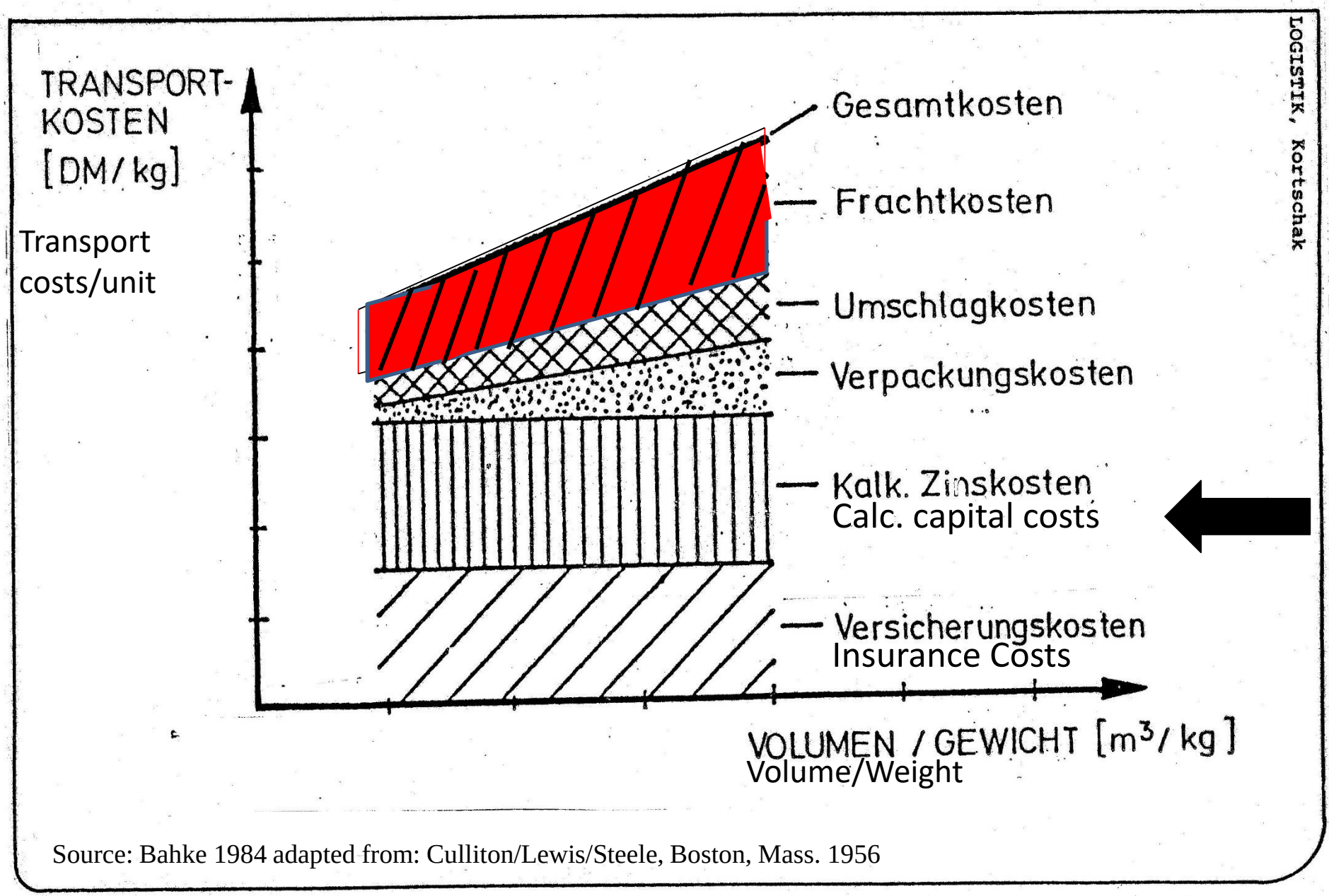

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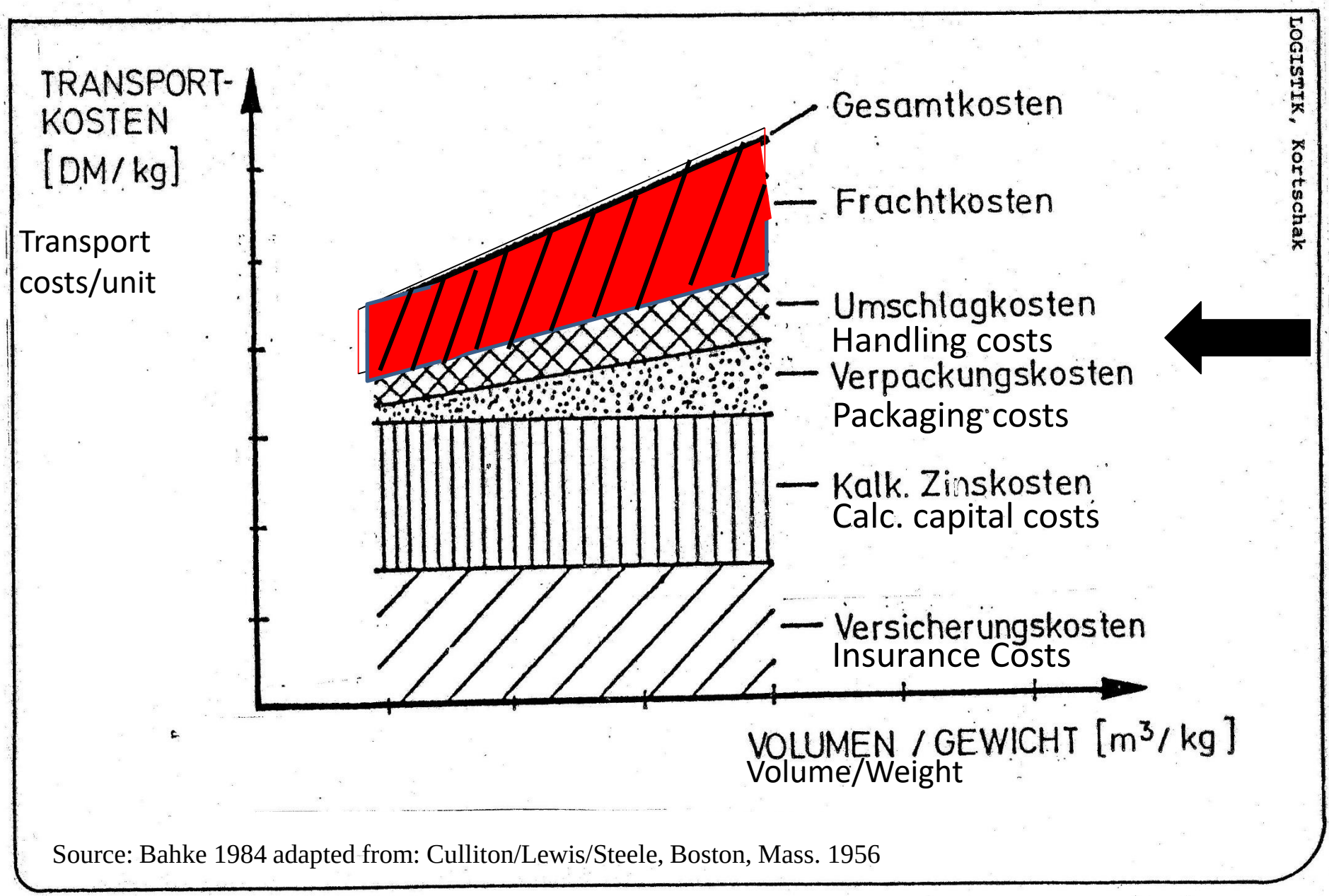

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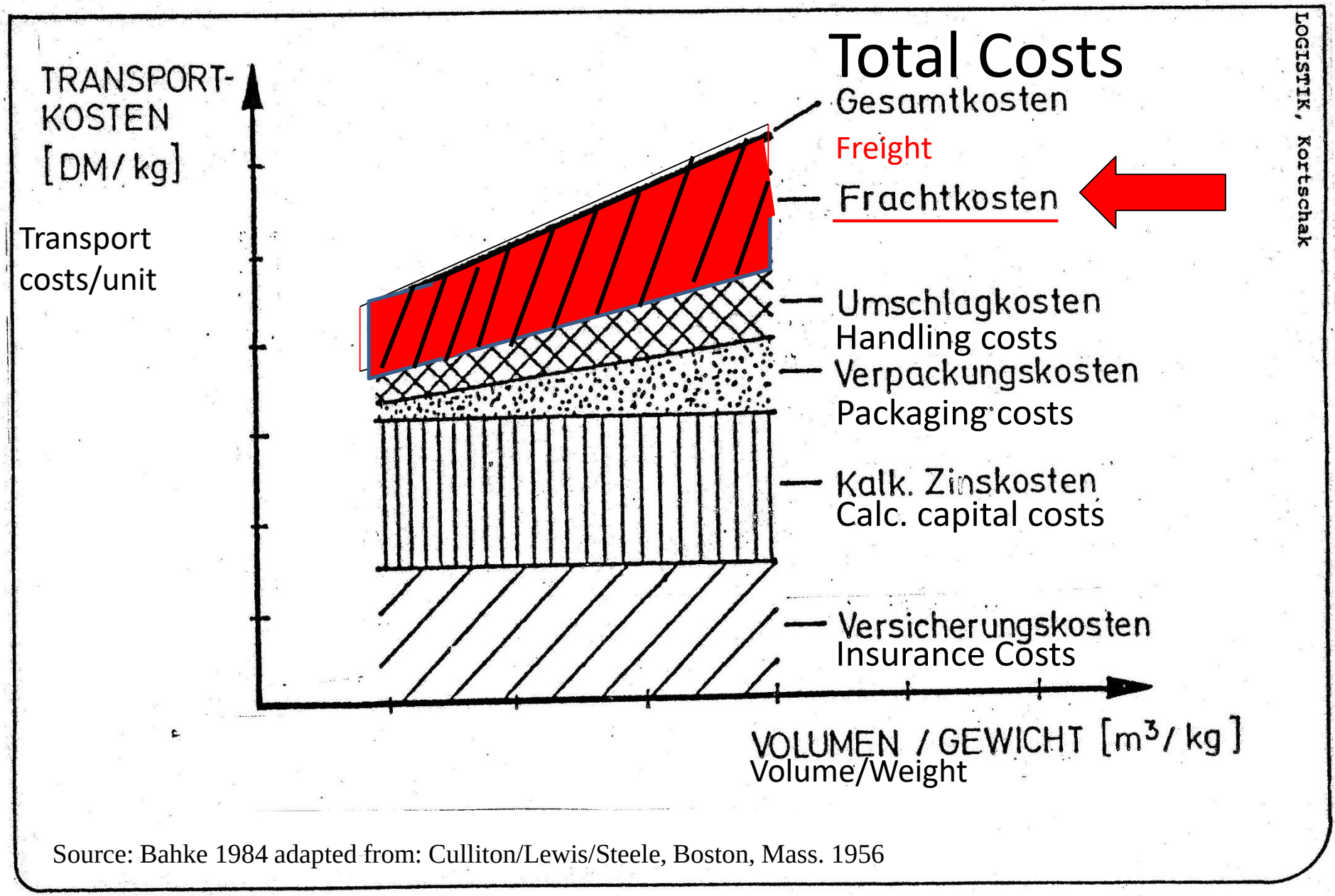

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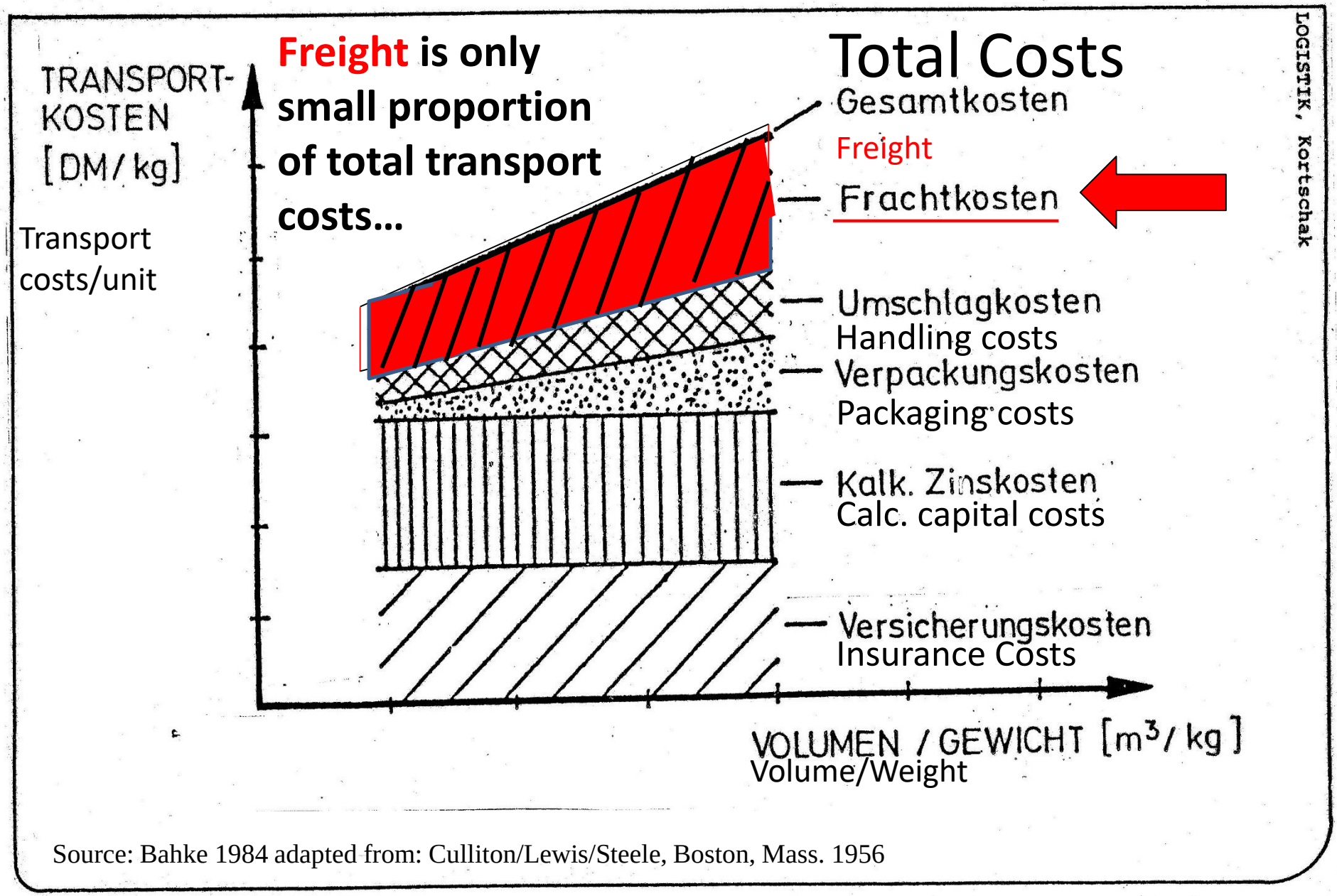

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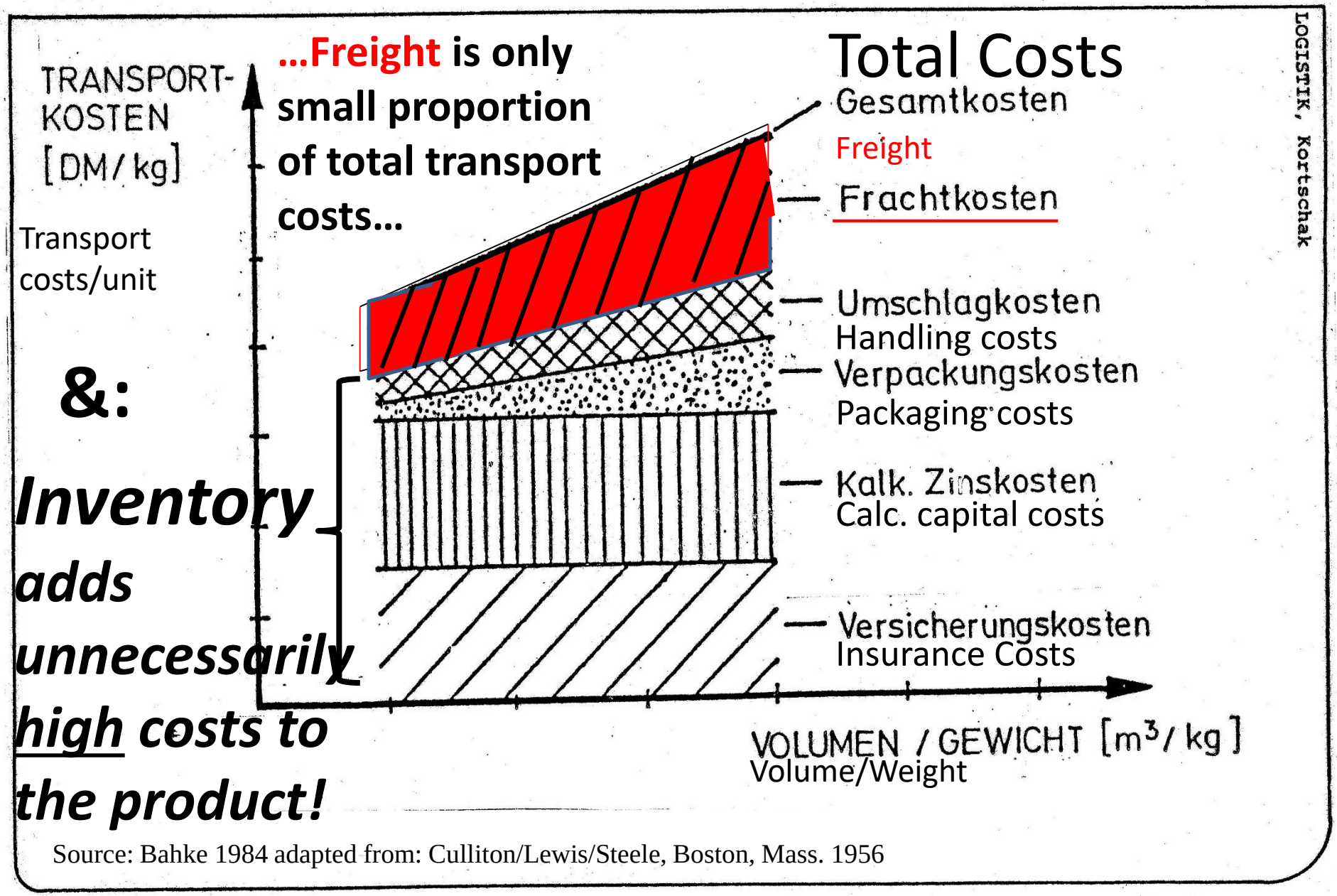


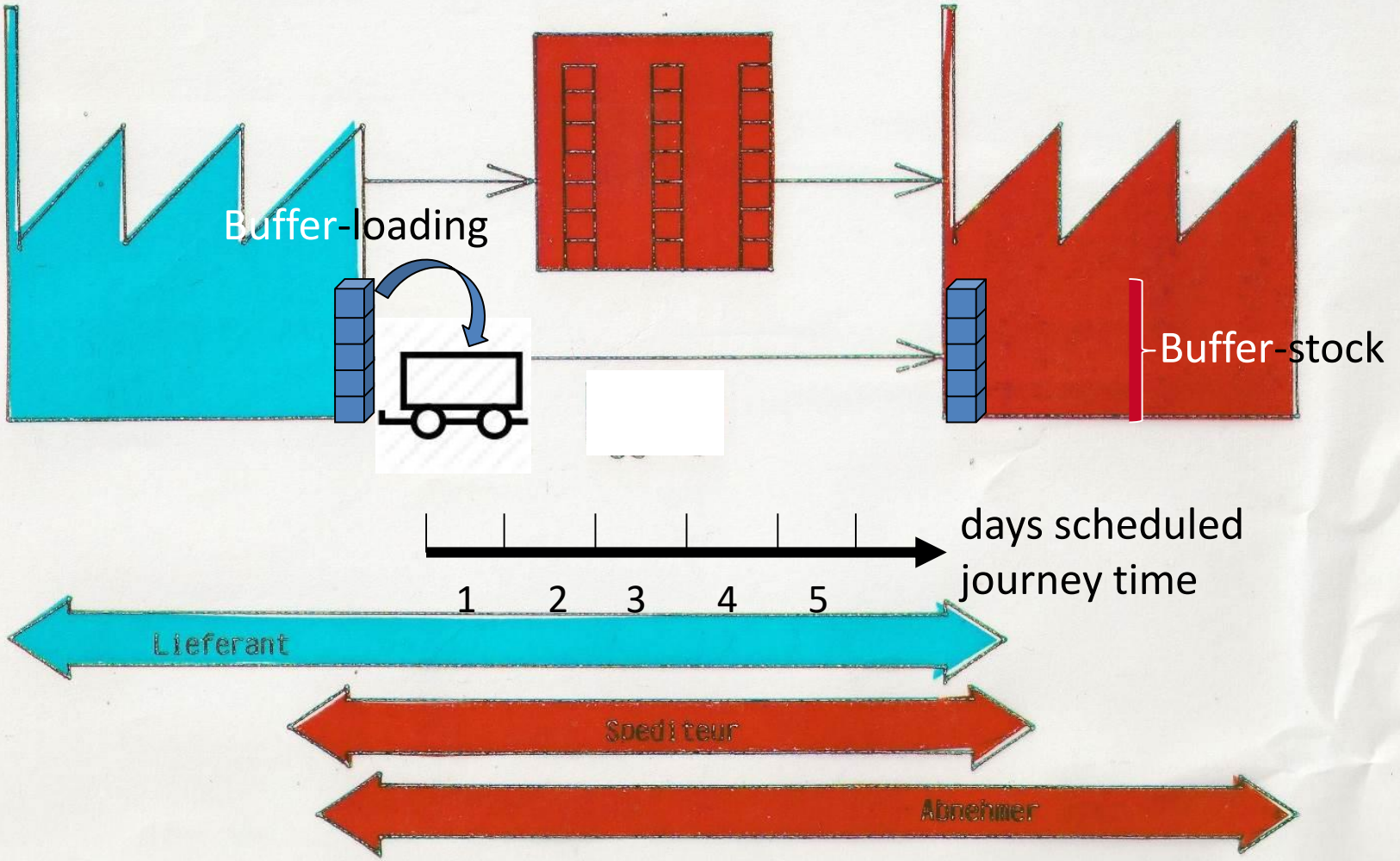
Source: Bahke 1984 adapted from: Culliton/Lewis/Steele, Boston, Mass. 1956

BOSCH

Adapted by Kortschak 2016

Logistische Informationsspanne (Soll)

The „ideal“ Supply Chain: only buffer stock as inventory left



BOSCH

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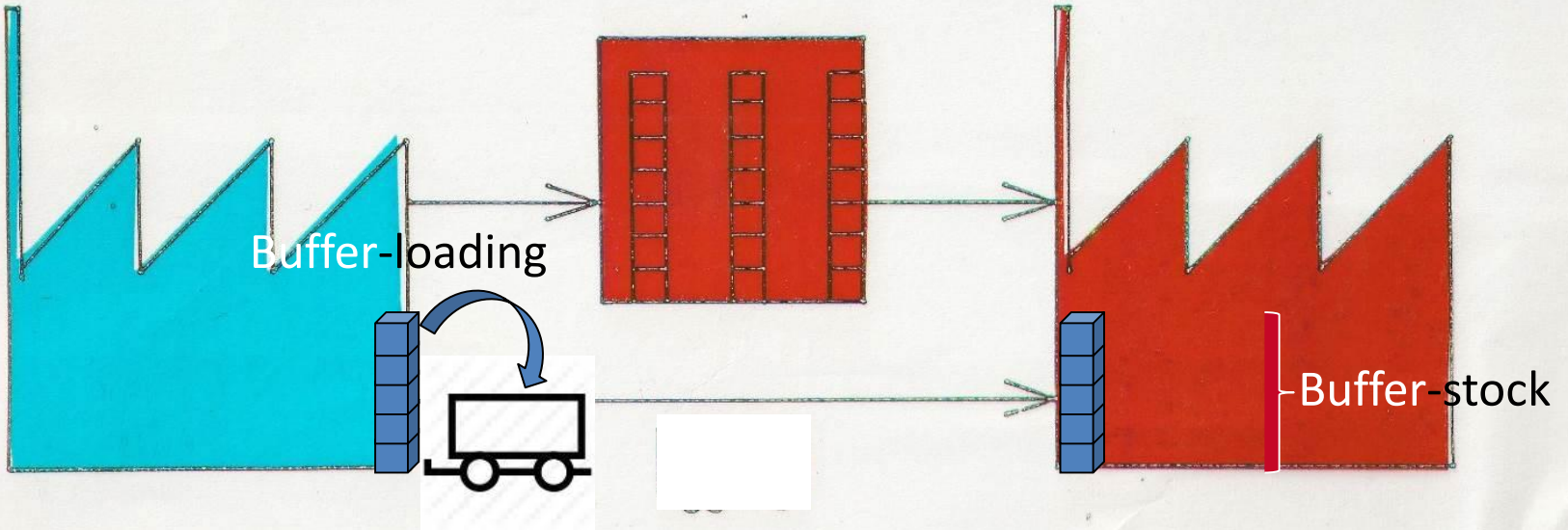
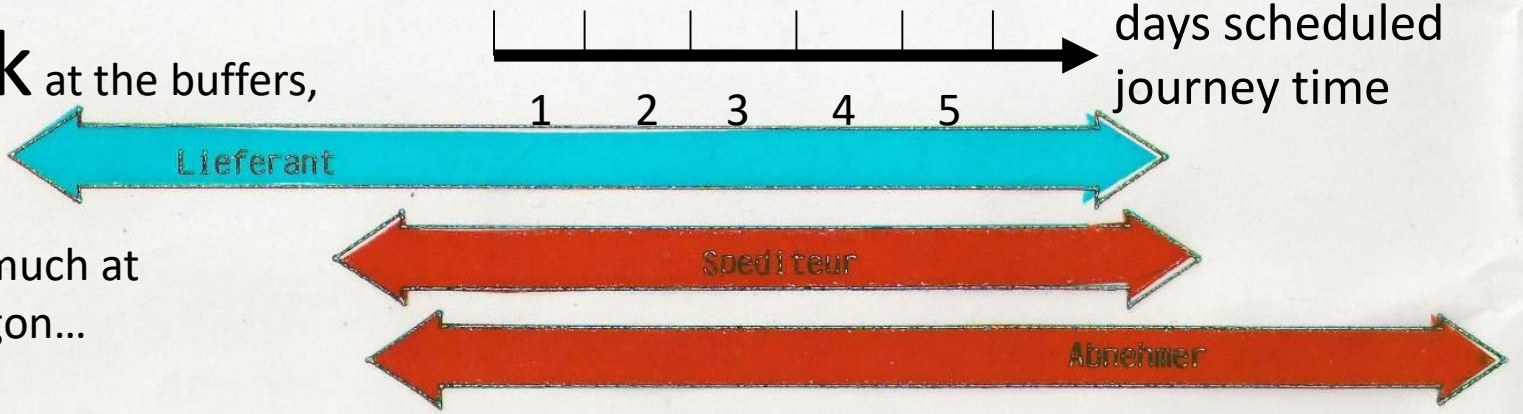


!Look at the buffers,

not so much at the wagon…

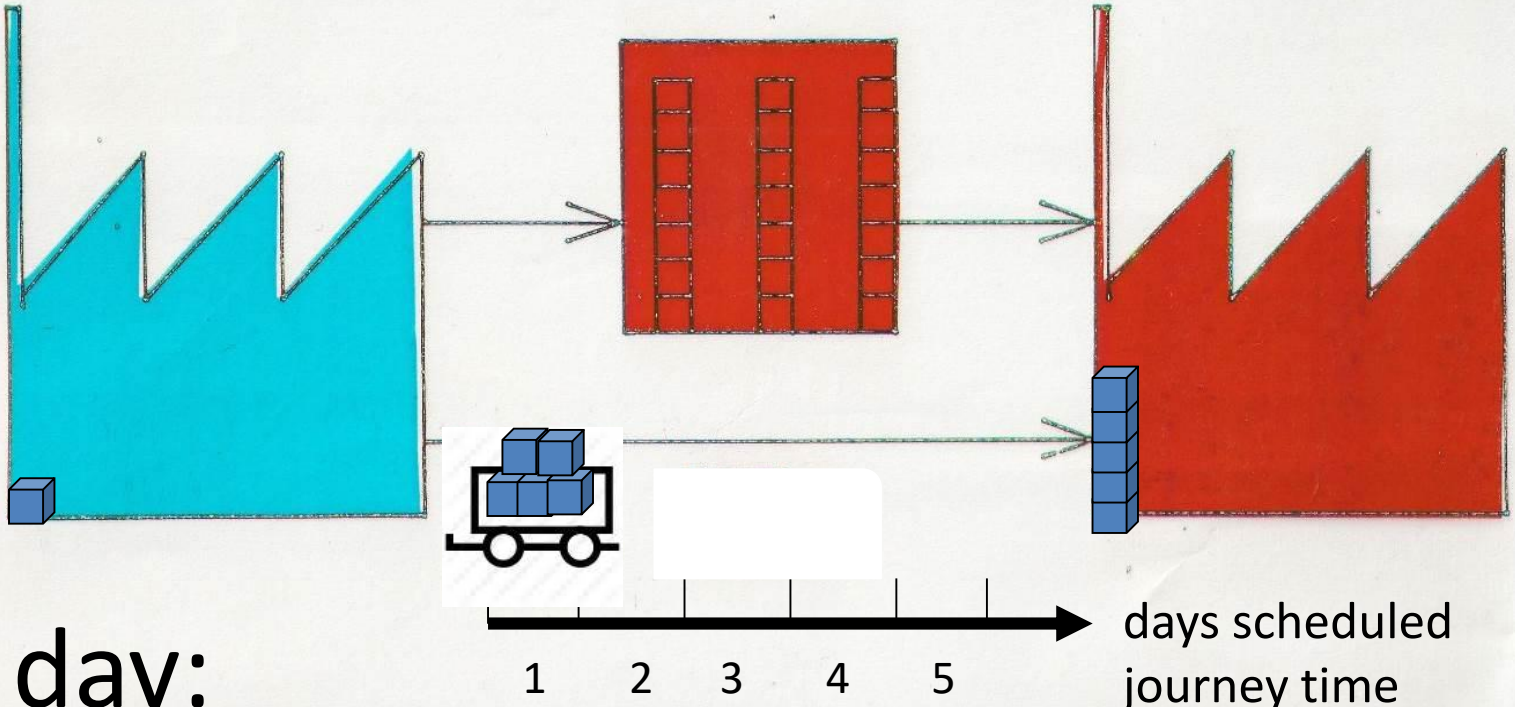


BOSCH

Adapted by Kortschak 2016

What happens with the buffer during transit time when cargo is transported?

Have a look at the shipper‘s & consignee‘s invenotry:



1st day:

the loaded wagon has left the factory

BOSCH

Adapted by Kortschak 2016

What happens with the buffer during transit time when cargo is transported?

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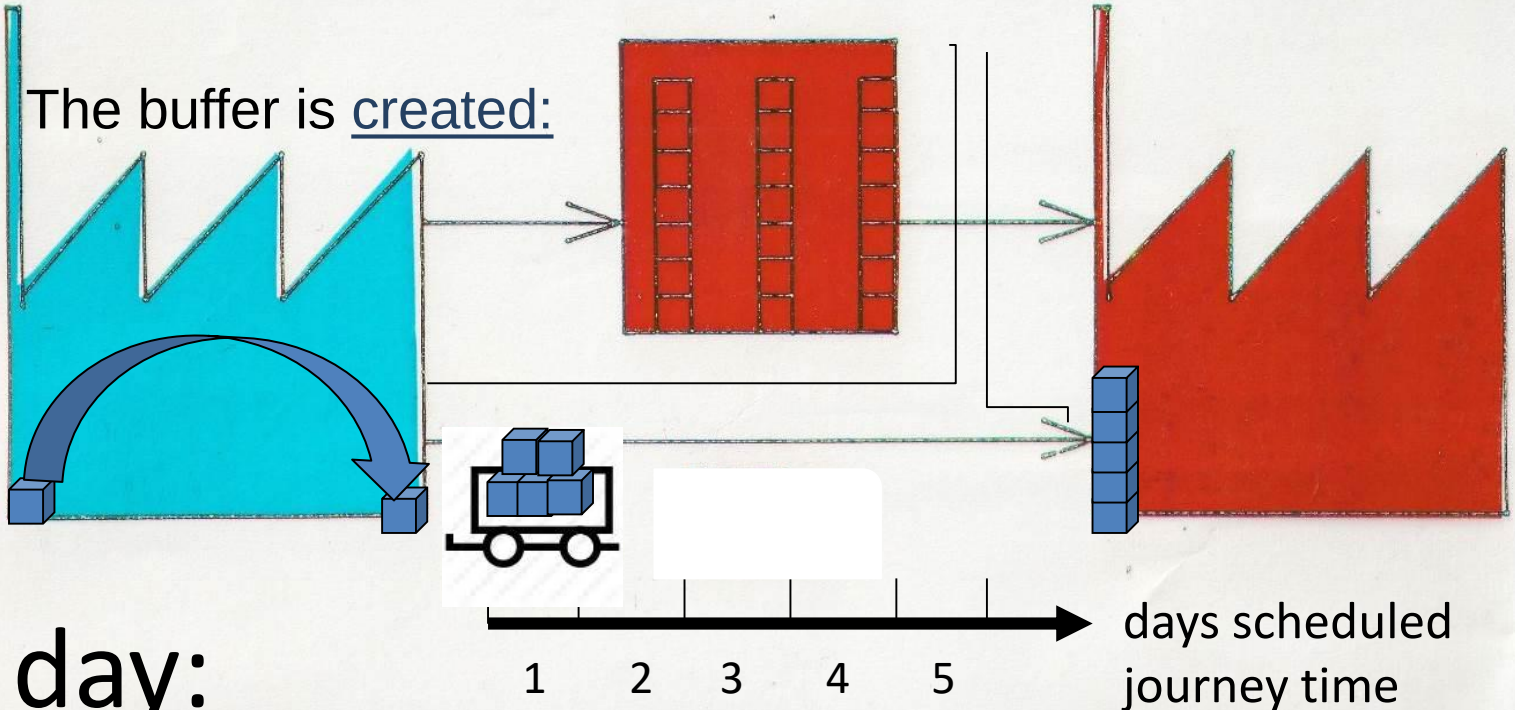


1st day:

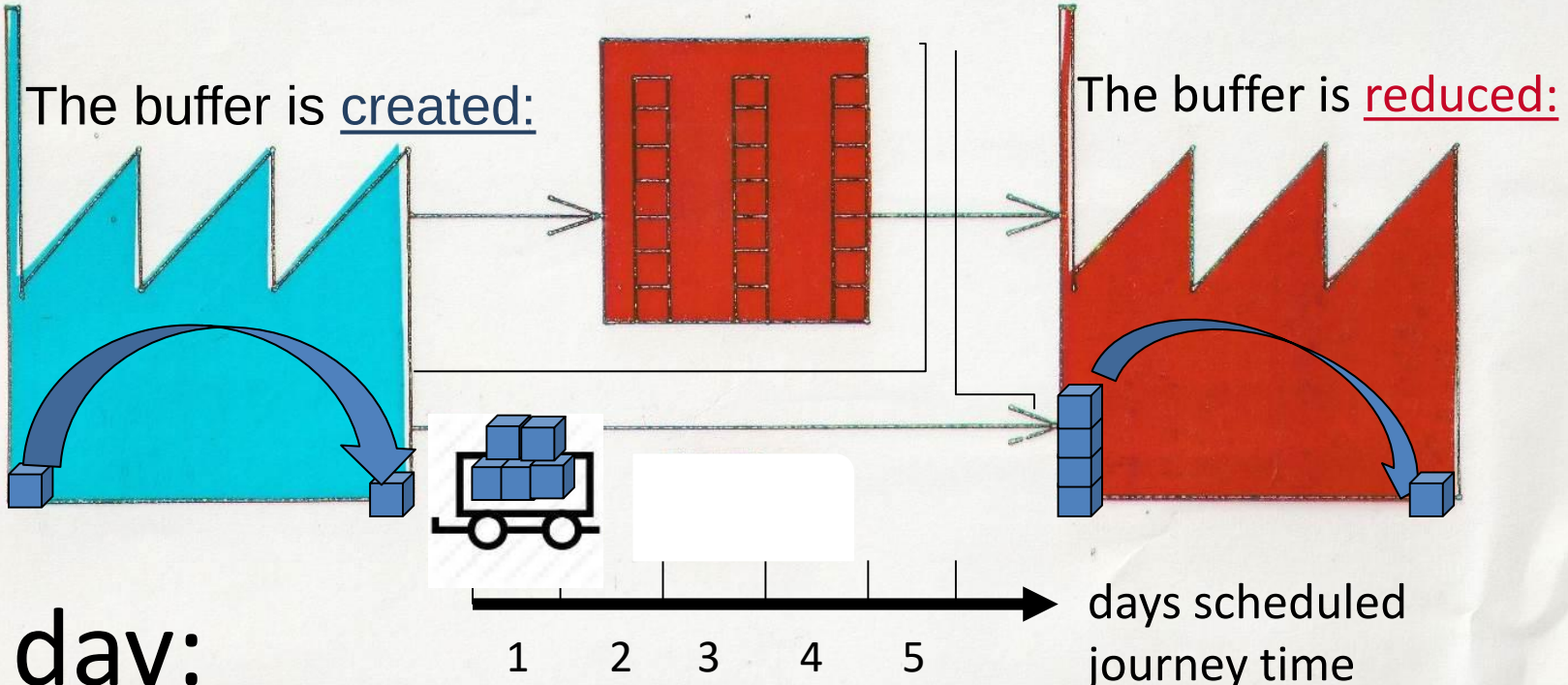
Production at the supplier creates the buffer for the next transport

BOSCH

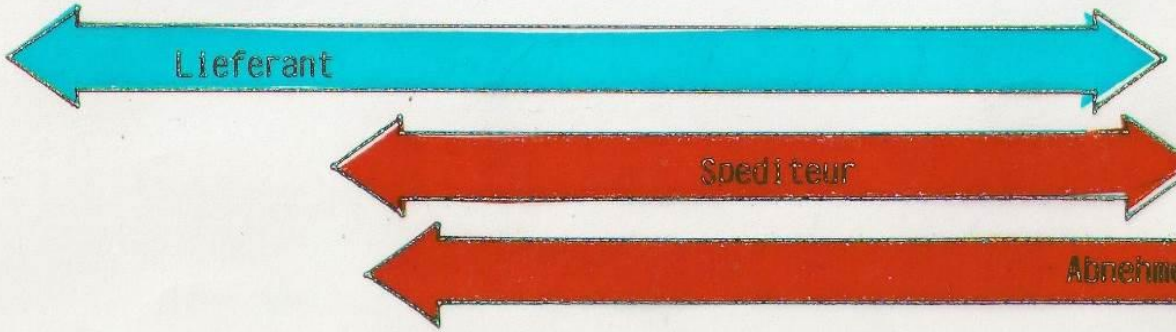
Adapted by Kortschak 2016

What happens with the buffer during transit time when cargo is transported?

Have a look at the shipper‘s & consignee‘s invenotry:



1st day:



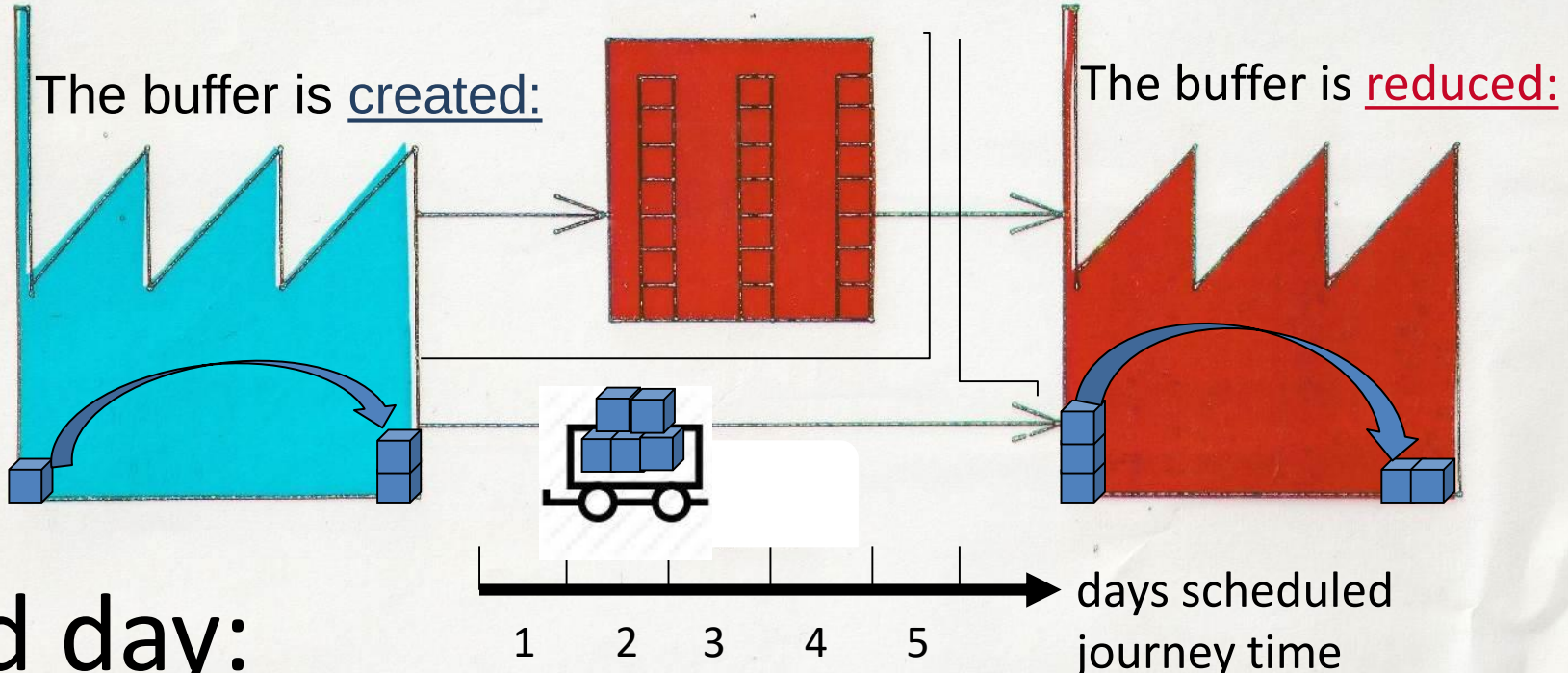
The buffer at the consignee is reduced to serve his production...

BOSCH

Adapted by Kortschak 2016

What happens with the buffer during transit time when cargo is transported?

Have a look at the shipper‘s & consignee‘s invenotry:



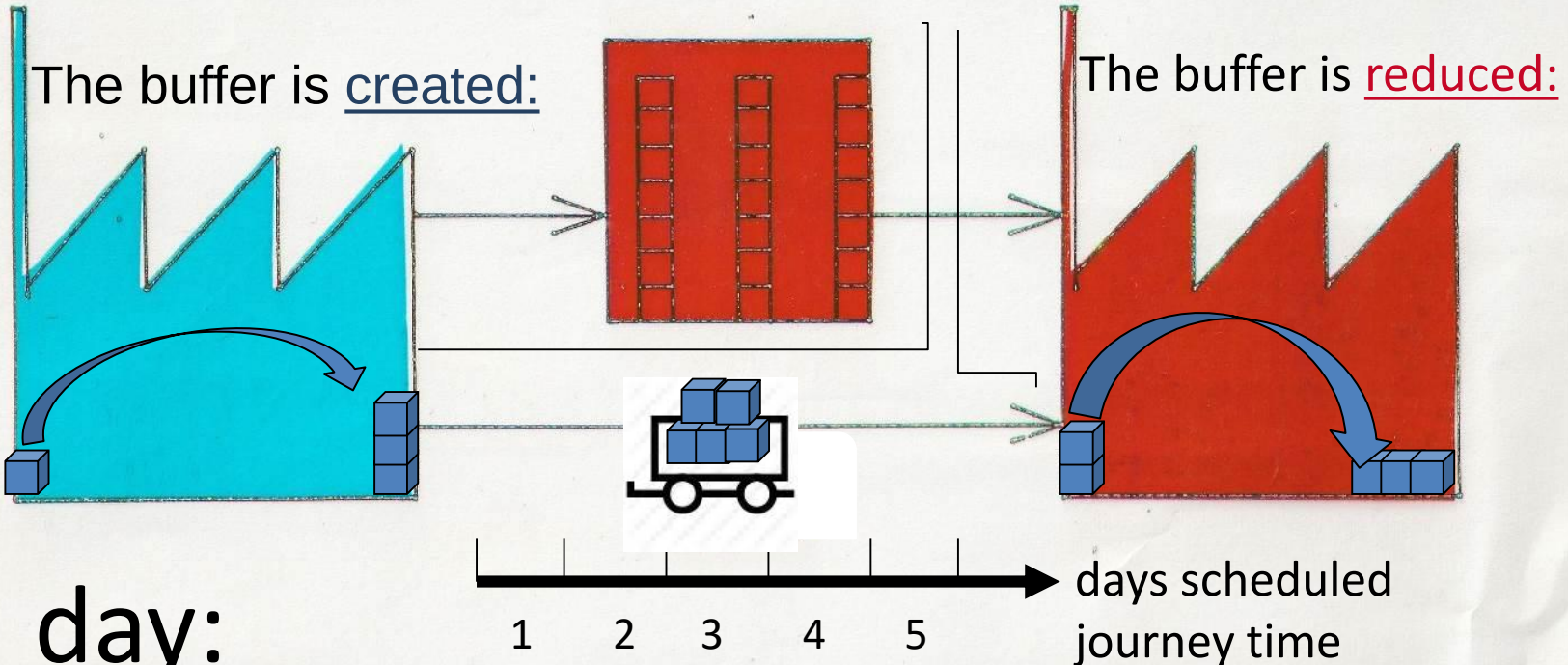
2nd day:

BOSCH

Adapted by Kortschak 2016

What happens with the buffer during transit time when cargo is transported?

Have a look at the shipper‘s & consignee‘s invenotry:



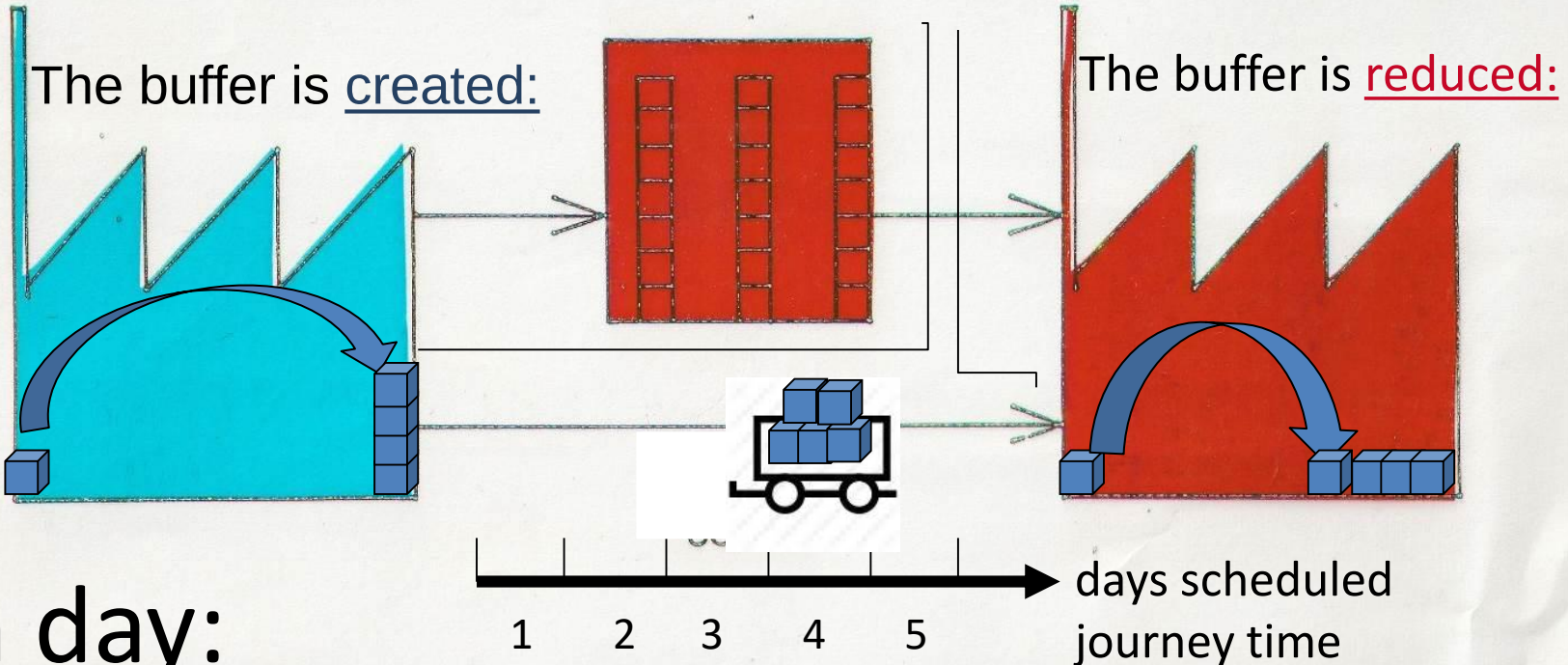
3rd day:

BOSCH

Adapted by Kortschak 2016

What happens with the buffer during transit time when cargo is transported?

Have a look at the shipper‘s & consignee‘s invenotry:



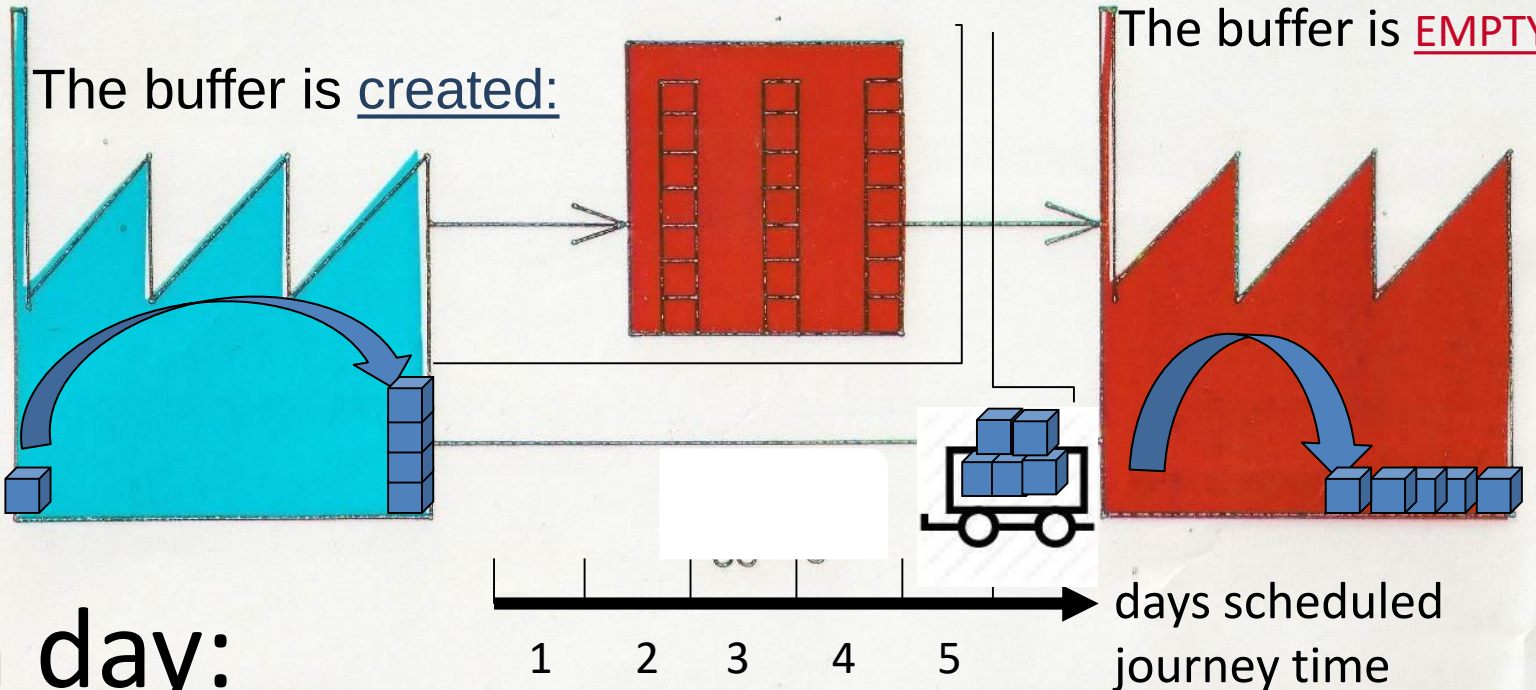
4th day:

BOSCH

Adapted by Kortschak 2016

What happens with the buffer during transit time when cargo is transported?

Have a look at the shipper‘s & consignee‘s invenotry: STOP!



5th day:

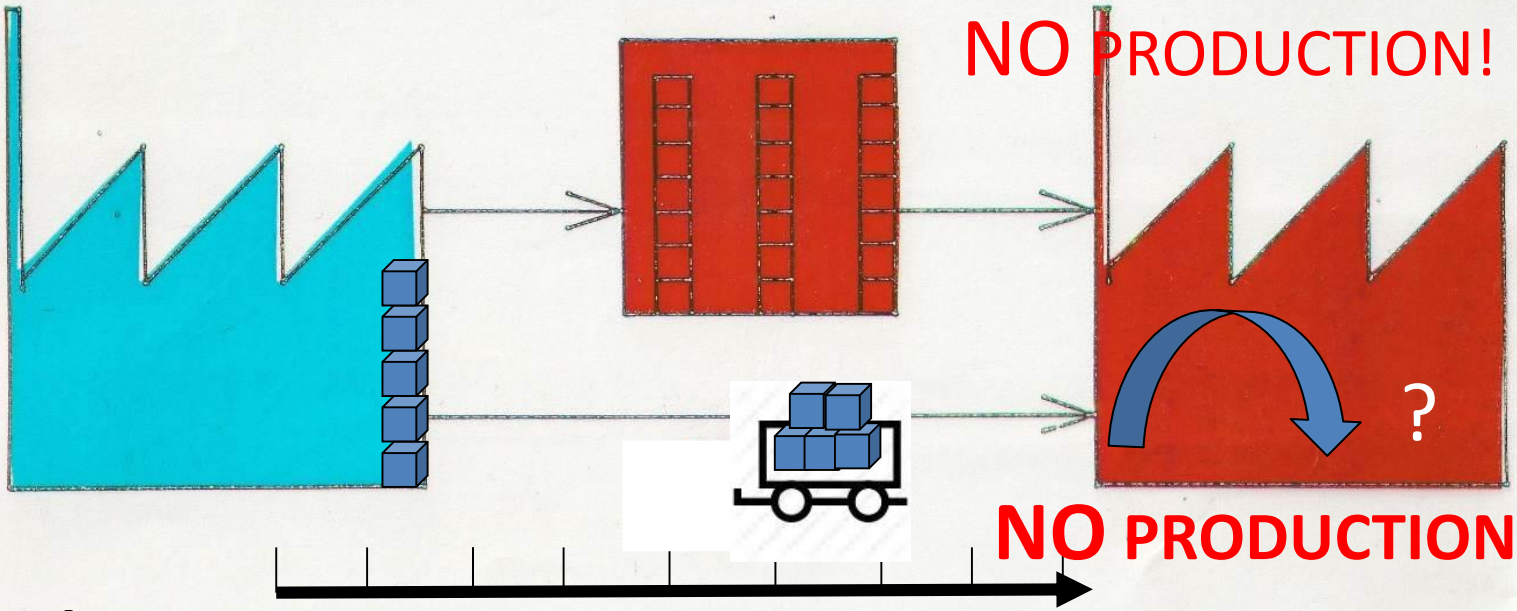
BOSCH

Adapted by Kortschak 2016

B U T:
What happens if train is 3 days late?

No buffer inventory left =

NO PRODUCTION!



NO PRODUCTION?

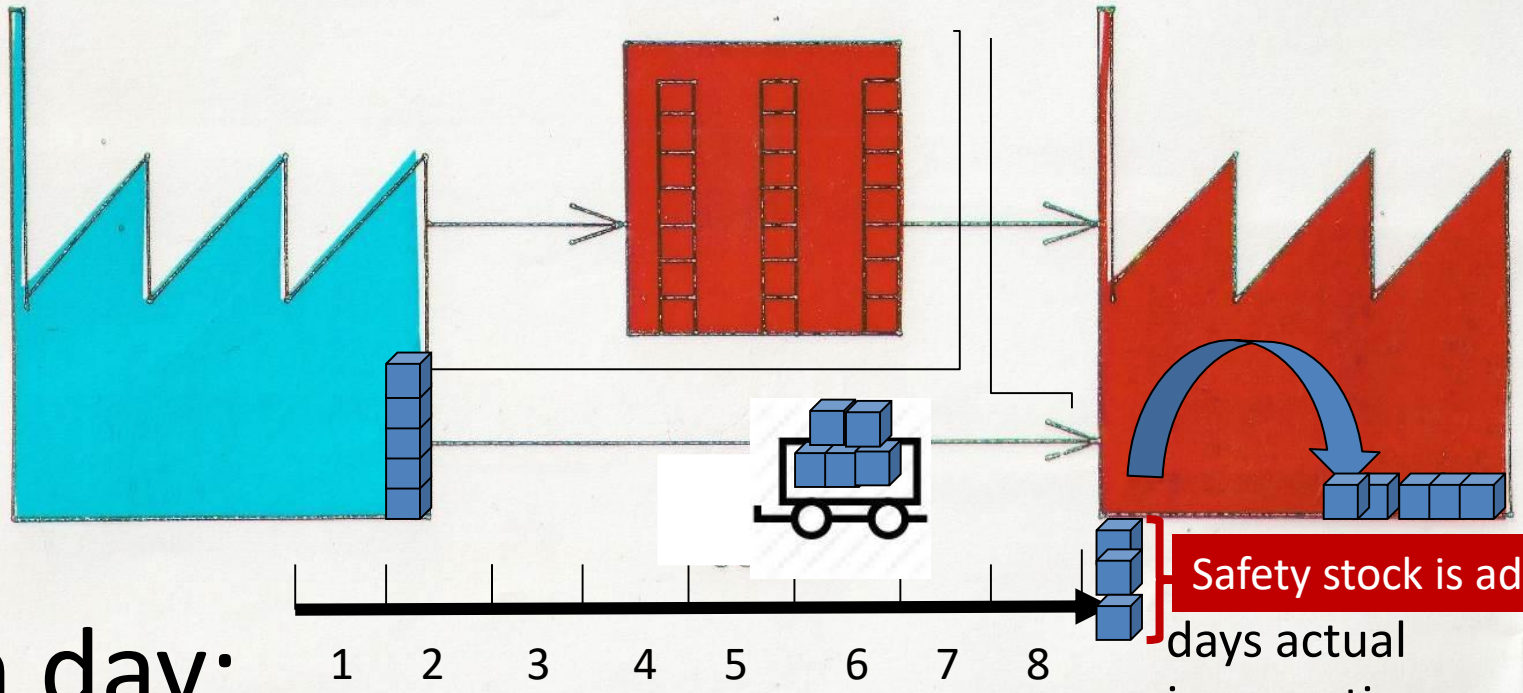
6th day:

BOSCH

Adapted by Kortschak 2016

What happens if train is 3 days late?
Industry holds additional safety stock

What does consignee, if ON TIME delivery is NOT expected?



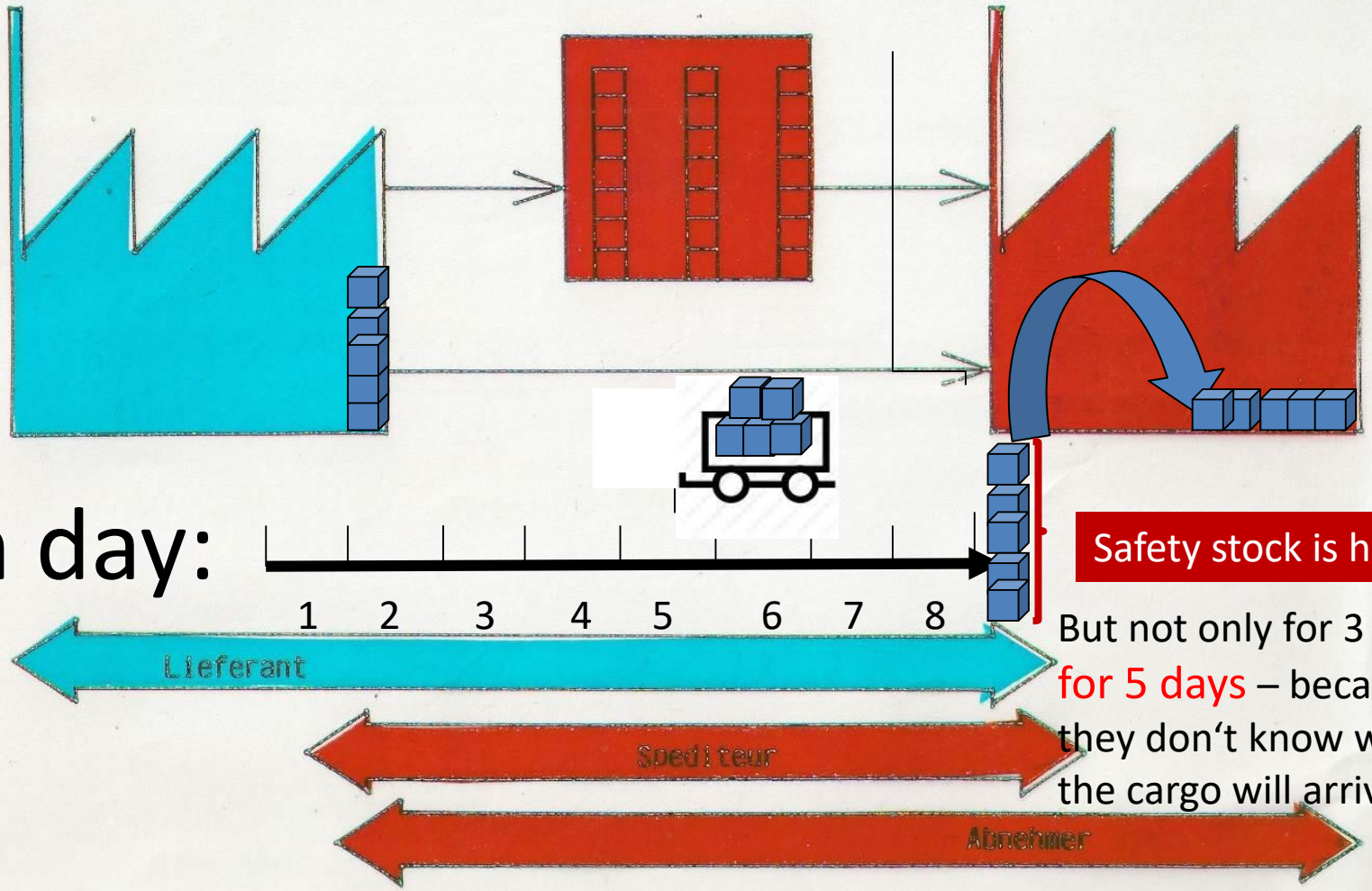
6th day:

BOSCH

Adapted by Kortschak 2016

What happens if train is 3 days late: Industry holds additional safety stock

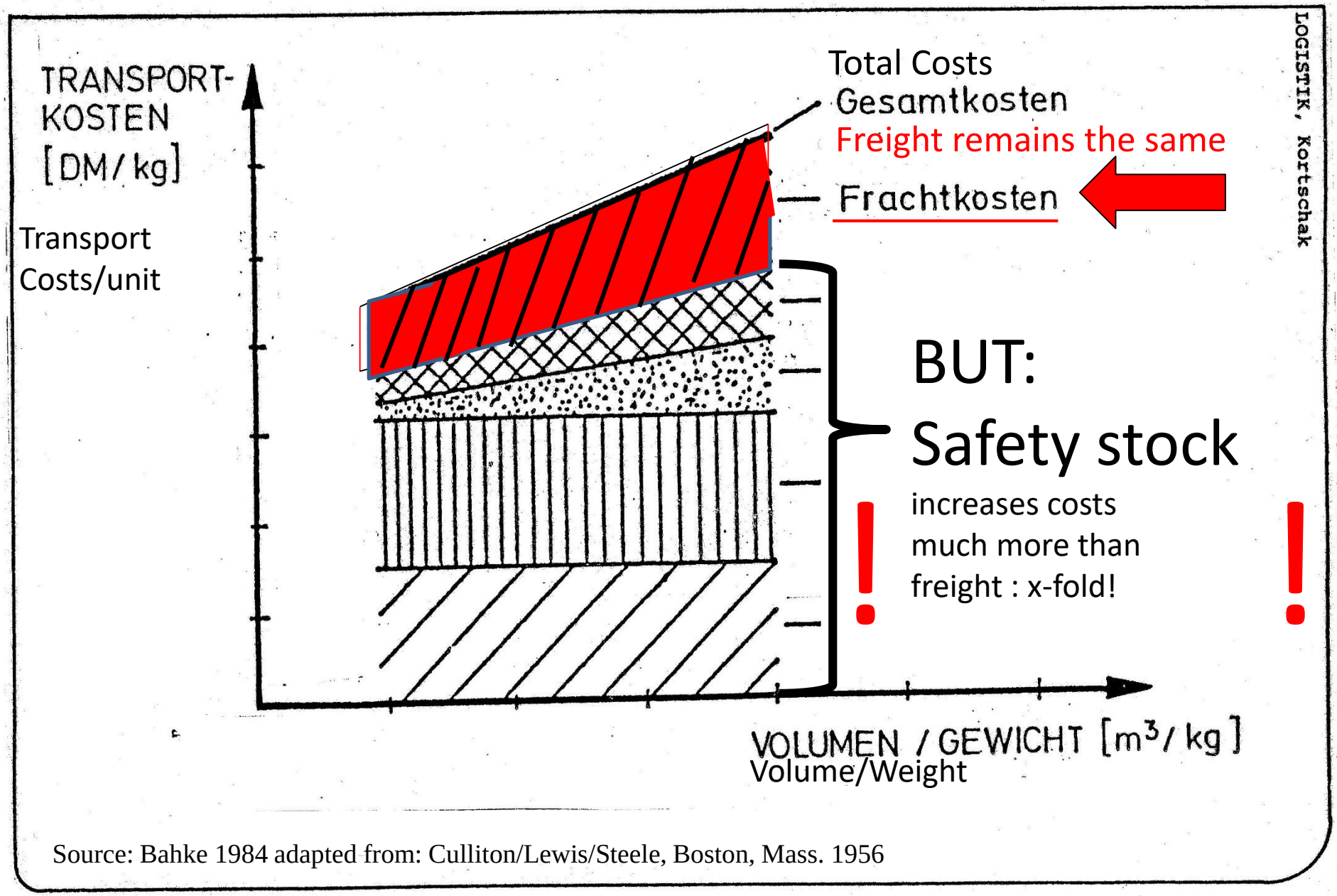
What does consignee, if on time delivery is not expected?



Safety stock is held!

But not only for 3 days, for 5 days – because they don‘t know when the cargo will arrive!

What is the economic result, if safety stock increases costs:



Source: Bahke 1984 adapted from: Culliton/Lewis/Steele, Boston, Mass. 1956

Conclusion:

Late freight trains *double inventory costs* of industry
due to progressive safety-stock increases in industry.

Inventory costs of industry *exceed freight* paid to
the carriers by many times (i.e. 1:5 in Western Europe on av.)

OR – in short:
If there is an alternative transport offer which promises AND
keeps ON TIME delivery *cargo will shift* to the alternative!

Progressive inventory costs with the truck available as alternative made rail share decline!

1992/3: Internal Market: Econ.of Scale in central. industries

Need cheap transport costs to serve the marktes (Postponement strategy)

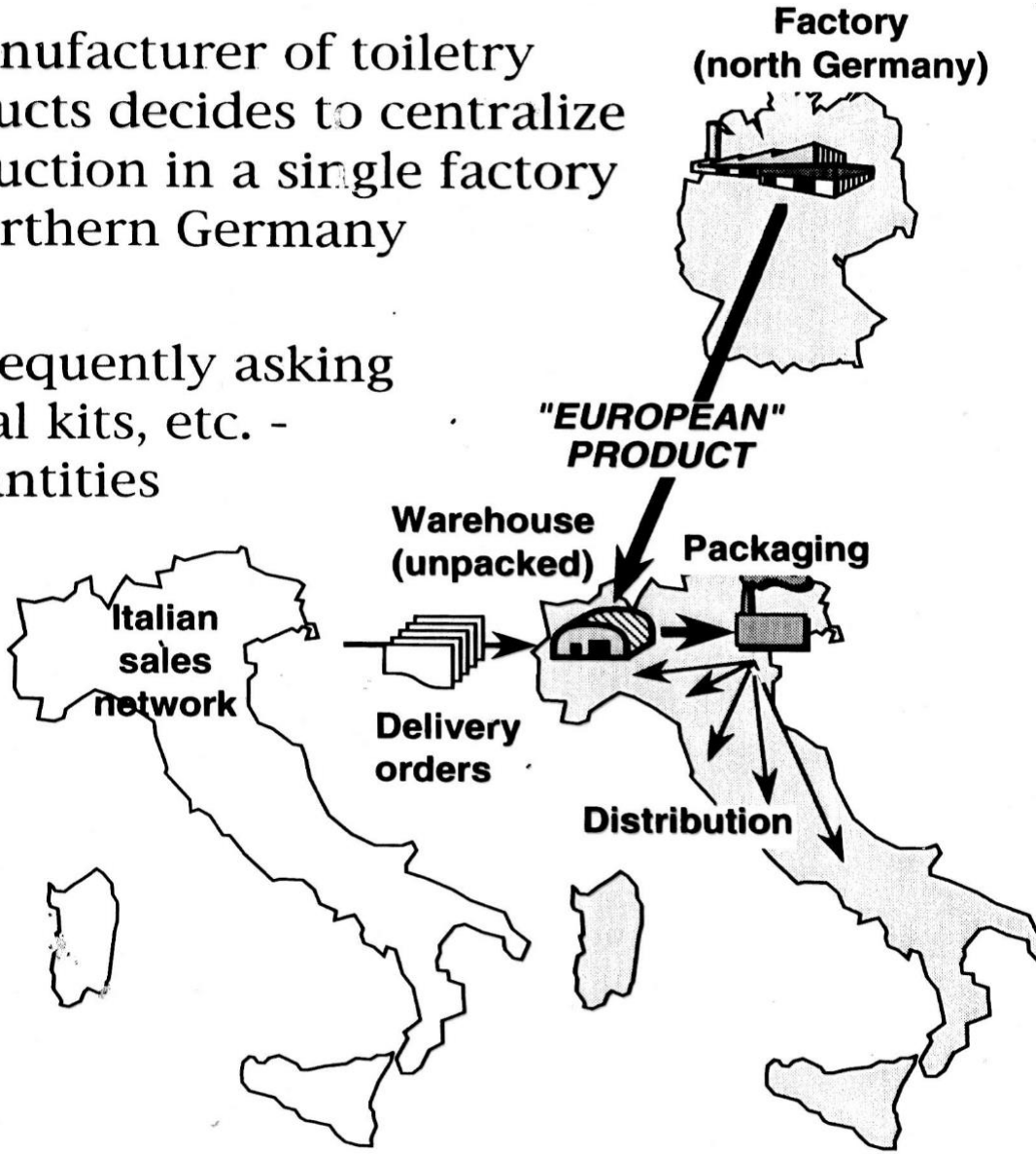
Postponement may support service segmentation

A manufacturer of toiletry products decides to centralize production in a single factory in northern Germany

The Italian sales network is frequently asking for new packages, promotional kits, etc. - urgent and often in small quantities

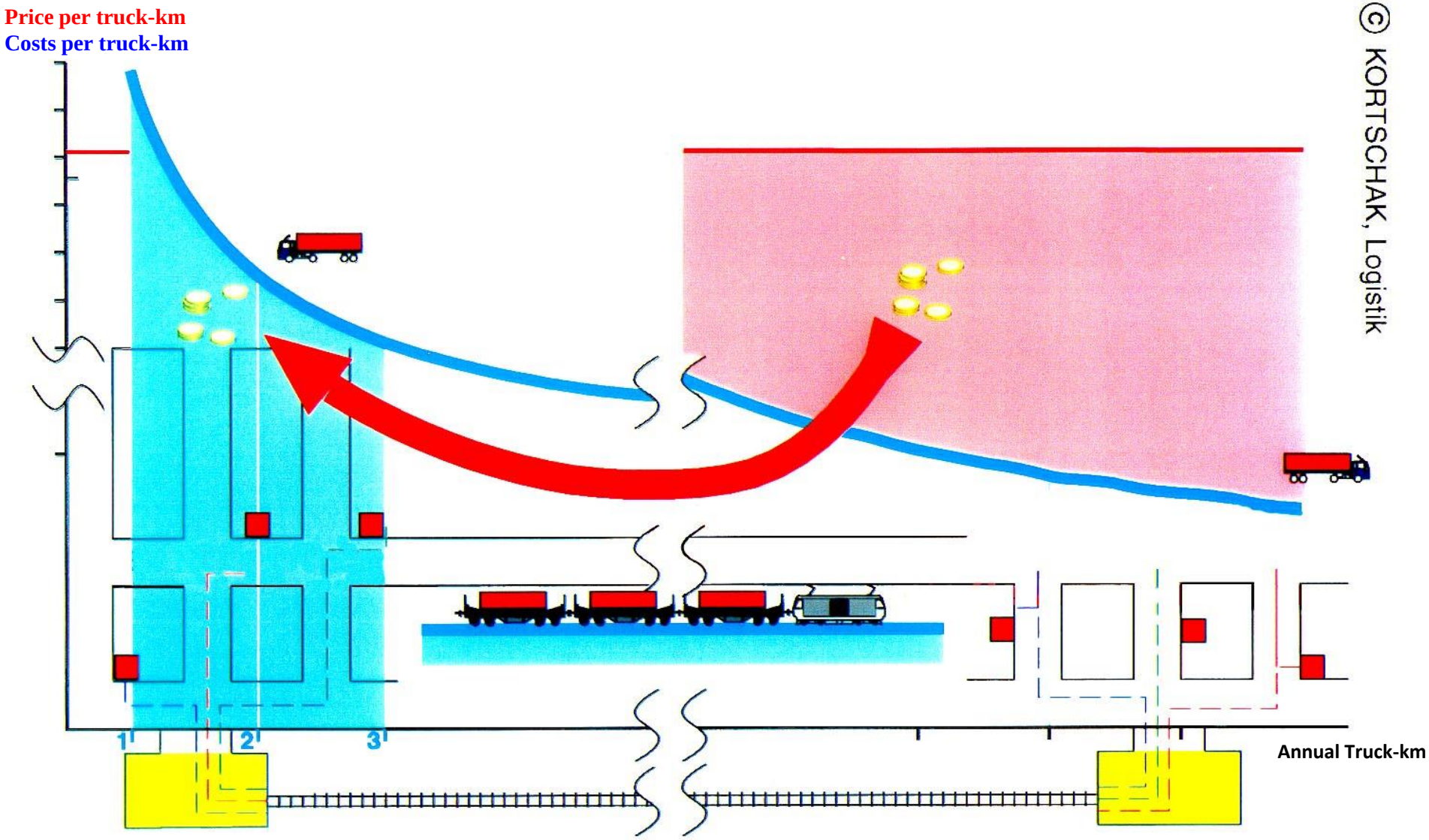
Saving in transport cost: 15 to 30% compared to fully packaged goods

Delivery time of customized product is + 1 day compared to the products as they are in stock

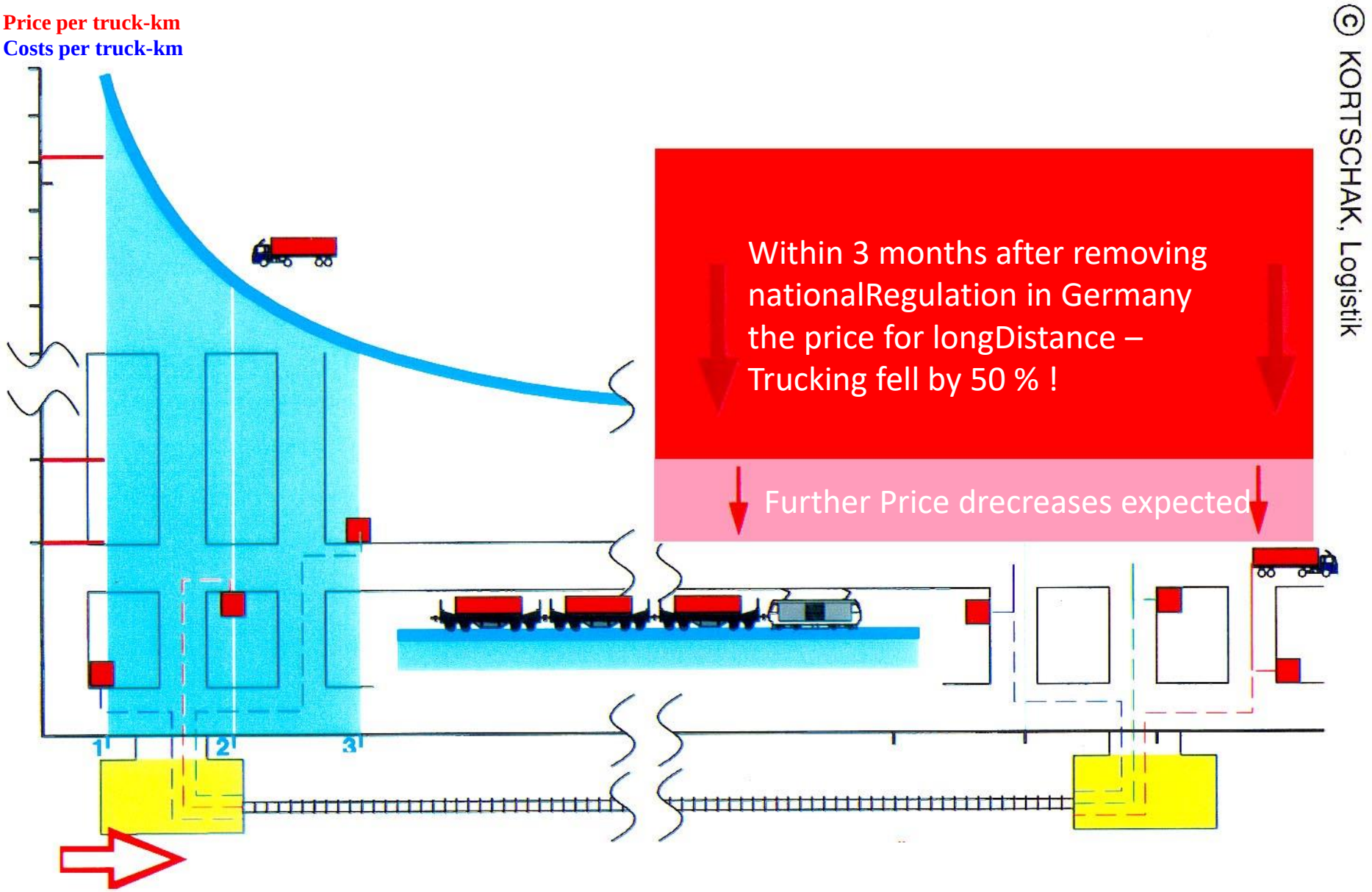


Source: Leonida 1994

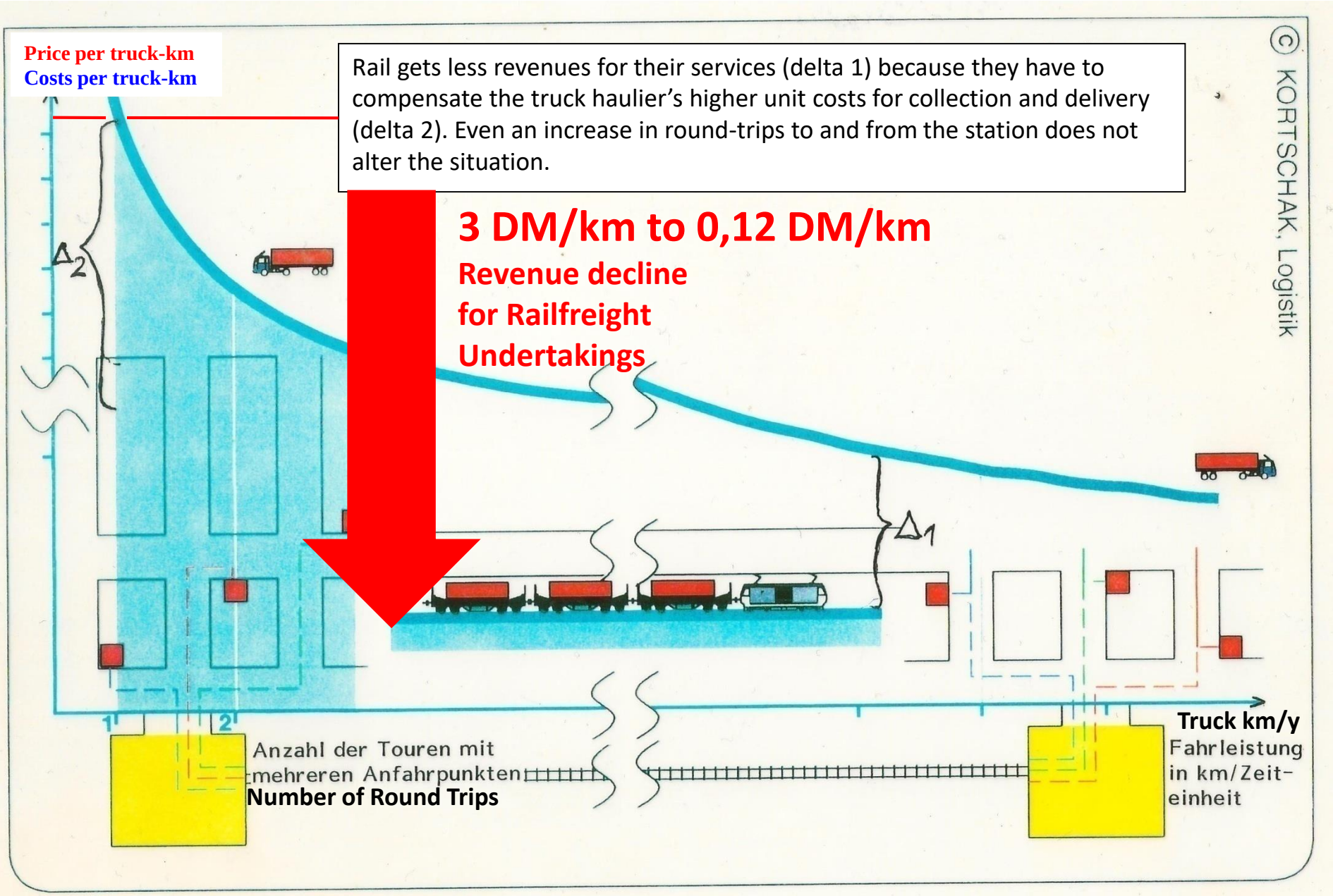
Prior to Internal Market. High transport costs of about 3 DM per truck km - any additional Collected or Delivered Cargo served as a Margin Contributor (Cross Subsidies for C & D)



National regulation for Road Transport was rapidly abandonned:



Consequences for Raillfreight: Revenues for Railfreight fell well below the long distance truck

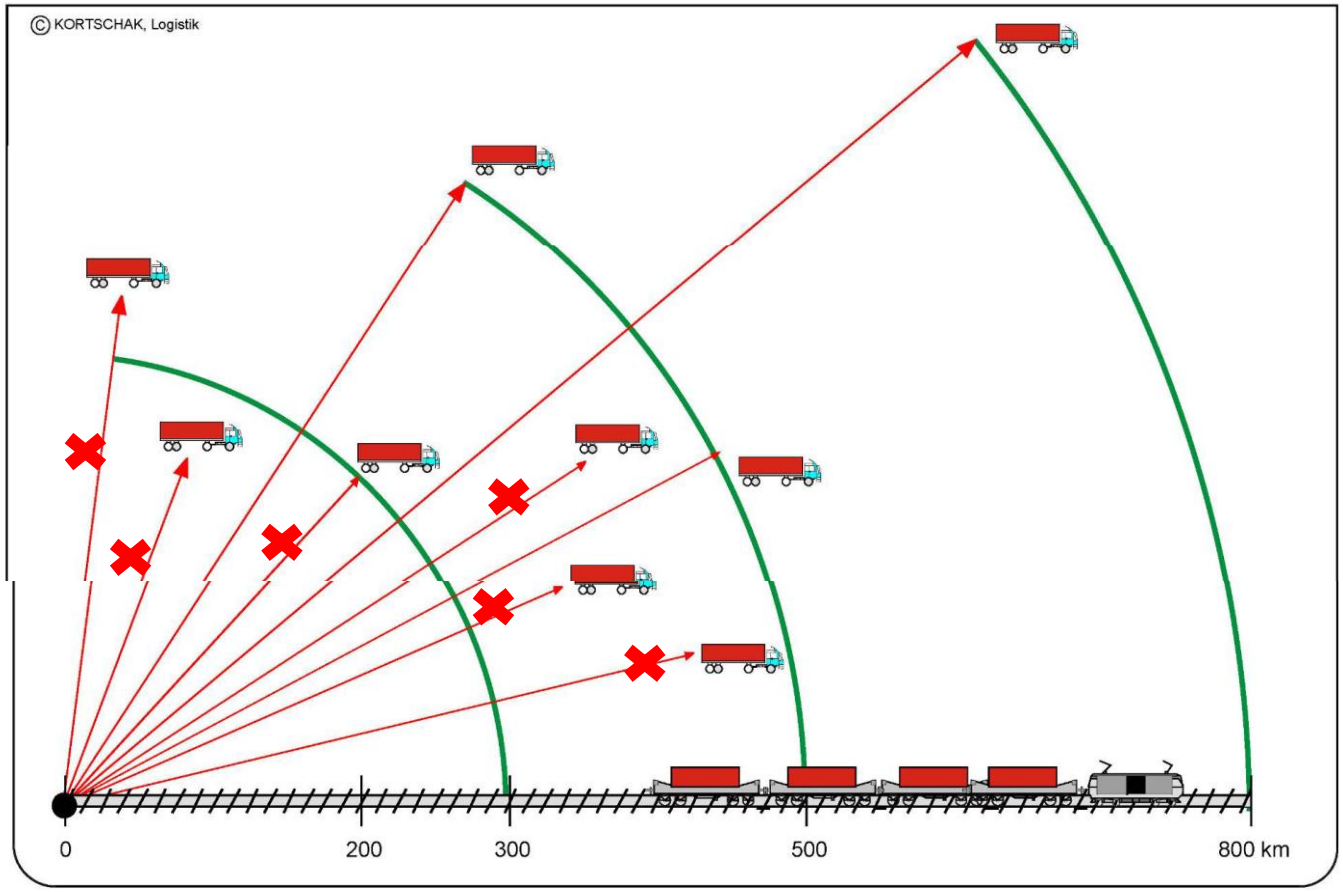


Block trains

... serve a few BIGGIES

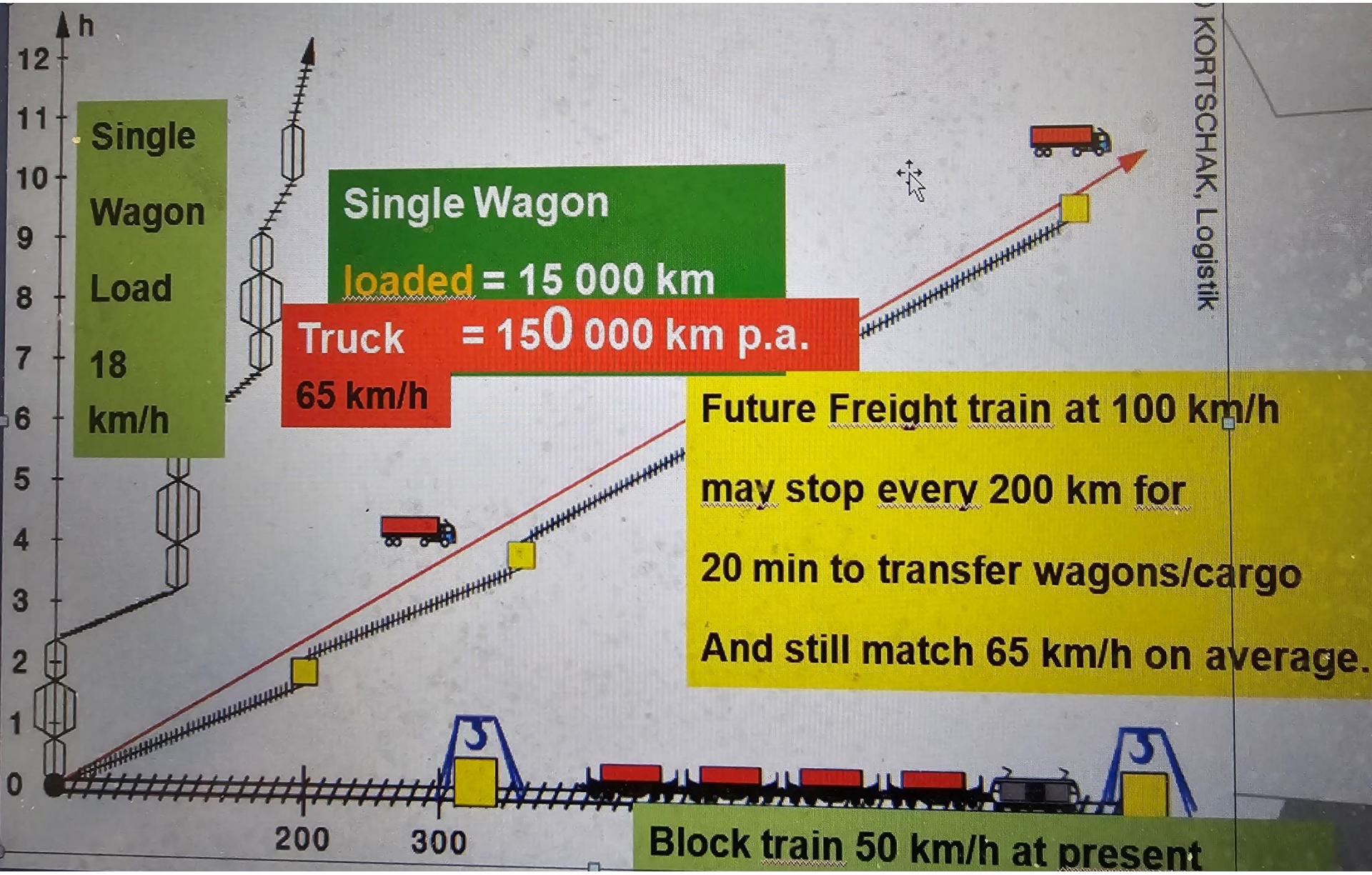
Single Wagon Loads

could serve EU shippers, if properly organised



... Block/Unit Trains do not catch the cargo in the region ✖

Innovative combination of single wagon load and combined transport:



Direct access of electric traction underneath gantry crane:

Europäisches Patentamt | European Patent Office | Office européen des brevets

URKUNDE

Es wird hiermit bescheinigt, daß für die in der beigefügten Patentschrift beschriebene Erfindung ein europäisches Patent für die in der Patentschrift bezeichneten Vertragsstaaten erteilt worden ist.

CERTIFICATE

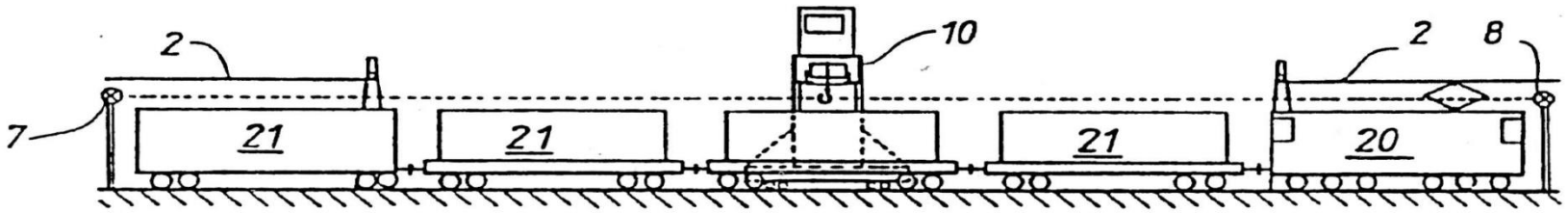
It is hereby certified that a European patent has been granted in respect of the invention described in the annexed patent specification for the Contracting States designated in the specification.

CERTIFICAT

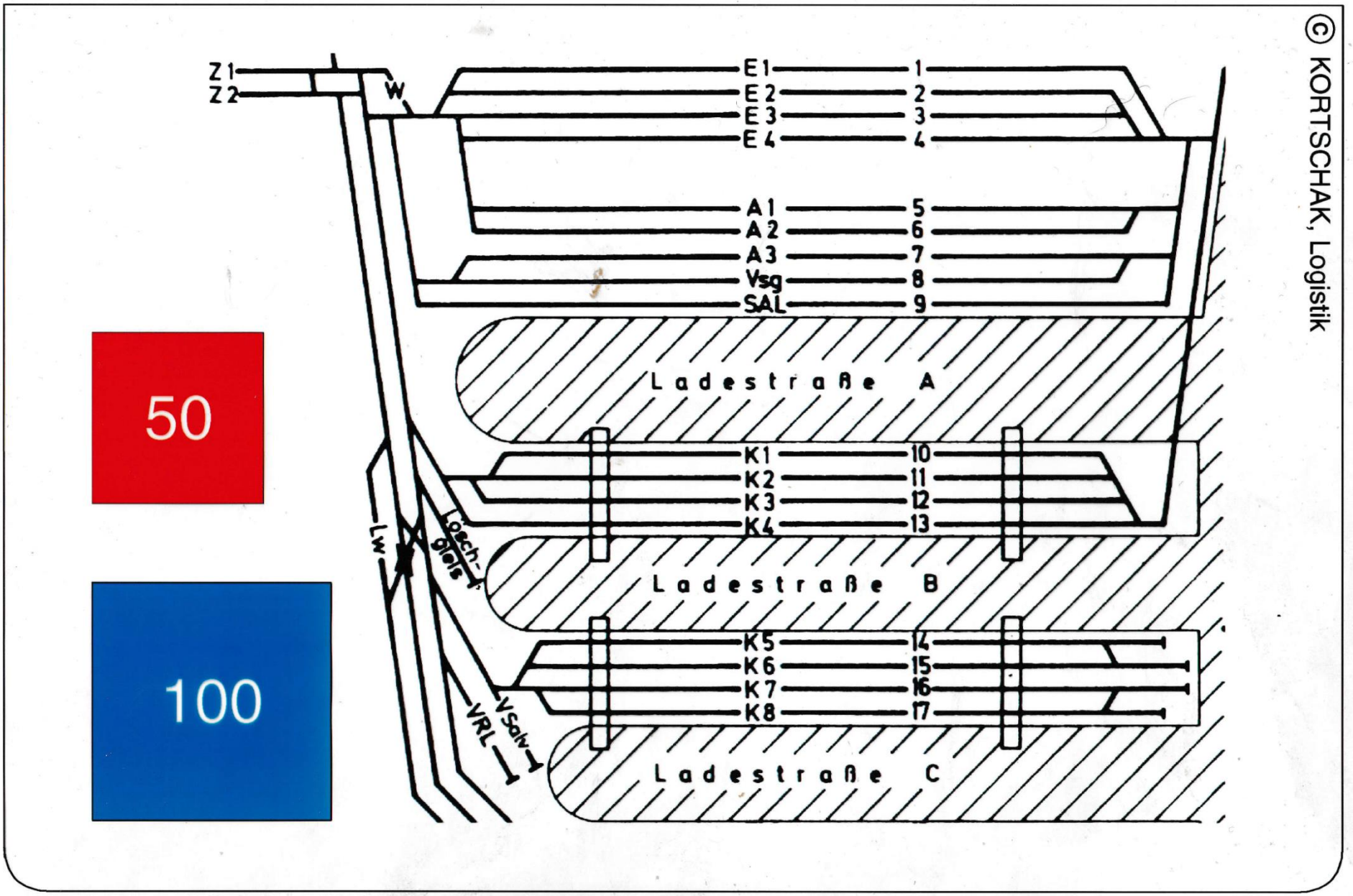
Il est certifié qu'un brevet européen a été délivré pour l'invention décrite dans le fascicule de brevet ci-joint, pour les Etats contractants désignés dans le fascicule de brevet.

Europäisches Patent Nr.:
European patent No.:
Brevet européen n°: 0174925

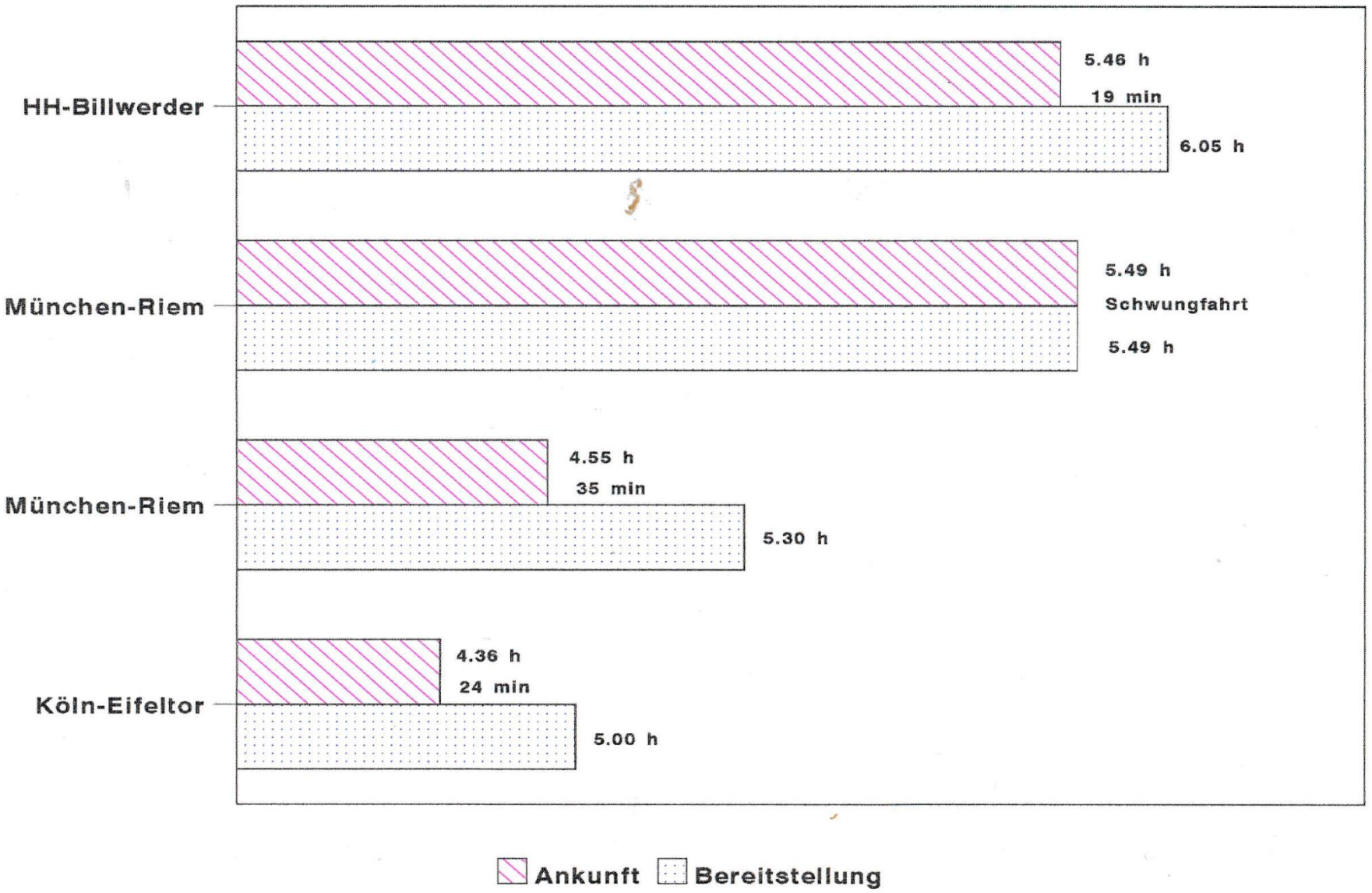
Patentinhaber:
Proprietor of the patent:
Titulaire du brevet: Kortschak, Bernd, DDr.



Terminal Munich Riem: Original setting: 4 reception tracks and 3 departure tracks

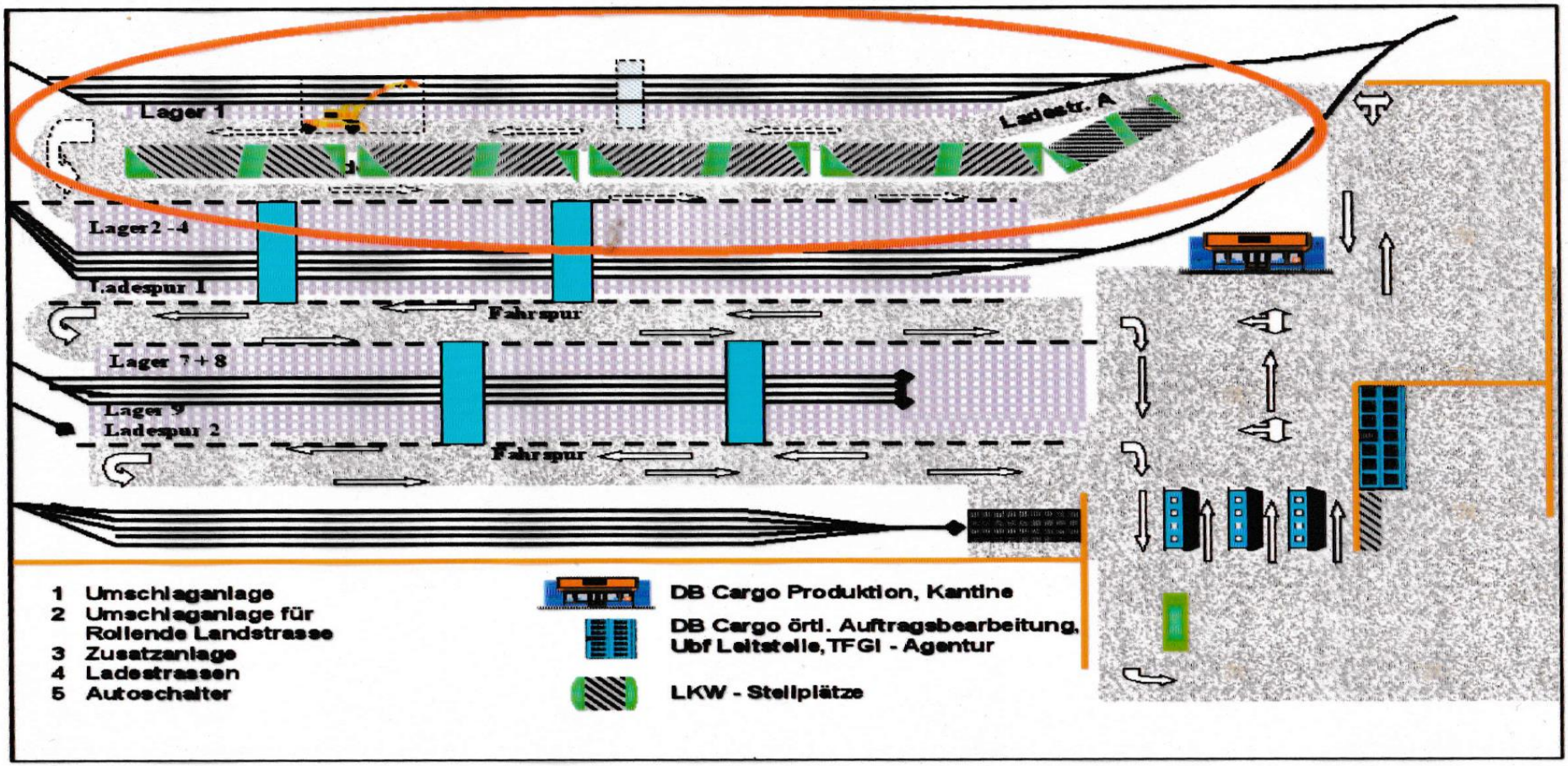


Leistungsprofil IKE Züge
Fahrplan 96/97



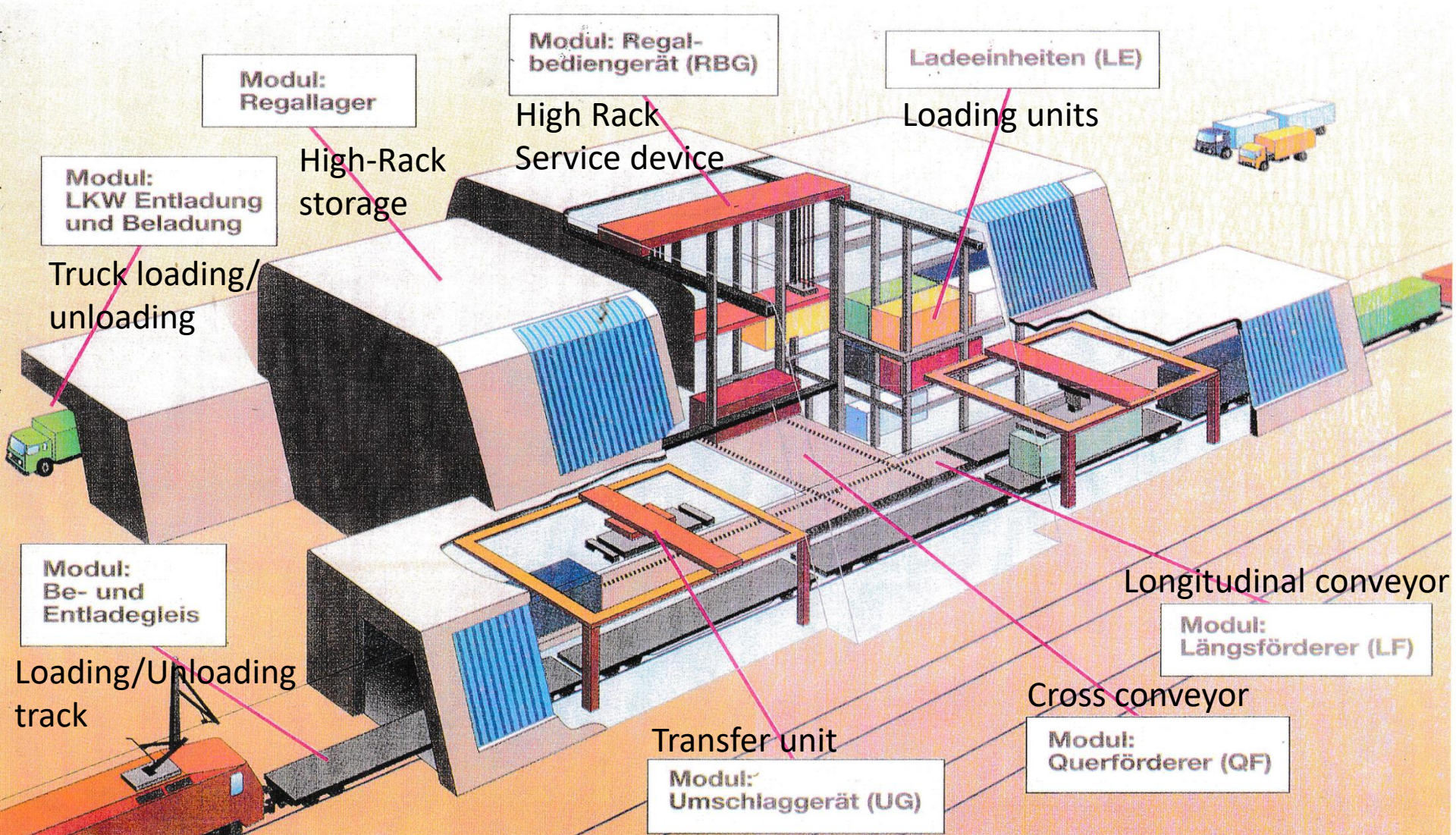
Munich Riem 2000+: The Reception and Departure Area becomes a Terminal modul:

Munich Riem: Replacing the Incoming and Departure tracks with another Terminall modul



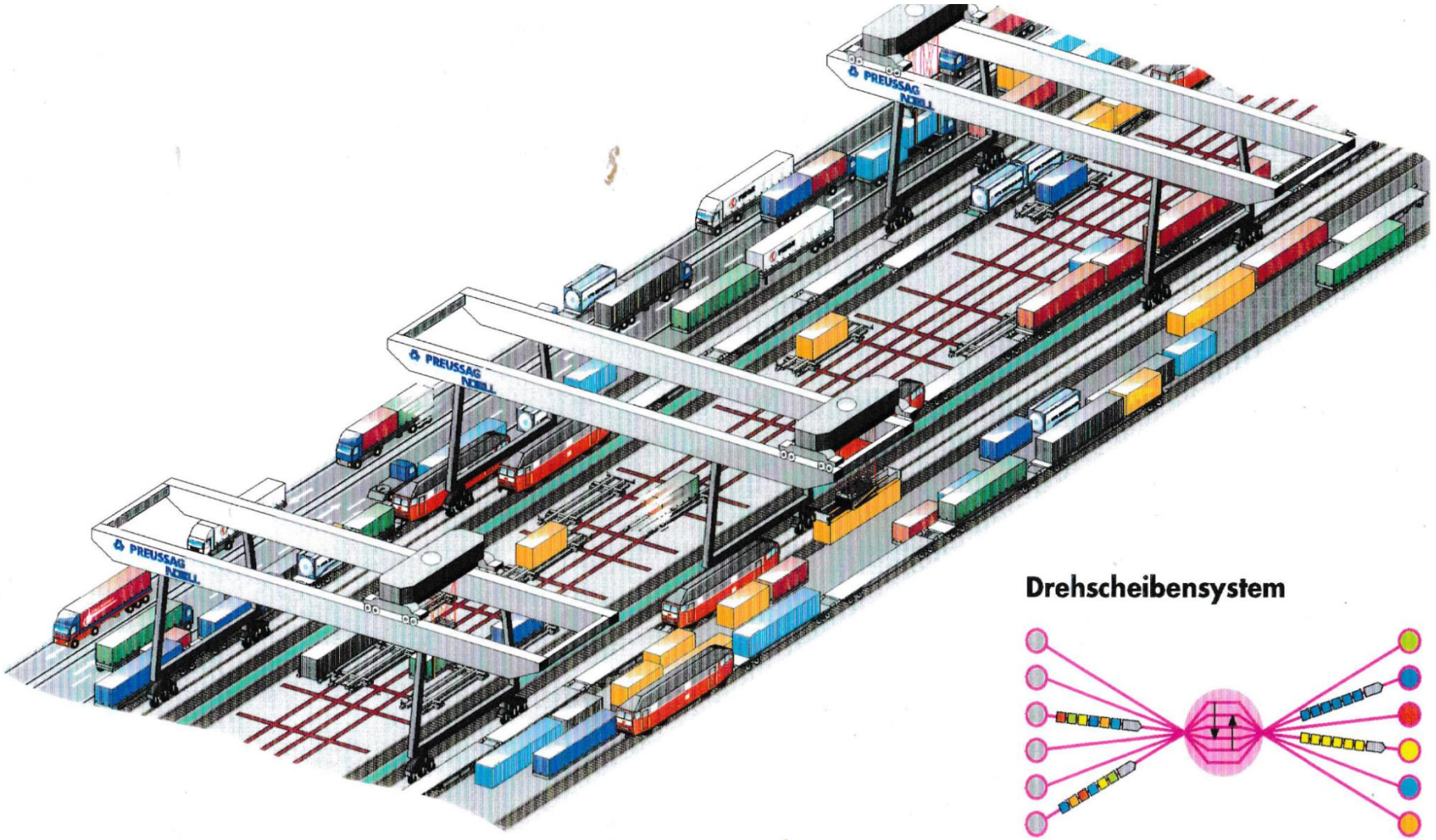
Quelle: Umschlagbahnhof München-Riem GmbH, Stand: 24.04.2001
© Andreas Hendrich

The KRUPP Fast transfer mega turntable in a closed building:



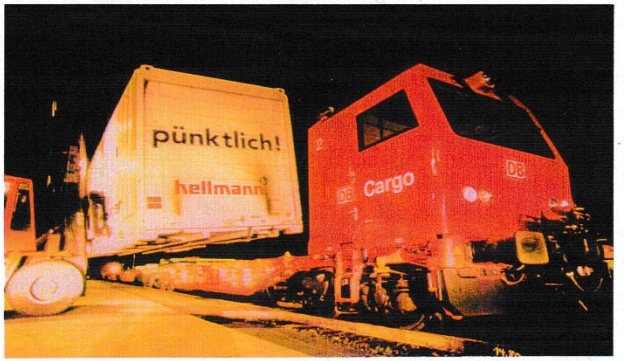
Mega – Turntable

Integrated System for maximum performance in Combined Transport

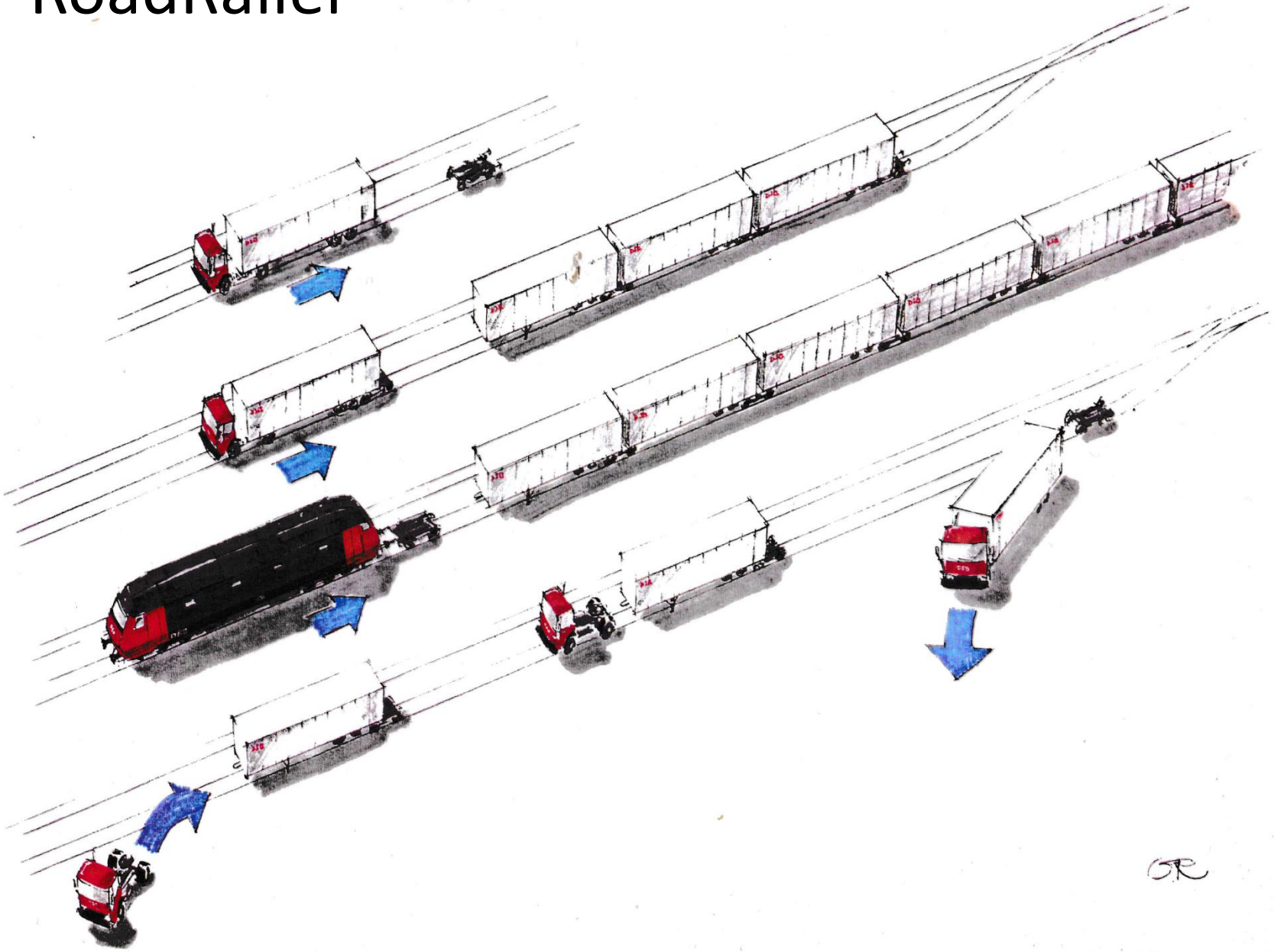


Transmann

Cargo Sprinter



RoadRailer

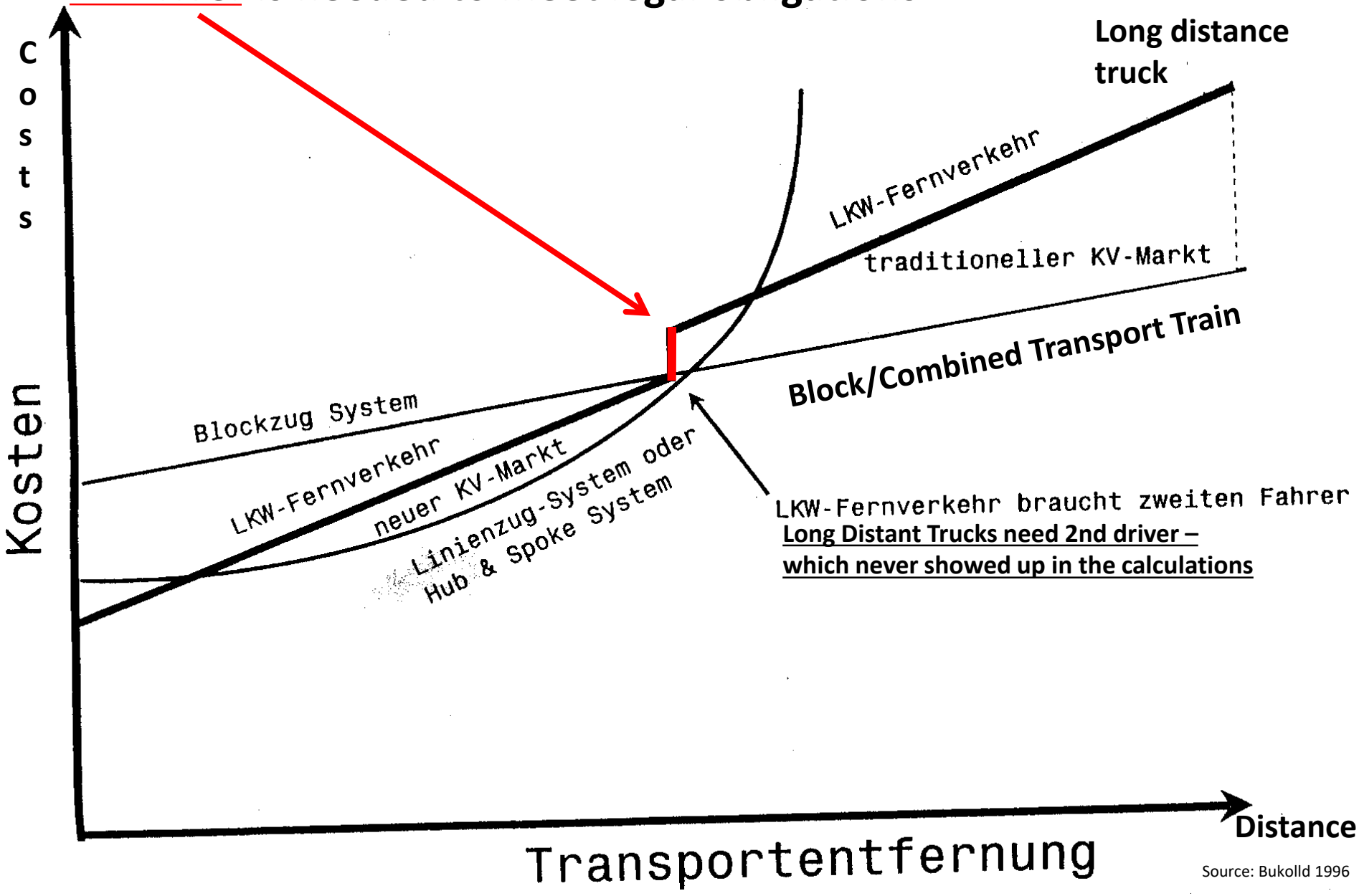


INNOFREIGHT Solutions:

Based on ISO-Containers:

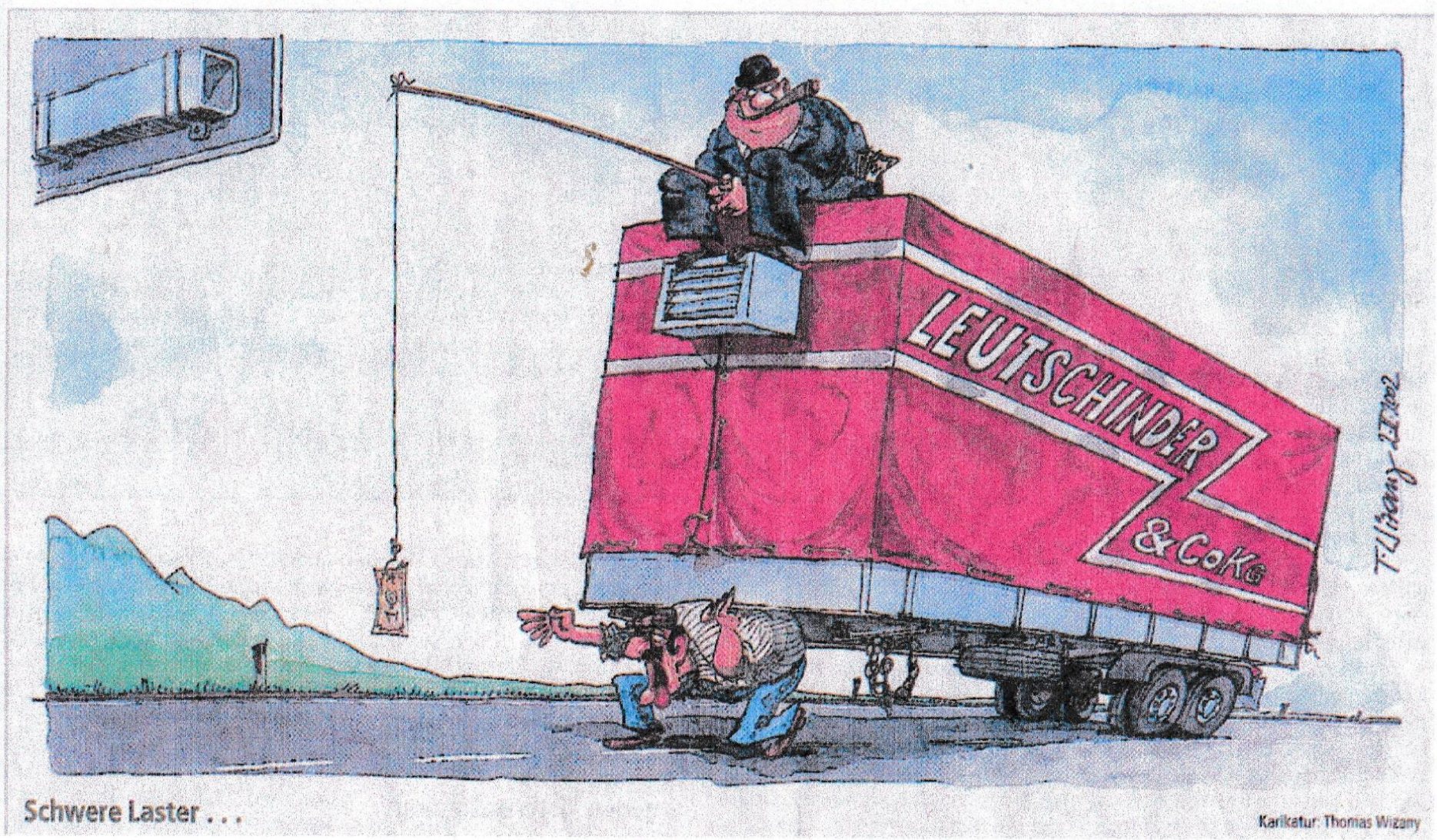
Making Railfreight competitive even in Sweden with RoadTrains and higher HGV-limits

Rail often claims to be competive when a 2nd Driver is needed to meet legal obligations



Source: Bukolld 1996

But the situation is even worse….



Quelle: *Salzburger Nachrichten*, Nr. 28, 58. Jahrgang (2./3. Februar 2002)

Development of single wagon infrastructure in Europe til 2012:

		CFL	DB	Swe-den	SNCB	RCA	SBB	X-Rail
Marshalling yards		1	11	4	2	8	5	37
Nodal point yards		11	1738	305	69	100	323	3620
Private sidings		16	3795	800	360	1100	1500	8801

Germany only:

Year	Number	Year	number
1994	11.742	2006	4.004
1995	11,290	2007	3.998
1996	11.096	2008	3.732
1997	9.264	2009	3.726
1998	7.524	2010	3.732
1999	7.024	2012	2.374

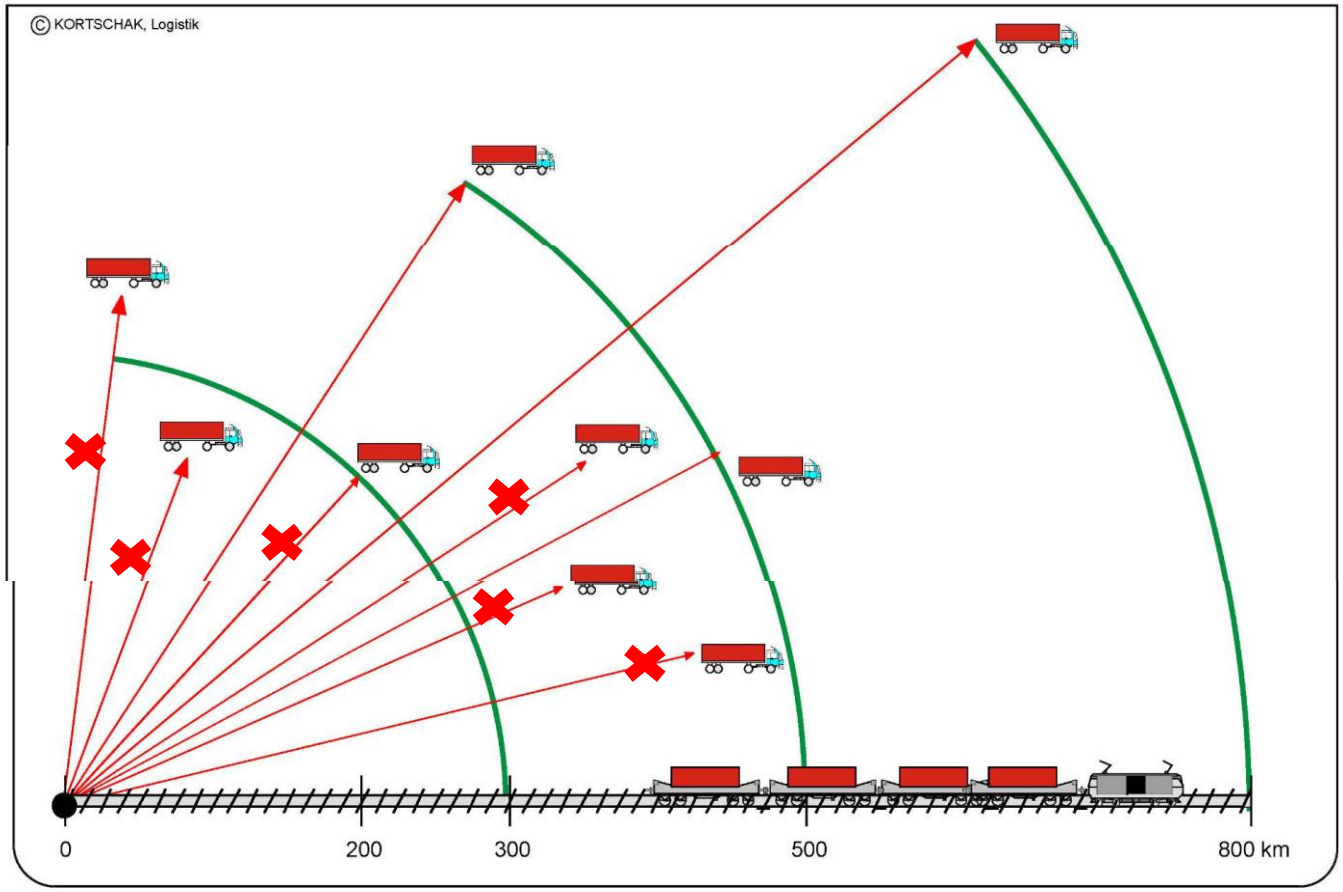
Source: Ferk 2012

Block trains

... serve a few BIGGIES

Single Wagon Loads

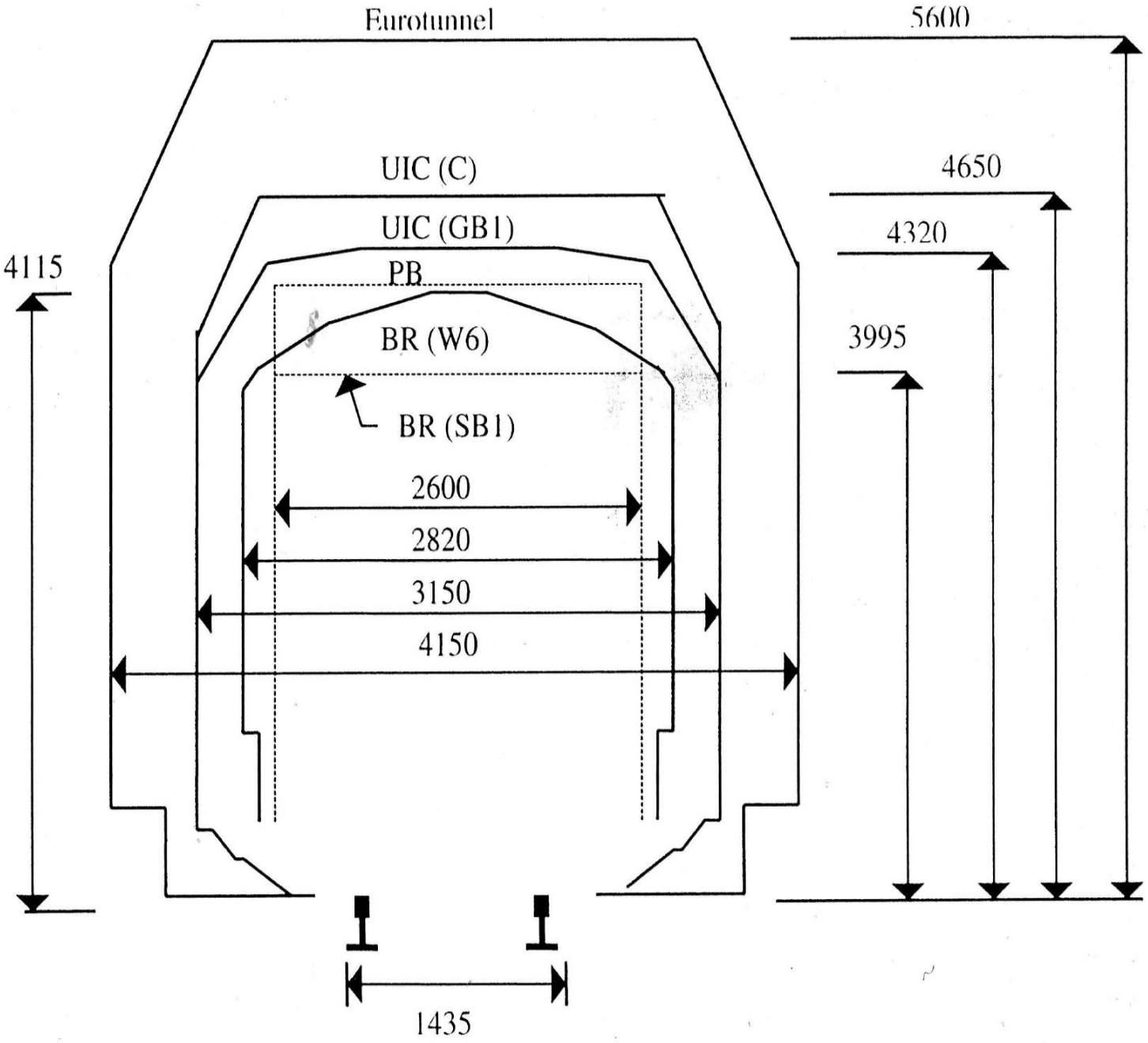
could serve EU shippers, if properly organised



... Block/Unit Trains do not catch the cargo in the region ✖

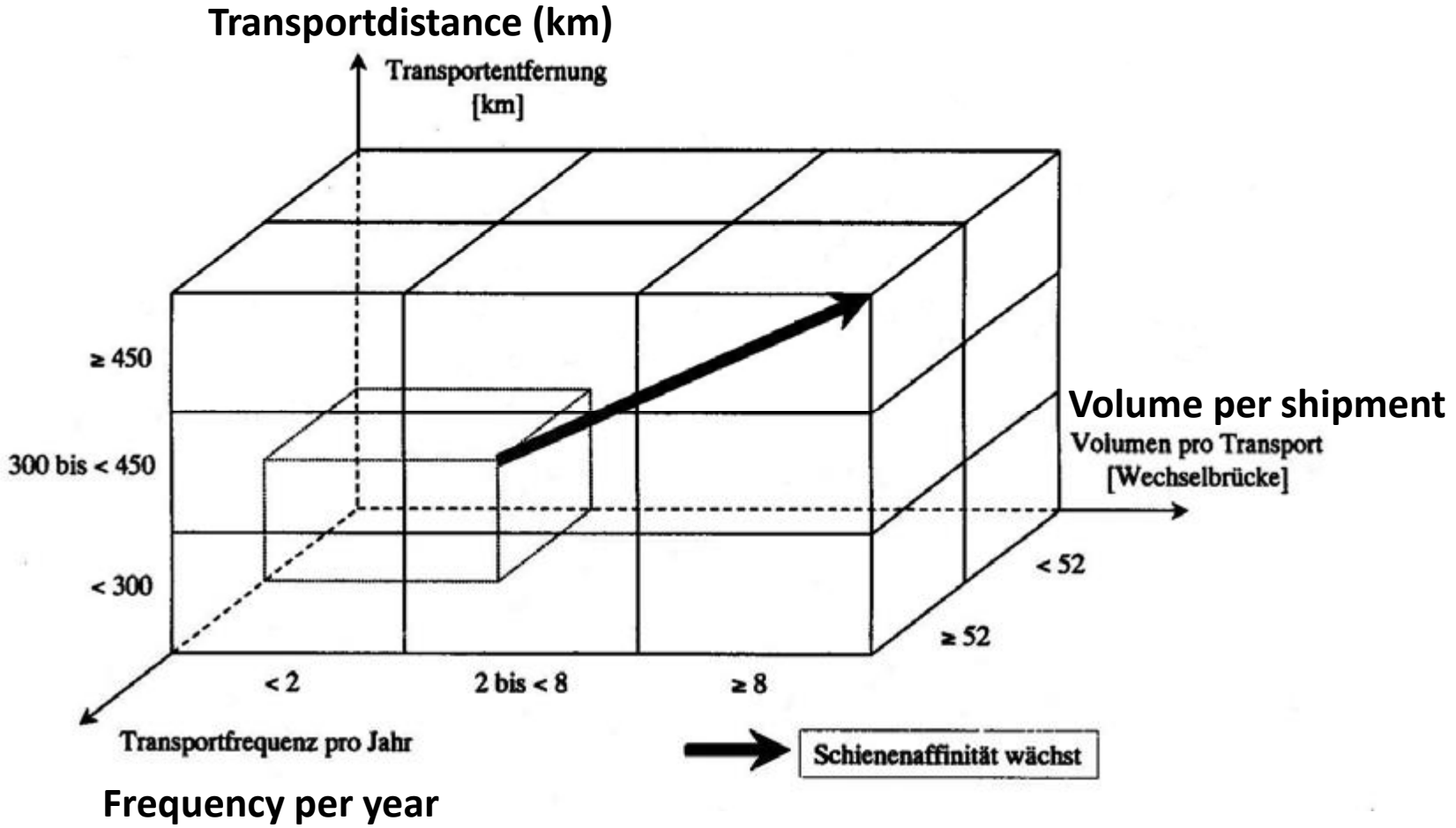
figure Loading gauge

Where do we want to go to?



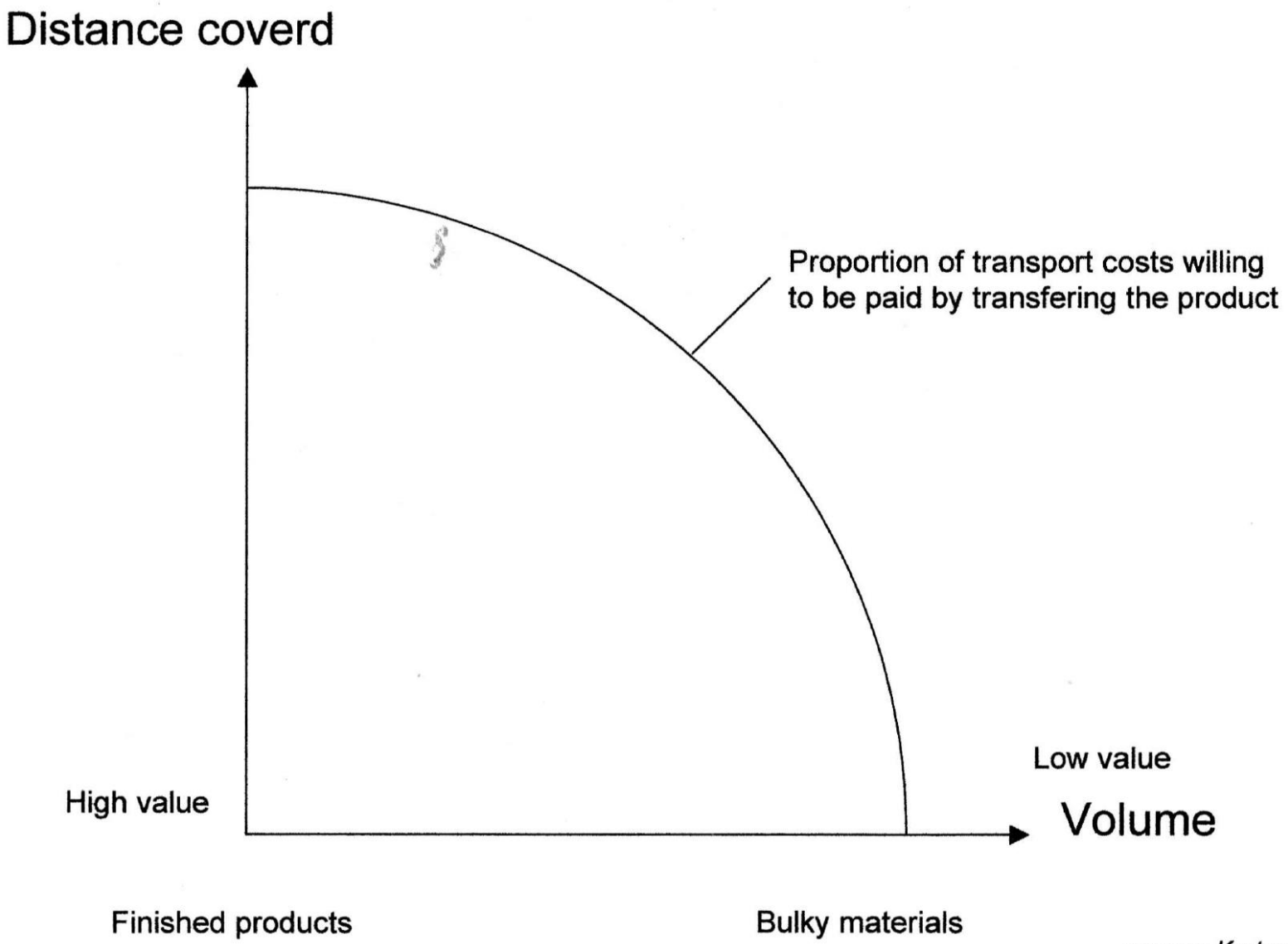
All measurements are in millimeters

How to identify railfreight potential?



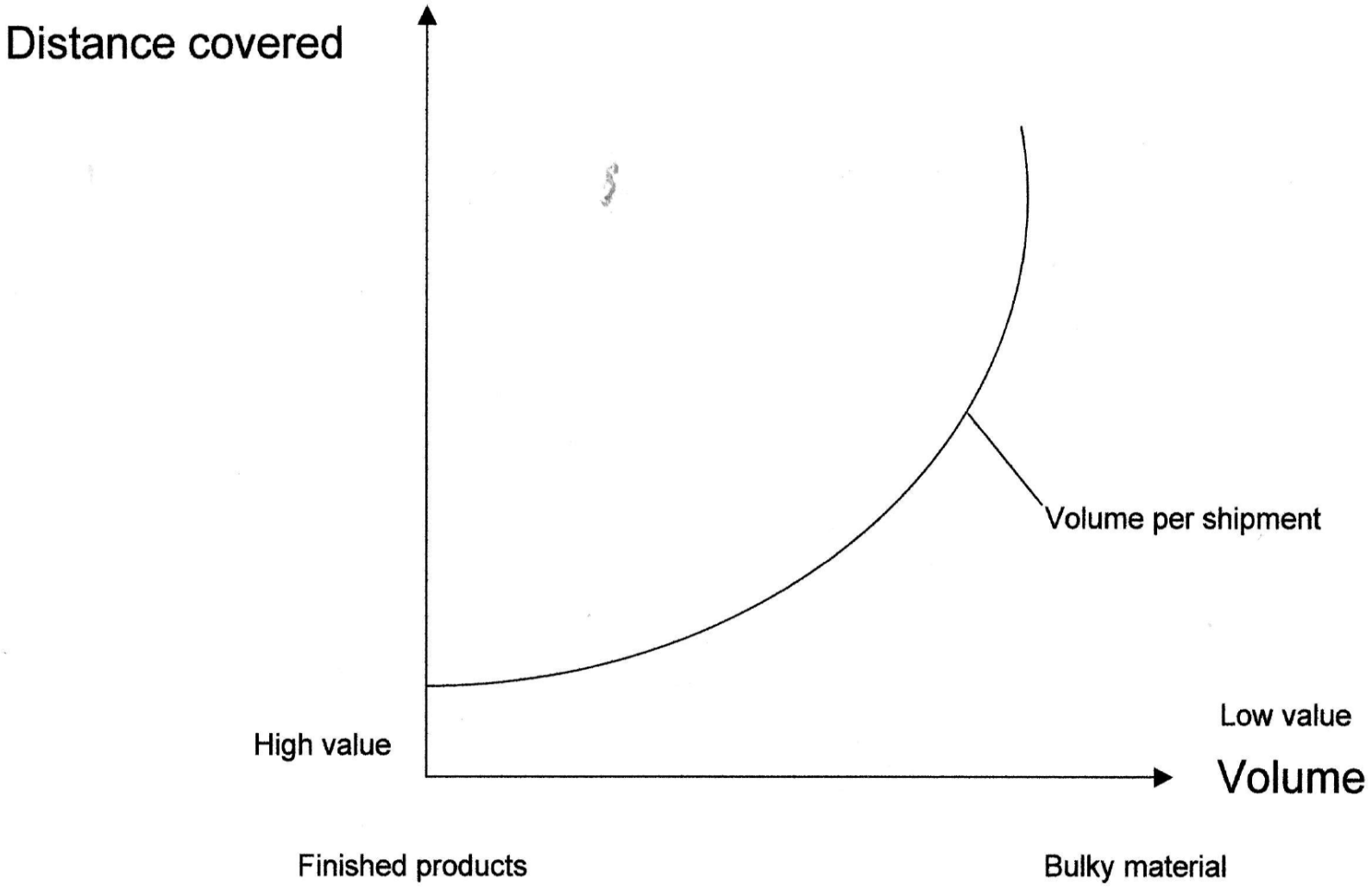
Pfohl, Stölzle 1999

Charge what the market will bear depending on the comodity concerned



source: Kortschak 1979

Economies of Transport depending on volume

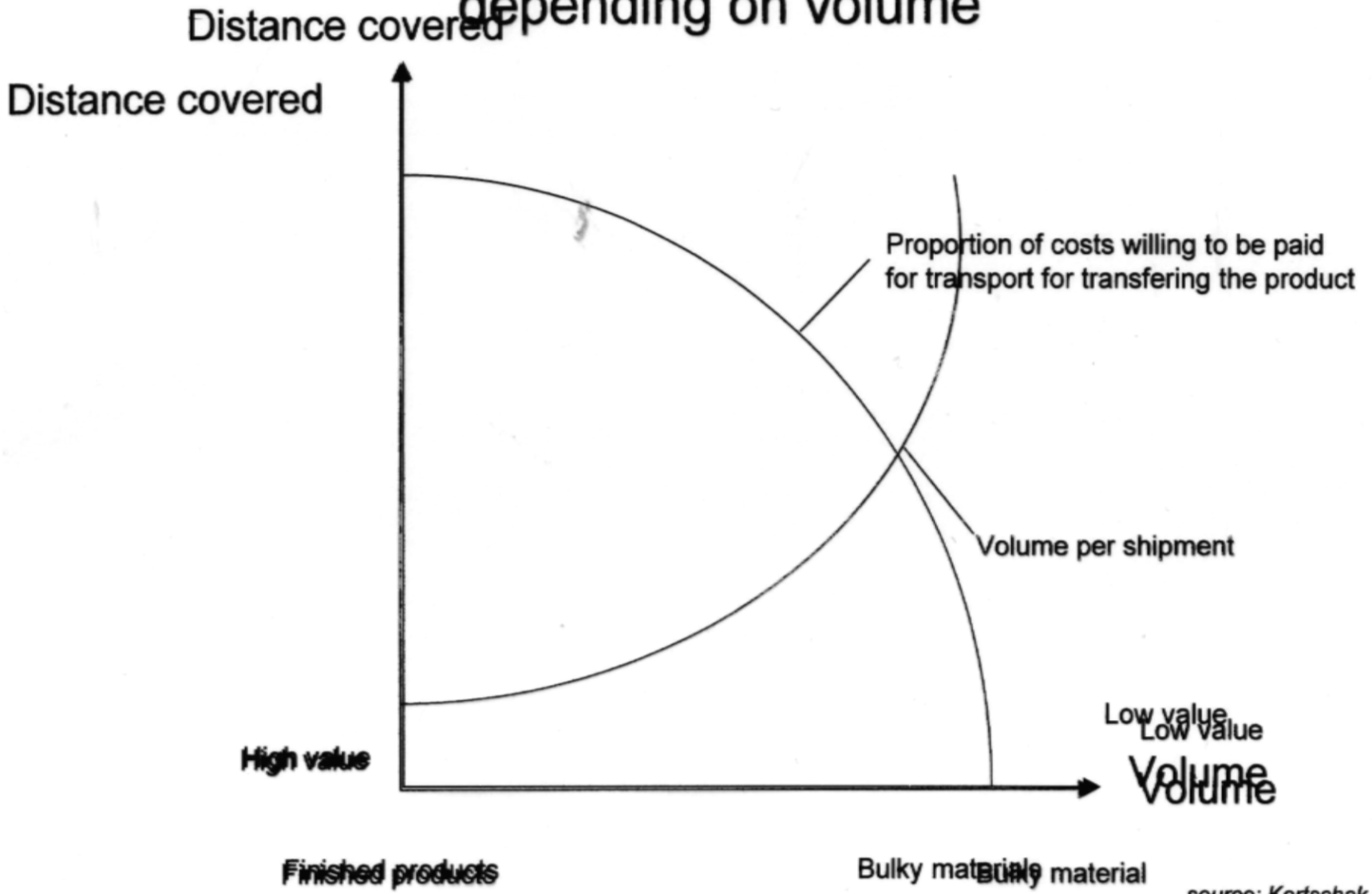


source: Kortschak 1979

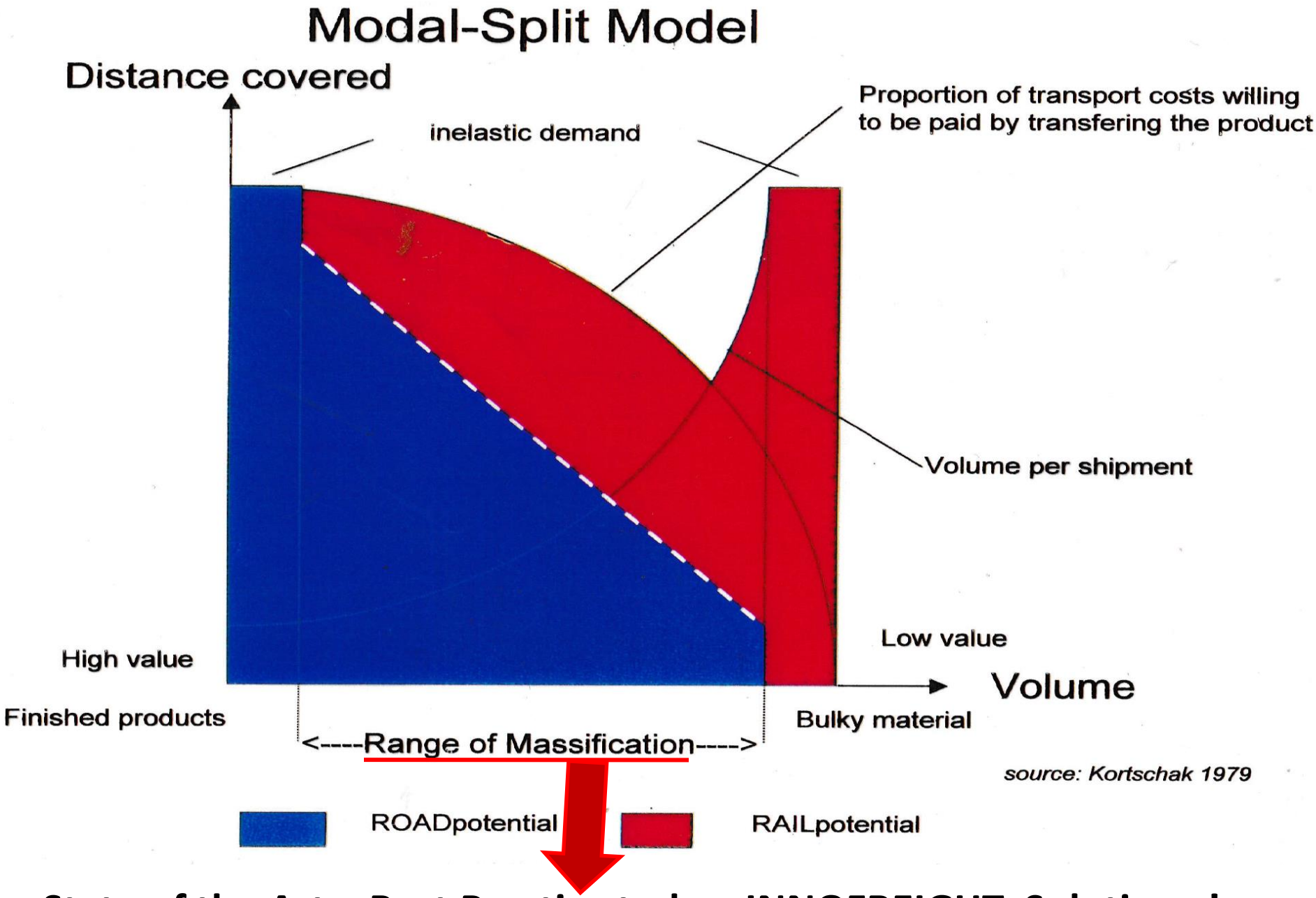
Economies of Transport

Charge what the market will bear depending on the commodity concerned

depending on volume



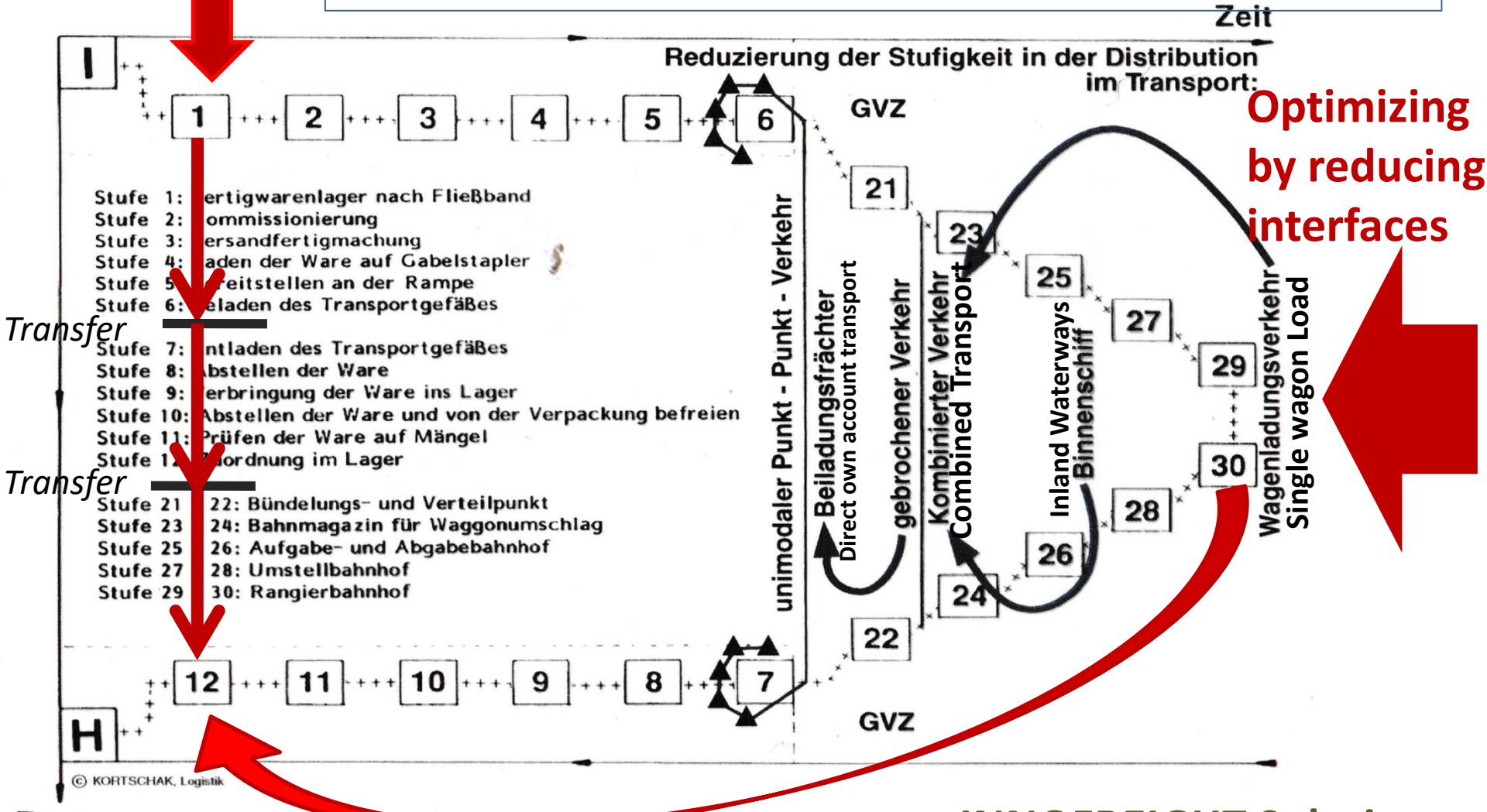
source: Kortschak 1979



State of the Art – Best Practice today: INNOFREIGHT Solutions !

INNOFREIGHT Solutions:

- Maximum Payload per m train length
- Direct Movement Warehouse to Warehouse



Optimizing by reducing interfaces

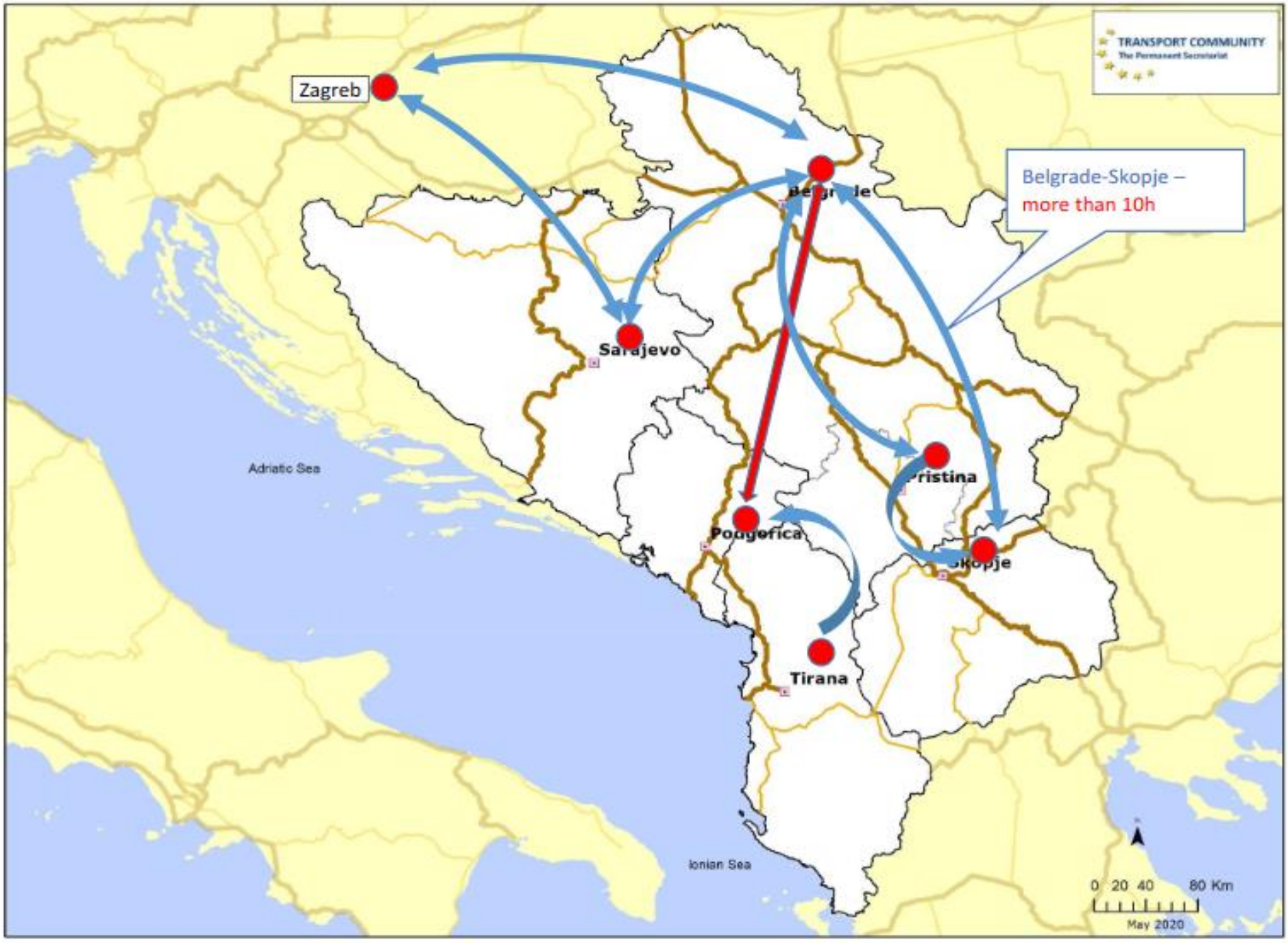
From 1 to 12 by immediate *transfer* without buffer = **INNOFREIGHT Solutions**

Ongoing infrastructure projects in the region

TRANSPORT COMMUNITY Lasica 2021

Regional Partner	Name of the project	Core/Comprehensive Network	Foreseen intervention	Total length	Total Cost (M€)	Estimated completion deadline
Albania	Durres- Tirana	Core	Reconstruction/rehabilitation	41	90.45	2023
Bosnia and Herzegovina	Šamac – Doboj – Rječica	Core	Reconstruction/rehabilitation	85	162.5	2025
North Macedonia	Kumanovo-Beljakovce	Core	Reconstruction/rehabilitation	30.8	48.9	2022
North Macedonia	Beljakovce-Kriva Palanka	Core	New infrastructure, Reconstruction/rehabilitation	34	145	2024
North Macedonia	Kriva Palanka -Deve Bair	Core	New infrastructure	34	420	2026
North Macedonia	Nogaevci-Negotino	Core	Reconstruction/rehabilitation	31	9.6	2022
Kosovo	Railway Rehabilitation Route 10	Core	Reconstruction/rehabilitation	148	245	2025
Montenegro	Vrbnica-Bar	Core	Reconstruction/rehabilitation	159	244	2024
Serbia	Brestovac - Presevo	Core	Reconstruction/rehabilitation	23	60	2023
Serbia	Belgrade - Novi Sad - Subotica	Core	New infrastructure, Reconstruction/rehabilitation	183	1994	2024
Serbia	Nis - Dimitrovgrad	Core	New infrastructure,	108	268	2024


Map of rail BCPs opened 24 hours
TRANSPORT COMMUNITY
Subotica
Vrsac
Belgrade
Sid/Tabanovic
Samac
Brasina
Sarajevo
Dimitrovgrad
Adriatic Sea
Pristina
Podgorica
Tuzi
Skopje
Tirana
Ionian Sea
Legend
Core Rail Network
Comprehensive Rail Network
BCBs between WB and EU MS
BCPs within WB
0 20 40 80 Km
May 2020


TRANSPORT COMMUNITY
The Permanent Secretariat
Zagreb
Belgrade-Skopje –
more than 10h
Sarajevo
Pristina
Podgorica
Skopje
Tirana
Adriatic Sea
Ionian Sea
0 20 40 80 Km
May 2020

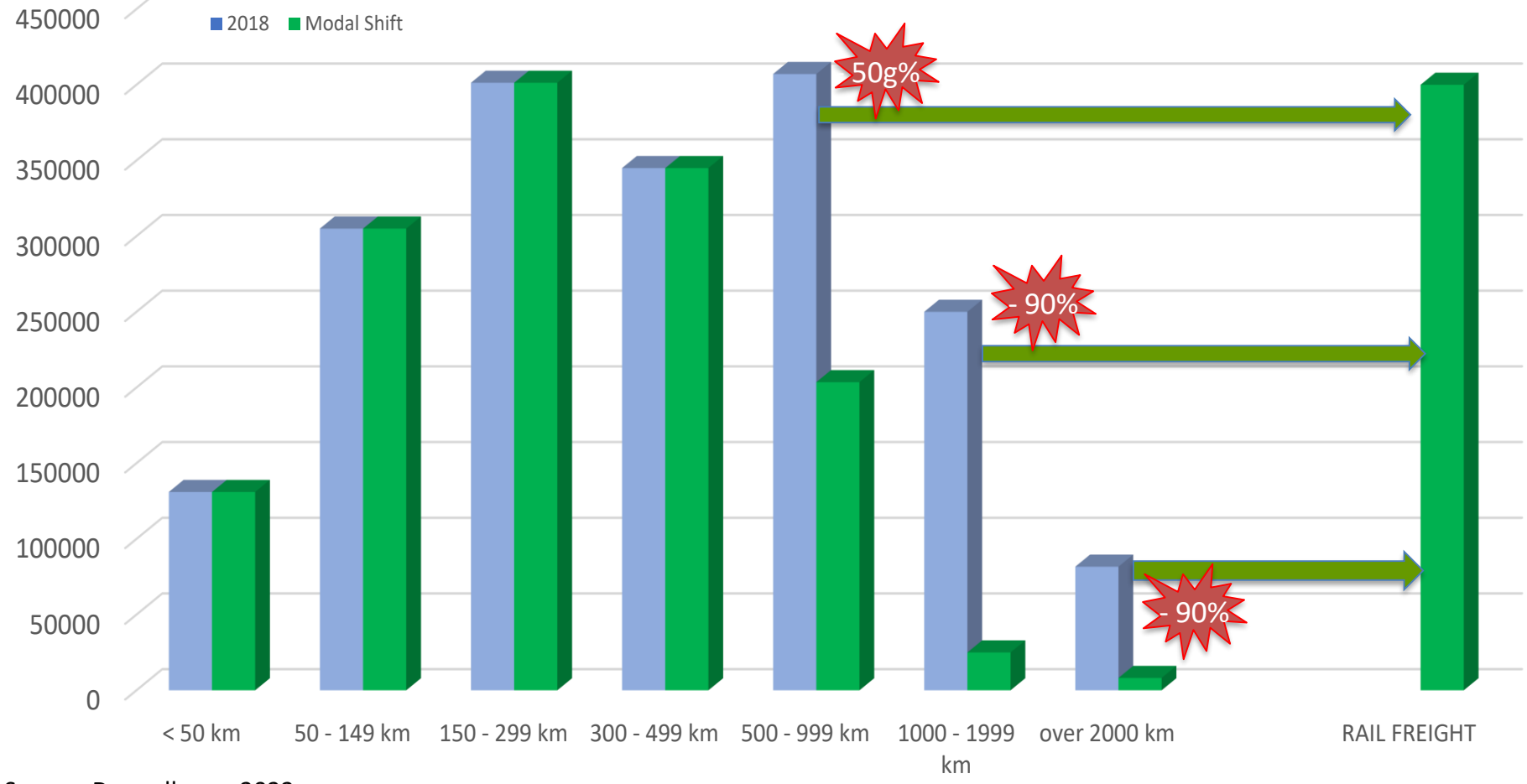
Lasica 2021

Route	Distance (km)		Travel time (hrs)	
	Rail	Road	train	bus
Belgrade – Skopje	400	435	11	6 – 7,5
Belgrade – Zagreb	423	395	6,5 - 8	5 - 6
Belgrade – Bar	476	485	11	9,5 – 11,5
Skopje – Pristina	93	96	3	2 – 2,5
Tirana – Podgorica	166	180	n/a	4
Sarajevo - Zagreb	450	390	10 (2007)	6,5 – 8
Belgrade - Sarajevo	400	310/380	8 – 9,5 (2011)	6,5 – 7,5
Belgrade - Priština	388	350	n/a	5,5 – 6,5
Belgrade - Kosovo Polje - Peć	388	350	10 (1999)	5,5 – 6,5

The Potential Volume:

36 %

Rail Modal Share –
if long distance road freight is substituted by rail



Source: Doppelbauer 2022

Saving **40 million** tonnes $C0_2$ per year

What to do to achieve ?

1. Saving Space for Railfreight in spacial and transport planning

2. Increasing train length to 650 and 740 m

3. Adjust sidings for 740 m trains

4.. Allow D4 – loadings on complete network

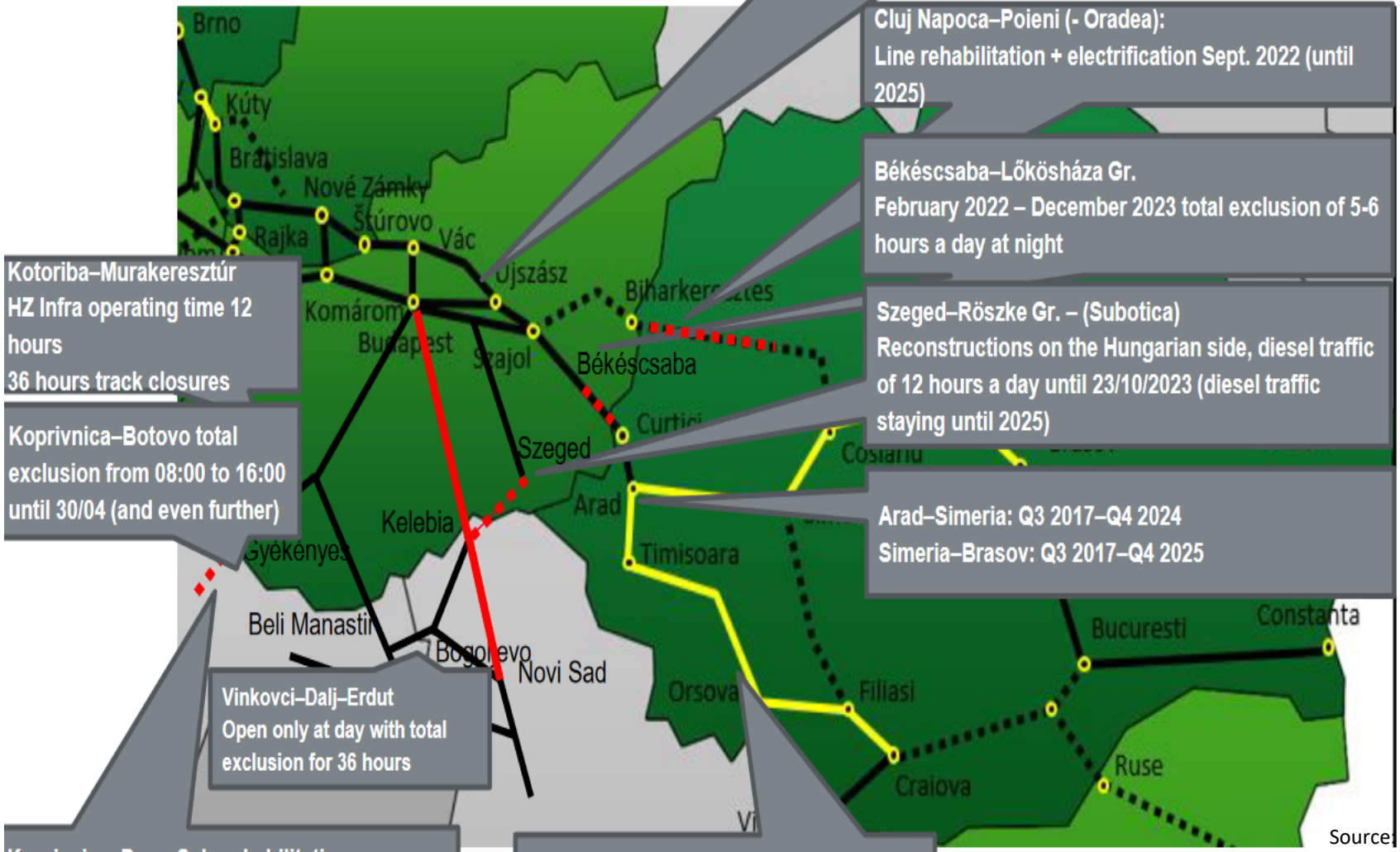
5. New track should have gradiants between 5 and 12,5 Promile – and not more:
   1 Loco for 2000 tons

6. High speed rail should be constructed for 230 km/h max. speed, but
   scheduled speed – regularly – of 160 km/h for passenger trains and 120 km/h for freight

And what could–and should you do immediatly:

Work on seamless traffic flows despite construction…

Is there a way to the Balkans in 2023?



Budapest–Hegyeshalom Gr. line:
Not plannaed track works for approx. 3 months
Reduced capacity for freight trains (1 track is closed)

Cluj Napoca–Poieni (- Oradea):
Line rehabilitation + electrification Sept. 2022 (until 2025)

Békéscsaba–Lőkösháza Gr.
February 2022 – December 2023 total exclusion of 5-6 hours a day at night

Szeged–Röszke Gr. – (Subotica)
Reconstructions on the Hungarian side, diesel traffic of 12 hours a day until 23/10/2023 (diesel traffic staying until 2025)

Arad–Simeria: Q3 2017–Q4 2024
Simeria–Brasov: Q3 2017–Q4 2025

Kotoriba–Murakeresztúr
HZ Infra operating time 12 hours
36 hours track closures

Koprivnica–Botovo total exclusion from 08:00 to 16:00 until 30/04 (and even further)

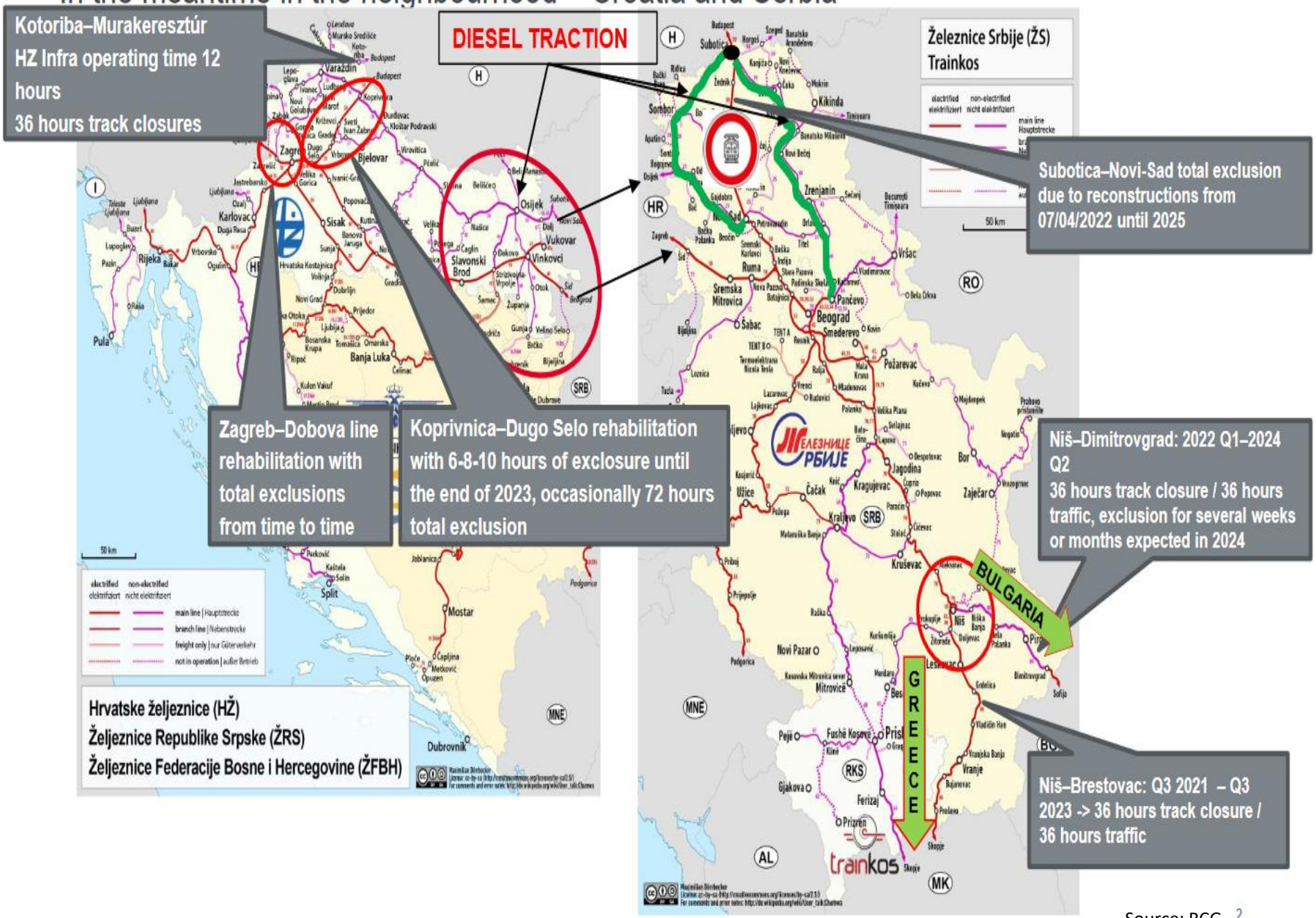
Vinkovci–Dalj–Erdut
Open only at day with total exclusion for 36 hours

Koprivnica–Dugo Selo rehabilitation
6-8-10 hours of exclosure until the end of 2023
Occasionally 72 hours total exclusion

Arad–Timisoara: Q3 2021–Q4 2025
Timisoara–Craiova: Q3 2021–Q4 2026
Craiova–Vidin: Q1 2022–Q4 2025

Source: RCG

In the meantime in the neighbourhood – Croatia and Serbia



Source: RCG

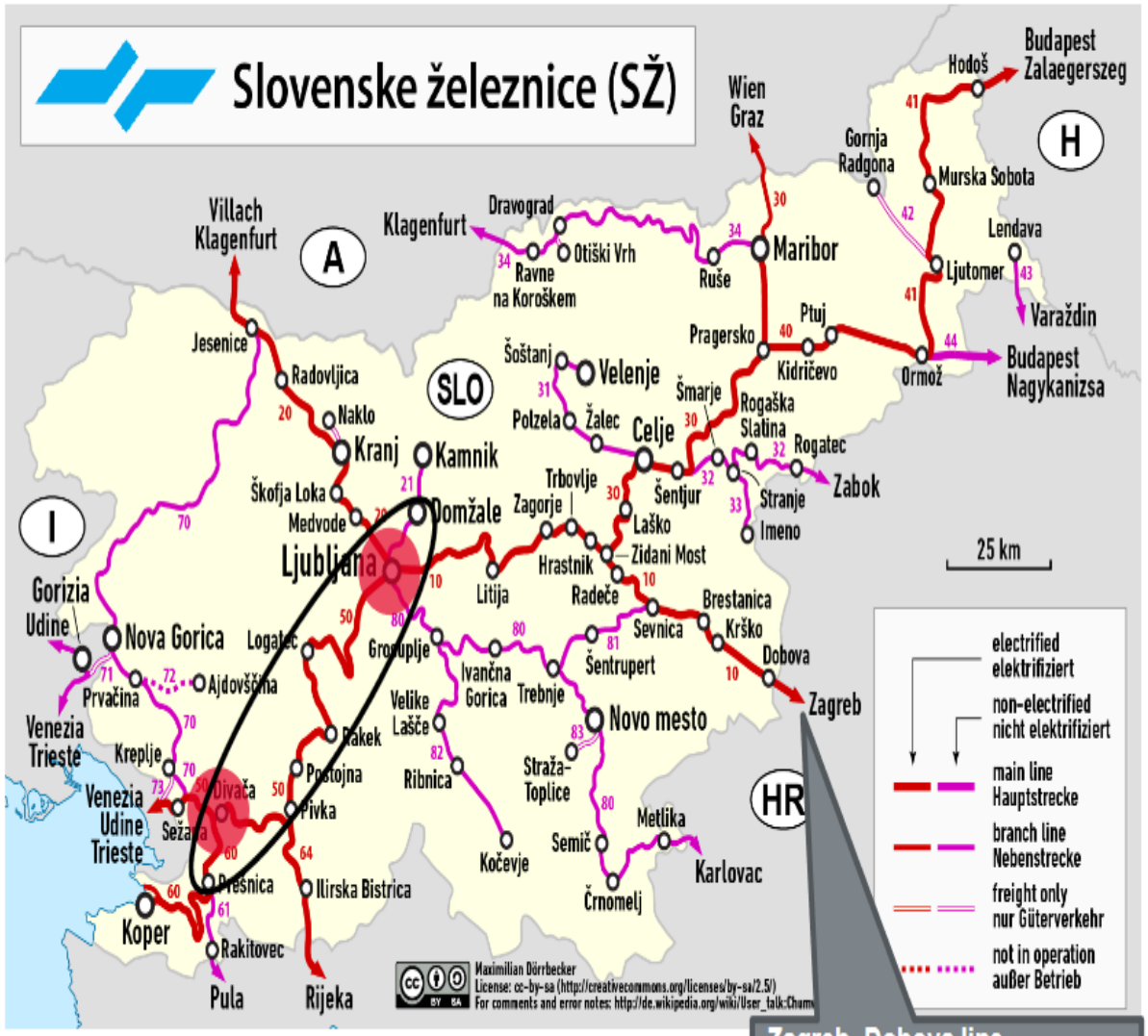
Slovenia – capacity reduction by 50% until 2025!

Ljubljana–Divača line rehabilitation until 2025

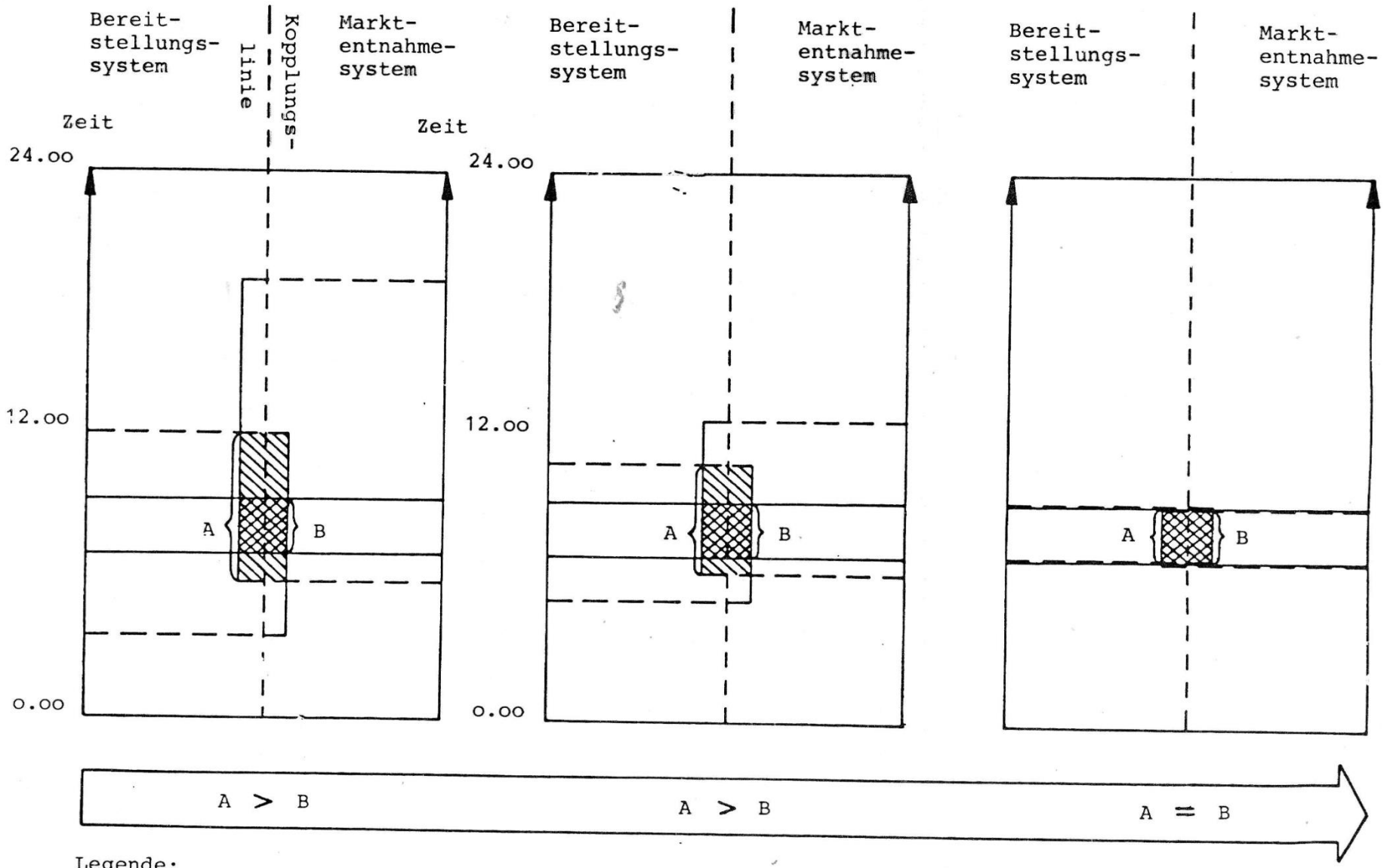
It is the main route to:

- the port of Koper
- Italy

No extra train path available for allocation!



Time Windows for Coupling in the Flow of goods have to be widened to let wagons and material flow:

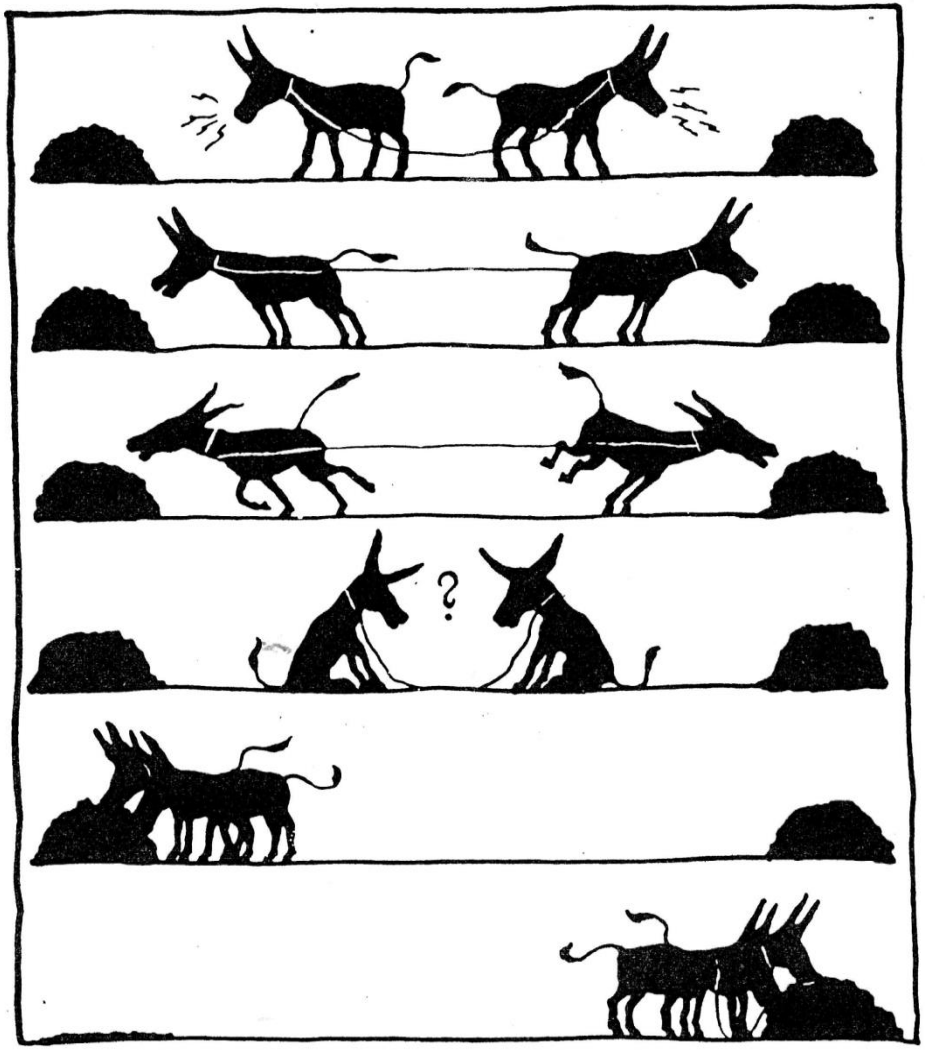


Legende:

A = Zeitraum, in dem Kopplungsvorgang stattfinden kann

With the cooperation on time windows for reconstruction and development you may start now:

Good cooperation



The CCC – Strategy:

1. **Commitment**
2. **Competence**
3. **Coordination**

Source Radovic 2019

Prof. Dr. Dr. Bernd Kortschak