Innovative Freight Wagon Concepts
for efficient Trans-European Rail Freight

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How to improve competitiveness of rail freight?

• Increase economies of scale
  → To improve productivity / reduce costs per output-unit
    → improving cost competitiveness of rail freight

• Introduce new production systems
  → To respond to new market demands / enter into new market-segments
    → improving quality competitiveness of rail freight
The role of freight wagons

- Key production resource for railway companies
- Important determinant of costs and quality of transport services (typically 15-25% of total transport costs)
- Influences transport customer’s logistics in loading/unloading process
- Strong interdependencies with rail infrastructure (e.g. axle-loads, loading gauges, etc.)
Situation today

- Separate wagon fleets for trainload, wagonload and intermodal
  - trainload: specialized wagons
  - wagonload: multipurpose wagons
  - intermodal: dedicated fleet for intermodal traffic

- Existing norms and standards not necessarily adequate to respond to future market demands due to changing competitive environment

- Most efficient wagons today are "exceptions from the standards"

- Careful review of vehicle as well as related infrastructure standards will be necessary
Outlines of a new freight wagon concept

• Platform Concept
  - to achieve economies of scale in production and maintenance
  - several wagon types can be derived
  - detachable superstructures

• Two basic designs
  - Design A: Long wagon → mainly for intermodal / volume-cargo
  - Design B: Flat wagon for trailer transport

• Approach
  - combine innovative, but proven solutions for sub-systems rather than developing ‘revolutionary’ new solutions with high technical risks
Examples of flexible superstructures (I)
Examples of flexible superstructures (II)
Key parameters

- Axle-loads: 25 tons (optionally more)
- Loading gauge: UIC GC, extended gauge on selected corridors
- Train length: 750 m (1,000 m) or 2 * 750 m = 1,500 m
- Design speed: Generally 100 km/h at 25 t axle-load, optionally more at reduced axle-load (120/140/160 km/h)
Benefits of higher axle-loads

... for heavy cargo (e.g. ore, steel, paper, liquid cargo):

→ Increased payload per train-length (ton/meter)
→ Heavy Cargo Wagon

... for volume cargo (e.g. finished and semi-finished products, typical intermodal cargo):

→ Decreased number of axles per train-length (axles/meter)
→ Wagon design A (Long wagon)
Design A – long wagon (80’)

Today – loading length ca. 19 m

Future – loading length ca. 25 m

- 33% more capacity when loaded with containers
- better adapted to 40’-containers (~75% of maritime containers)
- 50% more capacity when loaded with C-swap bodies
- frame slightly heavier due to longer span, but bigger distance between bogies → tare weight per meter less than today’s wagons
- tare weight ca. 23-24 ton
North-Amercian Standard 80’-wagon
Australian class CQMY 80’-wagon
German class Rbns 641/646-wagon

- for transport of steel bars
- Length over buffers = 26.35 m
- also regularly humped in marshalling yards (on special permission)

Source: DB Schenker Rail
Comparison:
Number of Loading Units per 100 m

<table>
<thead>
<tr>
<th>Nr of LU per 100 m</th>
<th>0,00</th>
<th>2,00</th>
<th>4,00</th>
<th>6,00</th>
<th>8,00</th>
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<th>12,00</th>
<th>14,00</th>
<th>16,00</th>
<th>18,00</th>
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<tbody>
<tr>
<td>Sgns 60'</td>
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<td>Sggmrs 104'</td>
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<td>New wagon concept</td>
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<table>
<thead>
<tr>
<th>Length</th>
<th>LU</th>
<th>LU</th>
<th>LU</th>
</tr>
</thead>
<tbody>
<tr>
<td>20'-ct</td>
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<td></td>
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<tr>
<td>40'-ct</td>
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<tr>
<td>7,45m-swap body</td>
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</table>
Comparison: Number of loading units per axle

Nr of LU per axle

20'-ct  40'-ct  7,45m-swap body

Sgns 60'
Sggmrs 104'
New wagon concept
Comparison:
Maximum payload per loading unit

Maximum payload per LU (with regard to axle-load !)

- **20'-ct**
- **40'-ct**
- **7,45m-swap body**

- **Sgns 60'**
- **Sggmrs 104'**
- **New wagon concept**

![Comparison Graph](Comparison.png)
Design B: Flat wagon for semi-trailers

Today – pocket wagon

Future – trailer on flat wagon

Excludes >95% of European semi-trailer fleet!

Handles 100% of European semi-trailer fleet
North American flat wagon for semi-trailers (TOFC = Trailers on Flat Cars)
Approach for European TOFC-solution

Combination of:

• Slightly decreased floor height – 800 mm
• Slightly increased loading gauge – 4,800 mm (on relevant corridors)

→ Sharing the responsibility for implementation between wagon design and infrastructure development
Different low floor designs today

- > 1155 mm
- 825–950 mm
- 410–600 mm
Example of low floor wagon – MEGAFRET-wagon (AAE)

- floor height: 825 mm
- Wheel diameter: 730 mm
- Axle load: 16 tons
- Max.speed: 120 km/h
Comparison of loading profiles

Double-Stack-Container-Trains
(two 9'6"-container in a well wagon)

Swedish loading gauge ‘C’

UIC ‘GC’-gauge

Swedish loading gauge ‘A’

UIC ‘GB’-gauge

UIC ‘GA’-gauge

Gerhard Troche, 2009
Proposal for new loading profile
"GC-extended"

"GC-extended"
(4 m-trailer on 80cm-flatcar)

UIC ‘GC’-gauge

4.650 mm

4.800 mm

2.910 mm

3.150 mm

Gerhard Troche, 2009
Options for the future

• utilize loading gauge for other wagon types

Example 1
## Comparison of SECU-unit with other transport options

<table>
<thead>
<tr>
<th>Cargo carrier</th>
<th>Loaded wagons, tonnes per wg. meter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Huckepack, 13.6 m trailer</td>
<td>1.3</td>
</tr>
<tr>
<td>40’ std container</td>
<td>1.5</td>
</tr>
<tr>
<td>45’ curtainsider</td>
<td>2.0</td>
</tr>
<tr>
<td>Conv. wagon</td>
<td>2.5</td>
</tr>
<tr>
<td>Double stack 40’</td>
<td>3.0</td>
</tr>
<tr>
<td>Stora Enso Cargo Unit</td>
<td>4.5</td>
</tr>
</tbody>
</table>

Source: STORA-ENSO
Options for the future

Example 2
Other key features

- **Automatic central couplers**
  - allows removal of side buffers and simpler/lighter frame design (medium-term)
  - screw-coupler-compatible central coupler to reduce implementation barriers

- **Electric power supply**
  - for railway-internal applications (IT)
  - for customer applications (e.g. reefer containers/trailers, operation of sliding doors, ...)
  → energy-supply stationary and during transport
Maximum train weights with new wagon concept

- **Design A (long wagon)**
  - at 700 m train-length (excl.locos): 27 wagons – 2.700 tons
  - at 1.400 m train-length (excl.locos): 54 wagons – 5.400 tons

- **Design B (trailer wagon)**
  - at 700 m train-length (excl.locos): 45 wagons – 2.880 tons
  - at 1.400 m train-length (excl.locos): 90 wagons – 5.760 tons
Ďakujem za pozornosť’!

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