Weight and dimensions of heavy commercial vehicles as established by Directive 96/53/EC and the European Modular System (EMS)

Workshop on LHV's

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June 24, 2009

Brussels
A new approach to increase capacity were developed when Sweden and Finland joined EU

**Issue**
For environmental and competitive reasons it was unacceptable for both Sweden and Finland to apply the existing EU Directive on vehicle size and weight, as they since long had allowed longer and heavier vehicle combinations.

**Challenge**
To find a solution that enables foreign transporters to compete on equal terms in Sweden and Finland.

**Solution**
The "Modular Concept" introduced in 96/53/EC. Allowing increased vehicle length and weight on appointed road networks on the condition that established EU modules were used.
The European Modular System (EMS)
on an appointed road network

- Road Class 3
- Road Class 2
- Rail Road
- Breakpoint Class 1/2
- Breakpoint Class 2/3
- Urban Area
- Area with streets class 1
- Inland waterway

Street Class 1: 7.82 m

Road Class 2: 13.6 m and 7.82 m

Road Class 3: 7.82 m, 13.6 m, and 7.82 m

Max. length 25.25 m and max. weight 60 ton on “Class 3” roads for EMS combinations allowed in Sweden and Finland when joining the European Union.
Road freight capacity was earlier increased by introducing new and larger loading units

EMS increases the capacity by using existing units

Table only as illustration (not always logic links between rows and columns)

<table>
<thead>
<tr>
<th>Containers</th>
<th>Swap bodies (m)</th>
<th>Length Tractor – Semitrailer (TST)</th>
<th>Length Truck – trailer (TT)</th>
<th>Load length*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Class C Class A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20´</td>
<td>7.15</td>
<td>15 m</td>
<td>18 m</td>
<td></td>
</tr>
<tr>
<td>40´</td>
<td>7.45 12.5 13.6</td>
<td>15.5 m 16.5 m**</td>
<td>18.35 m</td>
<td>13.6 m (TST)</td>
</tr>
<tr>
<td>45´**</td>
<td>7.82</td>
<td></td>
<td>18.75 m**</td>
<td>15.65 (2x7.82) (TT)</td>
</tr>
<tr>
<td>48´</td>
<td>8.22</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>53´</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Introduced by 89/461 EEC to protect the driver environment (Cab space) and established also the two loading units 7.82 m and 13.6 m

** 96/53 EC (as introduced in 1996 and incl. declaration in Dec 2006)
EMS is based on existing modules

Load units

20ft – 7,82m

Short module
Dimensions equal to
- ISO container 20ft
- Swap body CEN Class C
  7,15m 7,45m 7,82m

40ft / "13,6m" (& 45ft)

Long module
Dimensions equal to
- ISO container 40ft
- "13,6m" semitrailer
- 45 ft container if this will be generally allowed in EU

Vehicles

Tractor 4x2
For semitrailer

Tractor 6x2, 6x4
For semitrailer

Trailers

Semitrailer “13,6m”
for long module

Variant of Semitrailer;
“B-train”

dolly

Centre axle trailer
for short module

Combine existing modules (vehicle components and load units) in a more efficient way and allow this on an appointed road network, to make better use of what we already have
ACEA supports a wider EU application of EMS because:

- Positive environmental impact (CO$_2$ and other emissions)
- The Lisbon Agenda – European competitiveness
- Reduced congestion
- Co-modality & Intermodality considerations
- Traffic safety is maintained or improved
- Supports Efficient Logistics
- Flexible use of existing units
- Already included in Directive 96/53/EC

An EU wide application of EMS is likely the most cost-effective way to address all the relevant concerns, including co-modality.
## Impacts of different vehicles sizes to transport 106 EU pallets (600kg/pallet)

<table>
<thead>
<tr>
<th>No. of trucks</th>
<th>Space on road</th>
<th>Fuel per 1000tonkm*</th>
<th>Fuel Index</th>
<th>GCW</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>130 m</td>
<td>16 lit</td>
<td>84</td>
<td>60 ton</td>
<td><img src="2x25.25" alt="Image" /></td>
</tr>
<tr>
<td>3</td>
<td>172 m</td>
<td>19 lit</td>
<td>100</td>
<td>40 ton</td>
<td>![Image](1x18.75 2x16.5)</td>
</tr>
<tr>
<td>6</td>
<td>300 m</td>
<td>27 lit</td>
<td>142</td>
<td>26 ton</td>
<td><img src="6x2.5" alt="Image" /></td>
</tr>
<tr>
<td>9</td>
<td>432 m</td>
<td>37 lit</td>
<td>195</td>
<td>18 ton</td>
<td><img src="9x2.5" alt="Image" /></td>
</tr>
<tr>
<td>16</td>
<td>755 m</td>
<td>53 lit</td>
<td>279</td>
<td>12 ton</td>
<td><img src="16x2.5" alt="Image" /></td>
</tr>
<tr>
<td>20</td>
<td>903 m</td>
<td>78 lit</td>
<td>410</td>
<td>7.5 ton</td>
<td><img src="20x2.5" alt="Image" /></td>
</tr>
<tr>
<td>53</td>
<td>2360 m</td>
<td>178 lit</td>
<td>937</td>
<td>3.5 ton</td>
<td><img src="53x2.5" alt="Image" /></td>
</tr>
</tbody>
</table>

Source: Volvo  * Note: Calculated with consideration to “normal” utilization
EMS is efficient logistics

• It is a new systems thinking – the possibility to combine modules in different ways for adapting to local conditions

• Use longer combinations on an appointed road network

• Avoid national specific demands

• Not necessarily heavier vehicles – general cargo type of goods is often volume sensitive

Use long combinations when possible, shorter combinations when necessary.
Efficient Logistics

Fewer trucks needed for the same transport work

Class 2 roads

- Short module
- Long module

Class 3 roads

- Long module
- Short module

Fewer vehicles

- Possible to rearrange to shorter combinations and adopt to local conditions
- Standard loading units
- Same volume of cargo
- Less total fuel consumption
- Less emissions per tonkm
- Less total room on road
- Lower cost per tonkm
- Less road damage

- Based on existing equipment
- Easy to implement
Tractor + B-train for long haul, 25,25 m on Class 3 roads

Disconnect the semitrailer
Integrated Logistics Solutions

Example

Tractor + B-train for long haul, 25,25 m

Move the trailer wheels forward

The long distance truck is converted into a distribution vehicle
Combine existing modules in a more efficient way and allow this on an appointed road network, to make better use of what we already have.
EMS using existing modules
(vehicle components and load units)
on an appointed road network in
national territories of MS

When using existing modules to form longer and heavier vehicle combinations beyond the limits of requirements valid in national territories of Member States, some of these requirements might need to be modified.

When operation of these combinations are only intended on a limited part of the available road network some requirements valid for general vehicle usage might loose their relevance.
EMS using existing modules
(vehicle components and load units)
on an appointed road network
in cross border traffic

Requirements to be considered for EMS combinations in cross border operations should be evaluated on the basis of the requirements that are valid for their national operations in the bordering Member States.

For efficient cross border operations of EMS combinations, it is strongly recommended that the EU Commission provides recommendations to support a harmonised application of the EMS.
EMS - Safety

- Reduced accident risk – due to fewer trucks for the same goods
- Same braking capacities – as each axle braking it’s own load
- Overtaking distance no problem on multi lane roads

Braking tests have proven that the braking behaviour of a 60t EuroCombi is as good as that of modern 40t Standard combinations.
EMS - Dynamic Stability

Good dynamic stability of vehicles – equal to present EU vehicles

Source: NVF - Report no. 1/2007- Committee 54: Vehicles and Transports
EMS - Effect on infrastructure - Bridges
Same or better than existing combinations

Table 33: Impact on bridges of 46 tonnes – 25.25 m vehicles (2-axle tractor)

<table>
<thead>
<tr>
<th></th>
<th>Extreme loads</th>
<th>Fatigue</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Local effects</td>
</tr>
<tr>
<td>Short</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>Medium</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>Long</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>S</td>
<td>S</td>
</tr>
</tbody>
</table>

Table 29: Impact on bridges of 44 tonnes – 5 axles vehicles (18.50 m or 18.75 m)

<table>
<thead>
<tr>
<th></th>
<th>Extreme loads</th>
<th>Fatigue</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Local effects</td>
</tr>
<tr>
<td>Short</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>Medium</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>Long</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>S</td>
<td>S</td>
</tr>
</tbody>
</table>

Caption:
- C = Reinforced and prestressed concrete bridges
- S = Steel and steel-concrete composite bridges
- = No effect
- = Moderate effect
- = Important effect, need of studies on this topic

Source:
TRANSPORT & MOBILITY LEUVEN
**EMS - Effect on infrastructure - Bridges**

Same or better than existing combinations

Table 34: Impact on bridges of 50 tonnes – \((24 \text{ m} \leq L \leq 25.25 \text{ m})\) vehicles – without counter measures

<table>
<thead>
<tr>
<th>Spans</th>
<th>Extreme loads</th>
<th>Fatigue</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Local effects</td>
<td>General effects</td>
</tr>
<tr>
<td>Short</td>
<td>C</td>
<td>S</td>
</tr>
<tr>
<td>Medium</td>
<td>C</td>
<td>S</td>
</tr>
<tr>
<td>Long</td>
<td>C</td>
<td>S</td>
</tr>
</tbody>
</table>

Table 36: Impact on bridges of 60 tonnes – \((24 \text{ m} \leq L \leq 25.25 \text{ m})\) vehicles – with counter measures

*Measures effective in limiting the aggressiveness of vehicles such as minimal spacing between 2 LHV, no overtaking, **authorizations limited to specific routes**

Source:
TRANSPORT & MOBILITY LEUVEN
### EMS - Effect on infrastructure – Pavement

**Same or better than existing combinations**

<table>
<thead>
<tr>
<th>Code</th>
<th>Shape</th>
<th>Pavement</th>
</tr>
</thead>
<tbody>
<tr>
<td>A44</td>
<td><img src="image" alt="A44 Truck" /></td>
<td>2.39</td>
</tr>
<tr>
<td>A48</td>
<td><img src="image" alt="A48 Truck" /></td>
<td>&gt;2.39</td>
</tr>
<tr>
<td>B40</td>
<td><img src="image" alt="B40 Truck" /></td>
<td>1.33</td>
</tr>
<tr>
<td>B44</td>
<td><img src="image" alt="B44 Truck" /></td>
<td>1.92</td>
</tr>
<tr>
<td>B48</td>
<td><img src="image" alt="B48 Truck" /></td>
<td>&gt;1.92</td>
</tr>
<tr>
<td>C40</td>
<td><img src="image" alt="C40 Truck" /></td>
<td>1.07</td>
</tr>
<tr>
<td>C44</td>
<td><img src="image" alt="C44 Truck" /></td>
<td>1.42</td>
</tr>
<tr>
<td>C48</td>
<td><img src="image" alt="C48 Truck" /></td>
<td>1.85</td>
</tr>
<tr>
<td>D46</td>
<td><img src="image" alt="D46 Truck" /></td>
<td>1.94</td>
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<tr>
<td>E50</td>
<td><img src="image" alt="E50 Truck" /></td>
<td>0.55</td>
</tr>
<tr>
<td>F50</td>
<td><img src="image" alt="F50 Truck" /></td>
<td>0.55</td>
</tr>
<tr>
<td>G50</td>
<td><img src="image" alt="G50 Truck" /></td>
<td>0.42</td>
</tr>
<tr>
<td>E60</td>
<td><img src="image" alt="E60 Truck" /></td>
<td>2.05</td>
</tr>
<tr>
<td>F60</td>
<td><img src="image" alt="F60 Truck" /></td>
<td>2.07</td>
</tr>
<tr>
<td>G60</td>
<td><img src="image" alt="G60 Truck" /></td>
<td>1.46</td>
</tr>
</tbody>
</table>

**Relative aggressiveness per tonne carried**

![Graph showing relative aggressiveness](image)

**Source:**
TRANSPORT & MOBILITY LEUVEN

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*Figure 33: Summary of the consequences on infrastructures, without countermeasures.*

- Green: No consequences
- Yellow: Moderate consequences
- Red: Important consequences
Utilisation of trucks measured per no. of pallets, volume and weight for transport of general-cargo-like goods.

Road transport needs above all increased volume and load lengths.

Data source: NEA.
Rail and road are complementary modes

The value of goods in relation to transport modes

Changes in road transport will not move volumes from rail to road since road and rail handle goods of very different values

Source: Kenth Lumsden, CTH (1€=10SEK)
Inter-modal transports often need higher vehicle weights because of the use of heavier load carrier

Note the 44 t legal limit for 40´ ISO containers in combined transport compared with the general legal limit 40 t GCW

Restriction on weight of EMS vehicle combinations will likely have a negative impact on inter-modal transports and on bulk transports (weight sensitive) for which no alternative exist
EMS will create a more stable situation with respect to the lifetime of standardised load units and handling equipment.

Increased capacity is achieved by using existing modules.

“better and longer use of what we already have”
Important aspects to be considered in connection with the analysis

- Transport of general cargo needs increased volume and load-length on each unit
- Intermodal and bulk transports need higher weight because of heavier load carrier
- The efficiency of all transport modes need to improve
- Compare energy efficiency for the total transport (door to door)
  - As energy is needed for loading and unloading, these should be kept to a minimum
  - Coupling and uncoupling uses less energy than loading and unloading
  - Different modes requires different load carrier and packaging (loading/unloading/stacking, risk of damage and theft)
  - Production and transport of load carriers and packaging material uses energy
  - Vehicle size restrictions in urban areas prevent the use of the most fuel efficient solutions for intermodal transport if transit points are located in city centres
- EMS will create a more stable situation with respect to the lifetime of standardised load units and related handling equipment – “better and longer use of what we already have”
The European Modular System
Conclusions

Strengths and Opportunities

• Increases European transport efficiency and economic competitiveness
• Reduces the number of vehicles for a given amount of goods
• Reduces global and local environmental impact
• Maintains or improves traffic safety
• Reduces congestion
• Reduces road wear
• Supports intermodal transport
• Included in EU Directive 96/53/EC
• Is based on existing load units and vehicles
• Possible to rearrange into shorter combinations and adopt to local conditions
• Used for many years in Sweden and Finland and already tested in the Netherlands, Denmark and Germany with positive experience.
Thank you for your attention!
Back-up slides
Rail and road are complementary modes

ROAD TRANSPORT
(Generally higher level of services and higher costs per tonkm)

RAIL TRANSPORT

SERVICE (Lead time, frequency, flexibility)

Cost per tonkm
(long distances, high weights)

Source: Schenker Sweden

Projected transport growth and competitiveness requires increased efficiency and capacities in the whole transportation system “co-modality”.
Impacts of Financial Crisis on EU27 Vehicle Fleets according to Fraunhofer

Change of Vehicle Fleets in EU27

Source: What assumption regarding the HDV fleet has been used in the analysis for CER?
Aerodynamic characteristics can be improved if permitted by vehicle size regulations

Boat tails

4% Fuel Savings

5% Fuel Savings
Manoeuvrability of EMS combinations using existing modules on an appointed road network

The most relevant test manoeuvre to evaluate EMS combinations seems to be the 90-degree turn on a 12.5 m outer radius.