Rescue Single Wagon Load Traffic

Abolish Shunting!

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Efficiency and Safety on Rail-Bound - Systems
When started the problem?

With the emerging truck after World War I…
And this is how it looks like today:

Only unit-trains over long distances seem to be competitive…

source: A.T.KEARNEY/LOGITECH 1990
BUT:

Unlike America only few volume is carried over distances more than 800 km. Distances over 800 km require the change of border lines with different technical requirements to be met by regulations and obligations – unlike America, where class I railways comprise the United States & Canada with the same technical standards.
The Competitiveness of Rail Freight

Rolling speed:

Rail is faster than Road:

<table>
<thead>
<tr>
<th>100/120 km p h</th>
<th>80 km p h</th>
</tr>
</thead>
<tbody>
<tr>
<td>on average:</td>
<td></td>
</tr>
<tr>
<td>80 – 100 km p h</td>
<td>65 km p h</td>
</tr>
</tbody>
</table>
## The Competitiveness of Rail Freight

### Loading capacity:

<table>
<thead>
<tr>
<th></th>
<th>Rail Wagon 4-axle</th>
<th>Truck</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td>90 tons</td>
<td>40(44)tons</td>
</tr>
<tr>
<td><strong>Net-weight</strong></td>
<td>65 tons</td>
<td>&lt; 28 tons</td>
</tr>
<tr>
<td><strong>track-classification</strong></td>
<td>D4</td>
<td>Motorways</td>
</tr>
<tr>
<td><strong>Axle-loading</strong></td>
<td>22,5 tons</td>
<td>10/11,5 tons</td>
</tr>
</tbody>
</table>

*Source: EN 15528, German maximum values, StVO*
The Competitiveness of Rail Freight

Rail is better in all features (rolling speed, loading)

Why is it loosing in the market?

The problem:
Even in crisis (2008 to 2009) with oil prices sky rocketing
Road increased its market share from 70 to 71,1% compared to
Rail, whose market share declined from 17,6 to 16,4%!
The Competitiveness of Rail Freight

Rail is better in all features - Why is it loosing in the market?

Where does Rail loose ist competitiveness?

tkm by modes Germany:

- Road
- Rail
- Inland Waterways
- Pipelines

Where does Rail lose its competitiveness?

... by using shunting procedures for train forming:

As easily can be seen the shunting procedure does not contribute to the transport itself. It's a circle: it ends at the same point where it started.

source: Voigt 1973
Where does Rail lose its competitiveness?

... by using shunting procedures for train forming:

As easily can be seen the shunting procedure does not contribute to the transport itself. It’s a circle: it ends at the same point where it started

source: Voigt 1973

Therefore shunting does not contribute to value added...

According to the principles of Lean Production such processes have to be abandoned!
How did shunting develop?

1. switch-back-procedures

Switch-back-procedures are performed by shunting engines. These shunting engines pull out with the wagons in a train-forming line and after reversing the points the engine moves the wagons back in the appropriate siding. These procedures are valid for low volume transfer activities up to 50 wagons per hour.

source: Peter 1996
How did shunting develop?

2. Fly shunting-procedures

Fly shunting-procedures require fast changing switches and quick response of engine drivers and shunting personnel to keep track with the required sequencing of wagons. Because of the wagons finding the assigned track on their own, the productivity of the engine can be doubled: These procedures are valid for medium volume transfer activities up to 100 Wagons per hour.

source: Peter 1996
How did shunting develop?

3. Marshalling yard – gravity hump procedures

3.1. with constant speed over the hump

Operations over the hump boost productivity because of one working direction only. In systems with constant speed over the hump up to 150 wagons can be processed per hour; this system is typical for German marshalling yards.
How did shunting develop?

3. Marshalling yard – gravity hump procedures
3. 2. with variable speed over the hump

Operations over the hump boost productivity because of one working direction only. In systems with variable speed detectors check the running quality of the wagon at the beginning thus braking from point to point by retarders also reducing the damage in the sorting sidings (marshalling tracks). With variable speed systems more than 300 wagons can be processed per hour; this system is typical for Austria and Switzerland.
Where does Rail loose its competitiveness?

If logistics principles are applied, rail looses its competitiveness because of the hump!

When the hump was first introduced in 1876 in Duisburg-Speldorf it was a child of its time: the steam age! Steam engines for traction were scarce and required the replenishment of coal and water at the depot. The hump enabled the traction locomotive to be sent to the depot for replenishment of coal and water while shunting was performed by much smaller engines instead. Therefore the shunting engine came from the rear while the traction loco was uncoupled in the front at the same time.
Where does Rail lose its competitiveness?

If logistics principles are applied, rail looses 1st competitiveness because of the hump!

The productivity gain of the hump refers to the reuse of the traction steam locomotive. But: In the meantime the traction power is performed by diesel & electric engines who do not need replenishment stops in the same way. But the procedures prevailed as if: But having lost the monopoly of being the sole source of overland freight transport the time of wagons being spent in marshalling yards of 3 to 6 hours becomes critical.
Where does Rail lose its competitiveness?

If logistics principles are applied, rail loses its competitiveness because of the hump!

In Germany many marshalling yards consist of one hump for each main direction, like Hamburg Maschen or Mannheim. Such systems with two humps at the same place loose productivity if wagons are not going in one of the main directions, like north or south, but from east to west or vice versa. First of all: Which hump shall be taken, second: if 80% are good for the north to south hump what to do with the rest?
Where does Rail loose its competitiveness?

If logistics principles are applied, rail looses its competitiveness because of the hump!

Two solutions were developed:
1. the east – west wagon is pulled by separated engine out of the train – crossing all tracks to the hump and put to the other hump over special sidings. In this case the operations on the first hump are interrupted for this procedure. (= productivity loss!)
Where does Rail lose its competitiveness?

If logistics principles are applied, rail looses its competitiveness because of the hump!

Two solutions were developed:
2. The east–west wagon is processed first over the first hump then collected with other wagons who need another destination siding and transferred to the reception sidings of the second hump. This means possibly doubling the waiting time in the marshalling yard, therefore easing the competitiveness of single wagon load traffic!
Where does Rail lose its competitiveness?

If logistics principles are applied, rail loses its competitiveness because of the hump!

In the most productive marshalling yard Vienna Kledering the average processing time between in and out is 145 min. Although it takes maybe only 10 minutes to split a train up, it takes a long time for 76 sorting tracks until 700 m of train length is filled with wagons again. And every, every single wagon has to pass one short piece of track running down the hump. Therefore the hump is the bottle-neck in the system:
Rangierprinzip II:

Shunting principle:

Abrollberg

Jeder Waggon muss dieses Nadelöhr passieren:

Each wagon has to pass this bottle-neck:

(Hump)
And it happens more often during the journey: 3 to 4 times on average...

...und das passiert noch 3 - 4 mal hintereinander. So werden im Nachtsprung knapp 200 km zurückgelegt: Nur zwei bis drei Stunden bleiben für die Distanzvernichtung im Fernbereich übrig. Wieso?

...less than 200 km are covered in a night-span. Only two to three hours are left to be spent for long-distance transport. Why?
The historical compression of shipments in the hierarchy of satellite nodal points and marshalling yards generates...

...a sequence of shunting movements almost on the same spot with regard to the distance covered...
Present structure within X-rail alliance:

<table>
<thead>
<tr>
<th></th>
<th>CD</th>
<th>CFL</th>
<th>DB</th>
<th>Sweden</th>
<th>SNCB</th>
<th>RCA</th>
<th>SBB</th>
<th>X-Rail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marshalling yards</td>
<td>6</td>
<td>1</td>
<td>11</td>
<td>4</td>
<td>2</td>
<td>8</td>
<td>5</td>
<td>37</td>
</tr>
<tr>
<td>Nodal point yards</td>
<td>1074</td>
<td>11</td>
<td>1738</td>
<td>305</td>
<td>69</td>
<td>100</td>
<td>323</td>
<td>3620</td>
</tr>
<tr>
<td>Private sidings</td>
<td>1230</td>
<td>16</td>
<td>3795</td>
<td>800</td>
<td>360</td>
<td>1100</td>
<td>1500</td>
<td>8801</td>
</tr>
</tbody>
</table>

Source: Ferk 2012
In the marshalling yard only three wagons change from one train to a particular next one.

The same performance can be obtained by switching wagon groups in a terminal.
Where does Rail lose its competitiveness?

If logistics principles are applied, rail looses its competitiveness because of the hump!

For high volume low value goods the transport in single wagon loads is too costly, for low volume high value goods single wagon load service is too slow. Responsible for that is the hump – therefore the hump has to be removed – as well as many other inherited procedures who were innovative in their time of invention but hinder now to outperform other modes in terms of e-mobility.
What should a new train forming procedure for single wagon load should be able to perform?

The old hierarchy of shunting: Satelite–Node point yard–Marshalling yard…

…has to be abandoned and replaced with new procedures which enable train formation for single wagon load to be performed in less than one hour processing – and ON TIME!

Today the classification system in the yards is based on direction of travel. If time constraints for changing single wagon loads between trains are to be met special procedures which lower the productivity of the hump have to be performed. So they were abandoned – in Germany in 1996, in other countries like Bulgaria, France, Great Britain & Italy single wagon load in its classical form were abandoned!
What should a new train formation procedure for single wagon load should be able to perform?

In Greece the whole Railway was shut down immediately because of financial crisis and the remaining railways with a significant proportion of single wagon load traffic (Austria, Germany and Switzerland) suffer from rising unit costs and lack of cross-subsidies because of EU-legislation and limited Funds in public finance and spending. Therefore the solution must be found in a more competitive system on an economic basis:

My suggestion is: Get rid of shunting in the nodes! But not like the „Network Railway“ put forward in Germany – we need viable nodes but not to pass them by!
THANK YOU!

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