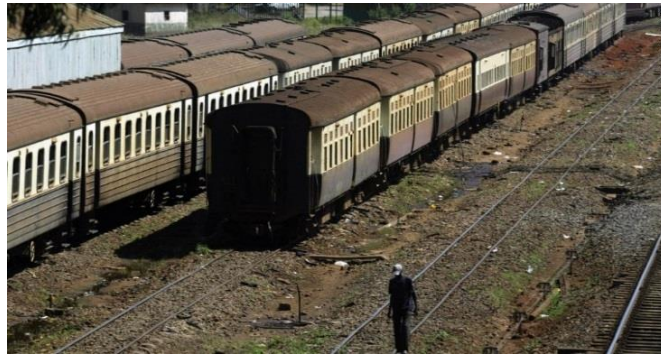


Automation – Prospects for the European Railway System

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European Railways need Innovation!



- Rail is a "**living**" network
- The rail network provides mobility services (for passengers and goods)
- Any network consists of
 - Network elements (carriages, trains)
 - Infrastructure

Operations & Maintenance

Tertiary Infrastructure:
Control Command/Signalling

Secondary Infrastructure:
Energy and Communication

Primary infrastructure:
Tracks, Tunnels, Bridges, Stations, etc.



Innovation in a network can be **LOCAL** to network elements, or
the **MIGRATION of the NETWORK** to a new status

Innovation means to introduce a **new product, service, or process** (including the supply chain) that increases **customer value**

Major innovations require **time** and **patience**

Innovation	Locality	Soft/hard	Comment
From steam traction to Diesel traction	largely local	soft	Provided sufficient fuel is available, both steam and Diesel locomotives can run anywhere on the network
Electric traction	network	semi-soft	Diesel, steam can continue to run under catenary; unless there is batteries (“fuel on board”), electric traction depends on the provision of an adequate energy supply infrastructure
Continuously welded track (CWT)	Local to track segment	soft	Immediate benefits in terms of customer comfort and reduction of wear on rolling stock
Air condition in passenger coaches	local	soft	Practically no impact on the network (? Weight, EMC)
New materials for carbodyes	local	soft	Passive safety? Fire safety?
Selfsteering trains – no moving parts in switches in the infrastructure	local + network	very hard	Saves massively maintenance cost for switches in infrastructure – however, ALL trains need to be converted – a “normal” train can no longer run across a new switch!
Automated Train Operation (ATO)	?	?	ATO exists since quite some time in closed (urban) rail networks

Automation (ATO) functions in railways provide **information** to the train driver for **optimisation of the train operation**, and **automate actions** that are otherwise executed manually by the train driver



- › Increases capacity, safety, performance, efficiency, punctuality and passenger comfort, etc.



- › Decreases costs, energy consumption and rail noise pollution, etc.
- › It is about **competitiveness of rail**
- › ... and (a little) about **Safety** (reducing the Human Factor)
- › "Grades of Automation" GoA 2, GoA 3, GoA 4

Innovation vs. Network (local/non-local, hard/soft)

- ATO (GoA2) shall be functionally decoupled (safe train operation ensured by train protection system (ETCS), automation functions (GoA2) ensured by ATO system)
- ATO usable for urban rail, high speed services, rail freight services, and mixed traffic lines

Innovation in public infrastructure

- Rail equipment is not a consumer market – "free play of market forces"?
- Infrastructure Managers vs. Railway Undertakings

Innovation vs. Safety – Vehicle Authorisation

Harmonised system concept needed at European level

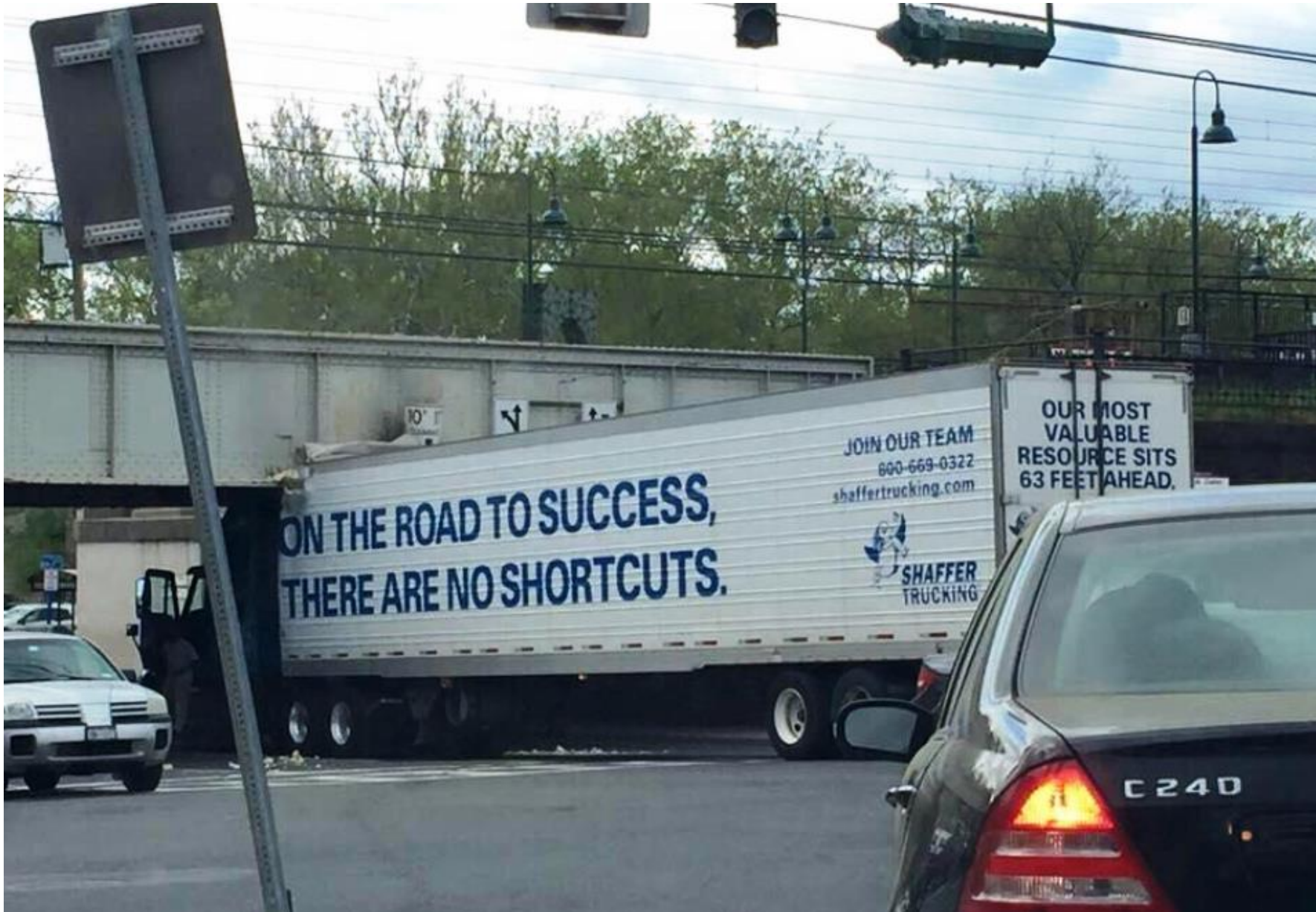
- Development of standards for interchangeable ATO components

Automation in Other Sectors



- › Significant amount of R&D effort is spent on **autonomous cars/trucks**
- › Because of current economies (e.g. laser sensor for Google car: US\$ 75.000), autonomous trucks could hit the market earlier than autonomous cars
- › The savings with autonomous trucks/truck platooning are MORE SIGNIFICANT than the savings to be achieved in rail with ATO
- › Automation will make road transport into a **network*** as well – with all consequences in terms of system architecture, locality of innovation, and safety authorisation!

*) A key pre-requisite for autonomous cars/trucks is connectivity through a high-bandwidth (500 Mbps) mobile network





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