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*Lars Slott Jensen (DSB)*



***The new IC-4 DMU for DSB***

***Technology and experience from the Approval Process***

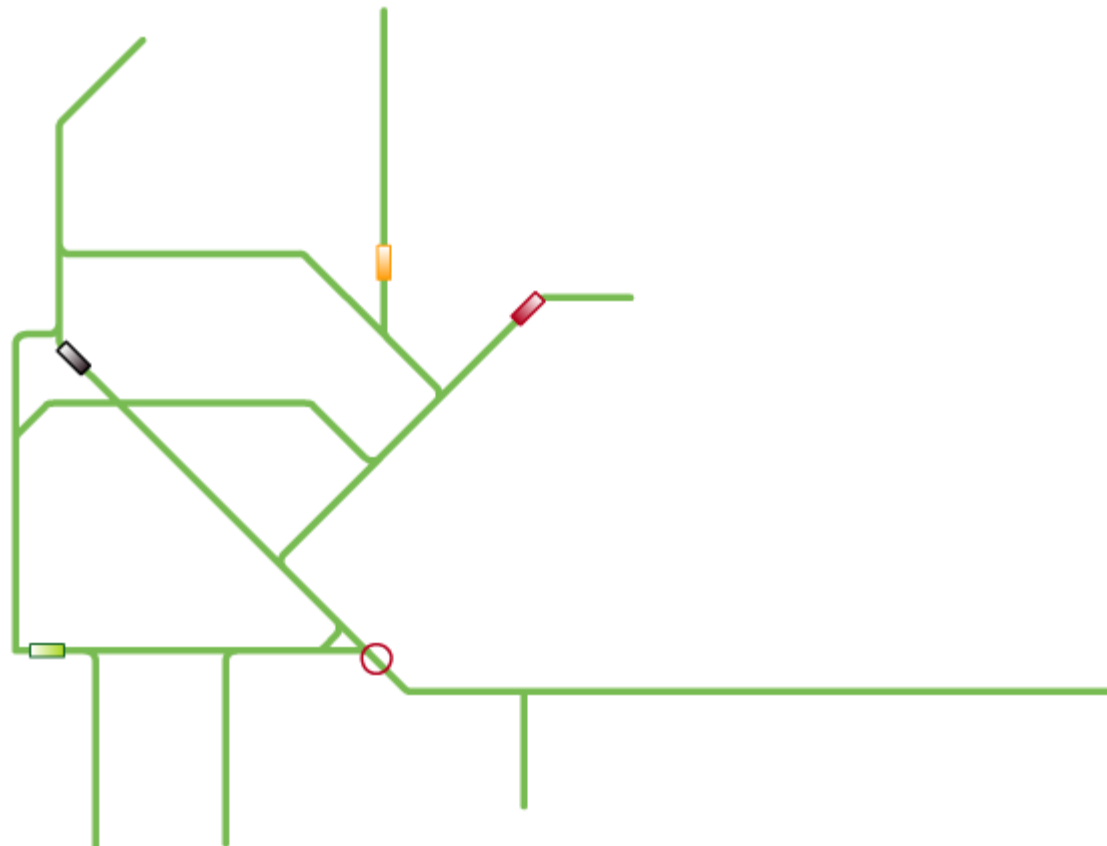
***Moderne Schienenfahrzeuge***

***39. Tagung***



***Graz 11-14 April 2010***

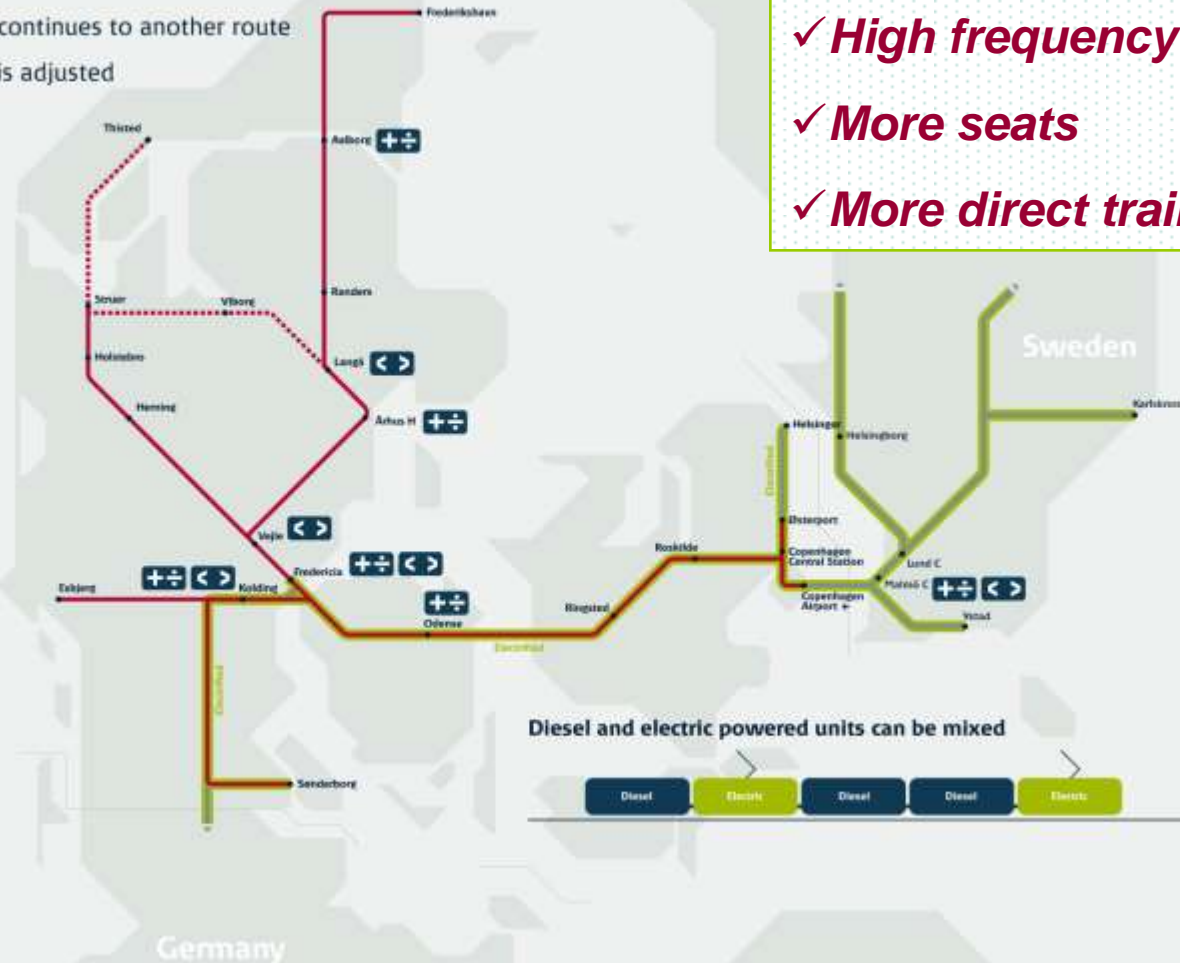


**1998: Danske Statsbaner launch vision**  
**GTA**  
**“Good Trains for All”**



## Direct trains and high efficiency

-  Part of the train continues to another route
-  Size of the train is adjusted



✓ *Modern and comfortable trains*

✓ *High frequency*

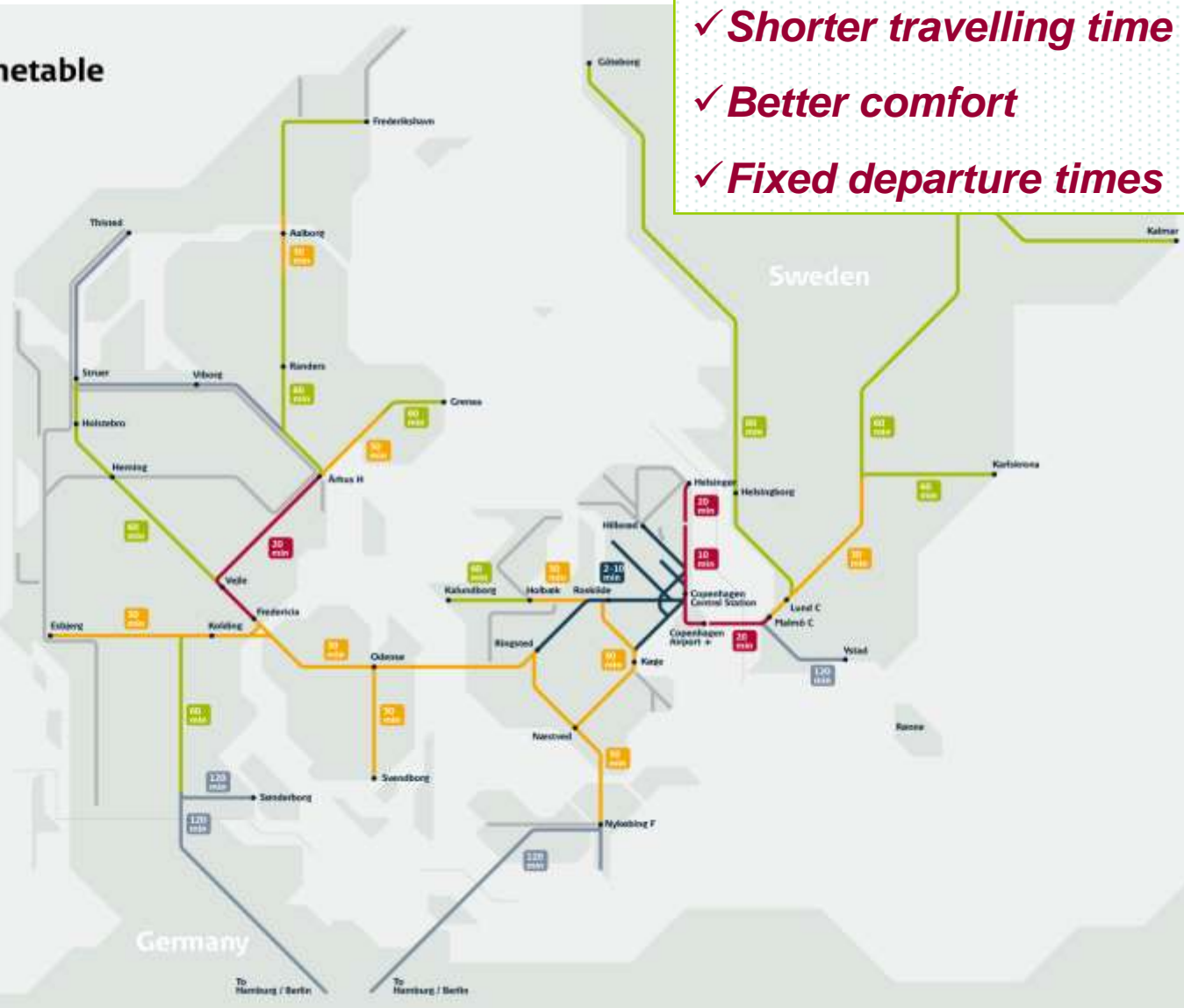
✓ *More seats*

✓ *More direct trains*

## Systematic timetable

Train every:

- 2-10 min.
- 10-20 min.
- 30 min.
- 60 min.
- 120 min.



✓ **Shorter travelling time**

✓ **Better comfort**

✓ **Fixed departure times**

- ✓ *Four-articulated diesel cars with four motor bogies and one trailer bogie*
- ✓ *High speed up to 200 km/h for Intercity service*

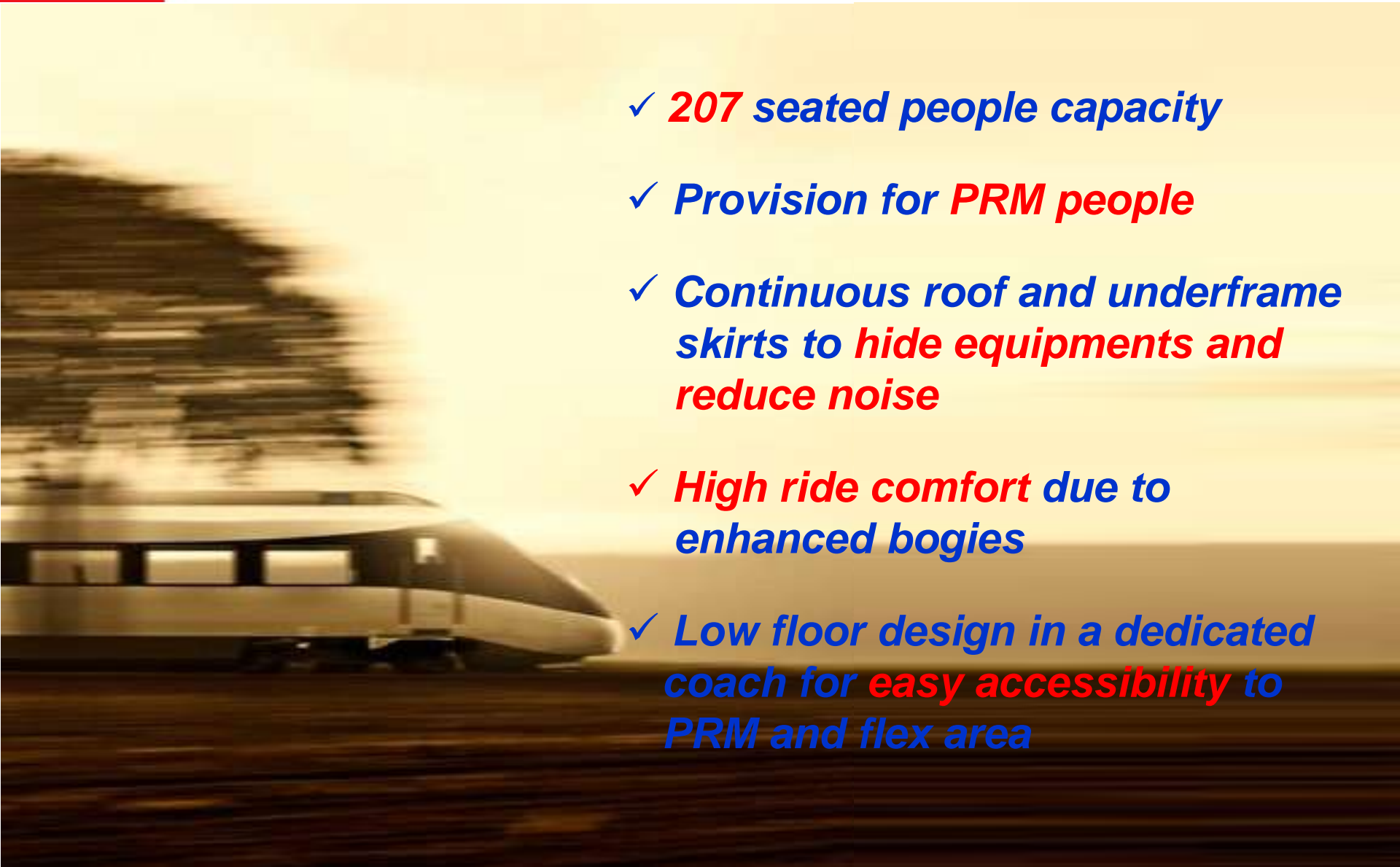




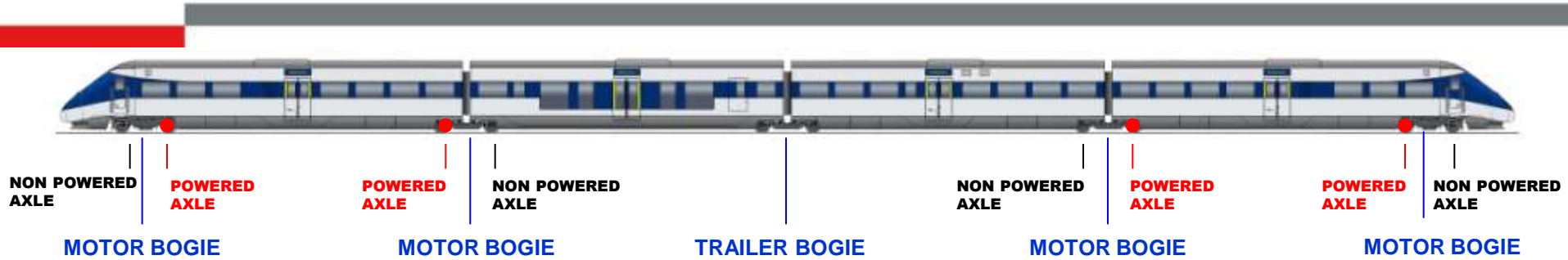


- ✓ *High efficiency low pollution diesel engine EU St. II (EURO 3)*
- ✓ *High efficiency mechanical 16 gear electronic gearbox without hydraulic torque converter*
- ✓ *Very low fuel consumption*
- ✓ *Wide use of recycling materials*

- ✓ **207** seated people capacity
- ✓ Provision for **PRM** people
- ✓ Continuous roof and underframe skirts to **hide equipments and reduce noise**
- ✓ **High ride comfort** due to enhanced bogies
- ✓ Low floor design in a dedicated coach for **easy accessibility to PRM and flex area**



# IC4 DMU for DSB



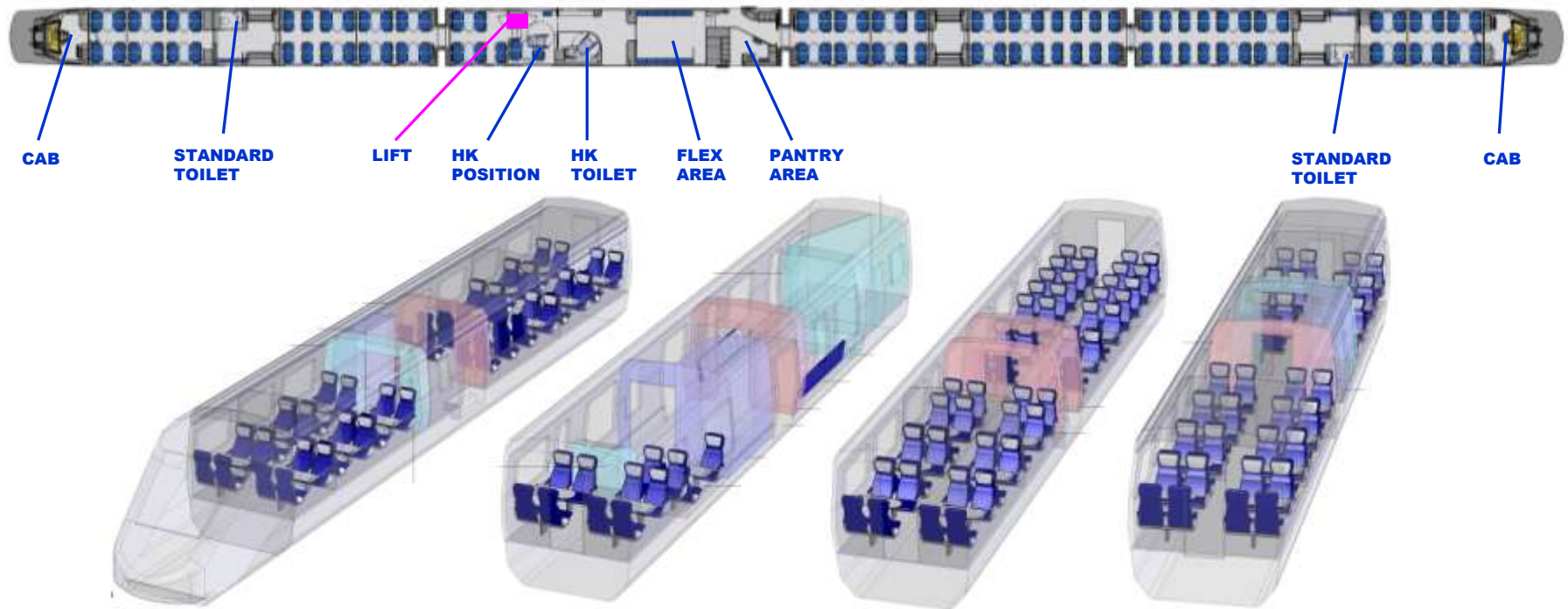
*features for People  
with Reduced  
Mobility (TSI PRM)*

**M1C**

**T2HK**

**T3**

**M4C**





# IC4 DMU for DSB: Power Pack

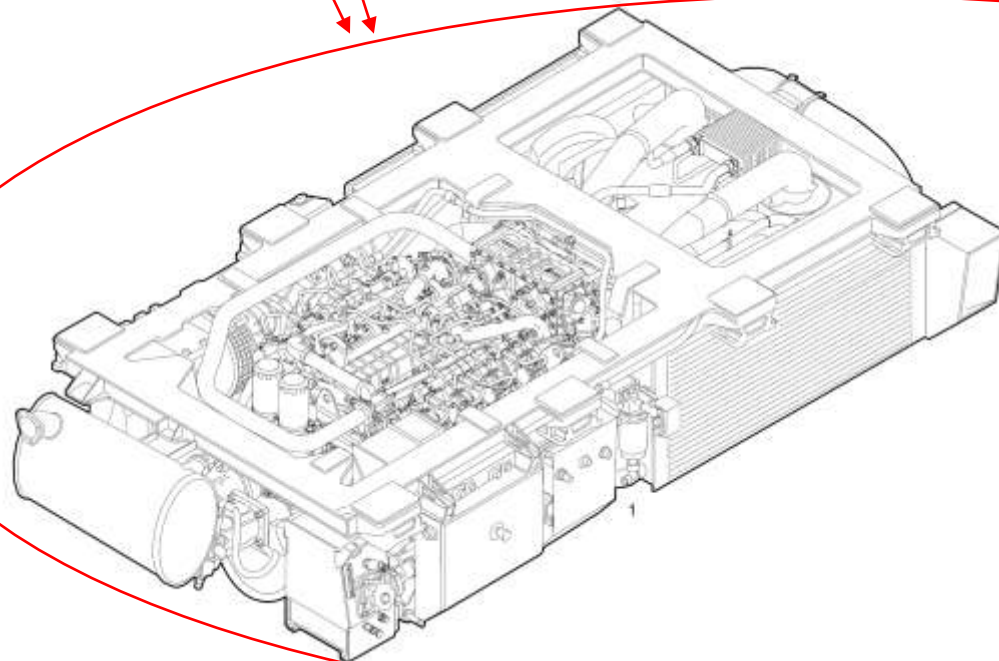


POWERED  
AXLE

POWERED  
AXLE

POWERED  
AXLE

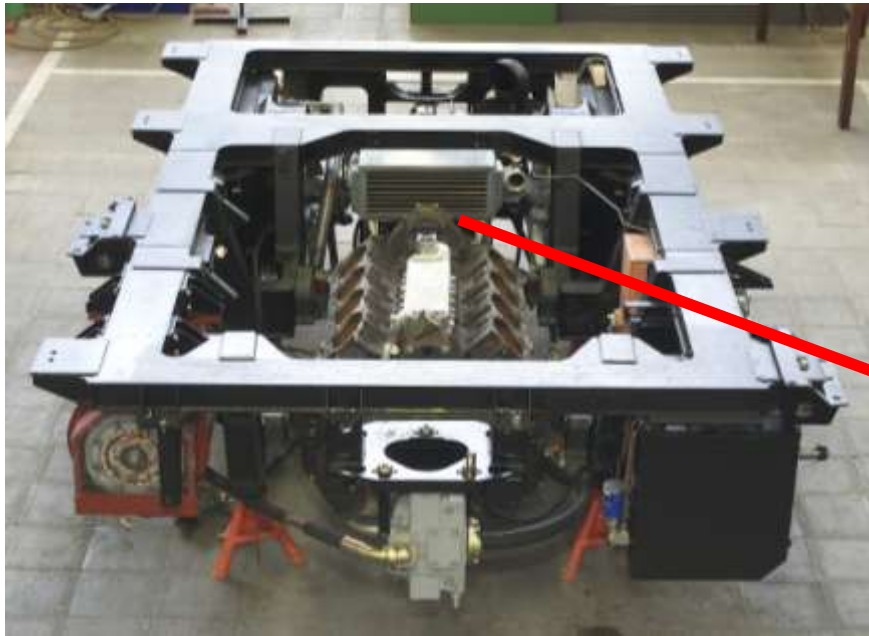
POWERED  
AXLE



## ***Power pack includes:***

- ***Diesel Engine***
- ***Gearbox***
- ***Hydraulic system***
- ***Cooling System***
- ***Electrical System  
(Alternator)***

# IC4 DMU for DSB: Power Pack



***Interface train / power pack:  
8 rubber supports***

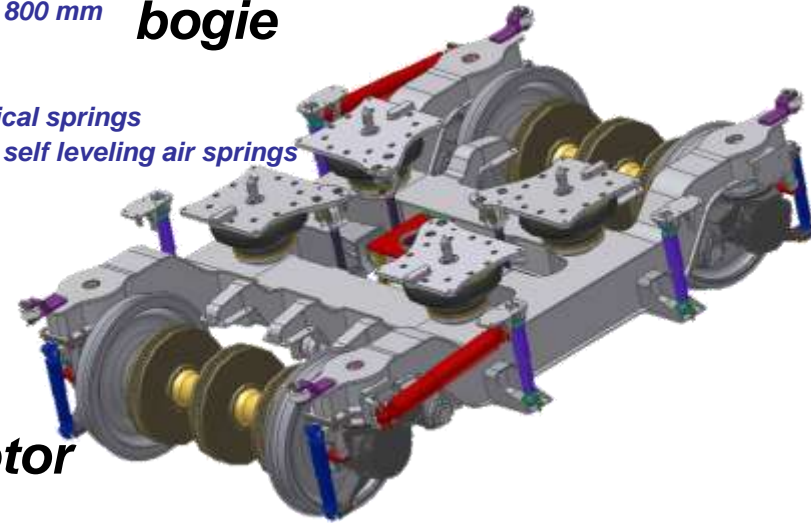
***Interface engine / power pack:  
5 rubber supports***

## ***DIESEL ENGINE (IVECO FVQE2883AX)***

<b><i>No of cylinders:</i></b>	<b><i>8 – V90°</i></b>
<b><i>Displacement:</i></b>	<b><i>20 dm<sup>3</sup></i></b>
<b><i>Injection system:</i></b>	<b><i>Common Rail</i></b>
<b><i>Air feeding:</i></b>	<b><i>Air-water Intercooler</i></b>
<b><i>Exhaust Emission level:</i></b>	<b><i>EU Stage II (EURO 3)</i></b>
<b><i>Max power:</i></b>	<b><i>560 kW @ 2000 rpm</i></b>
<b><i>Max torque:</i></b>	<b><i>3200 Nm</i></b>



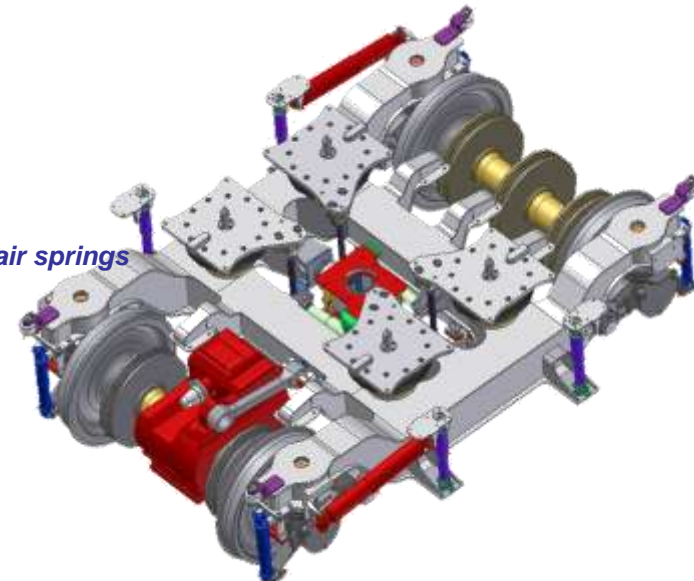
## Intermediate trailer bogie



WHEELBASE: 2800 mm  
WHEEL DIAMETER (NEW): 860 mm  
WHEEL DIAMETER (WORN): 800 mm  
DISC BRAKE N. : 3 + 3  
DISC DIAMETER: 640 mm  
PRIMARY SUSPENSION: helical springs  
SECONDARY SUSPENSION: self leveling air springs  
MAX AXLE LOAD: 21.300 kg

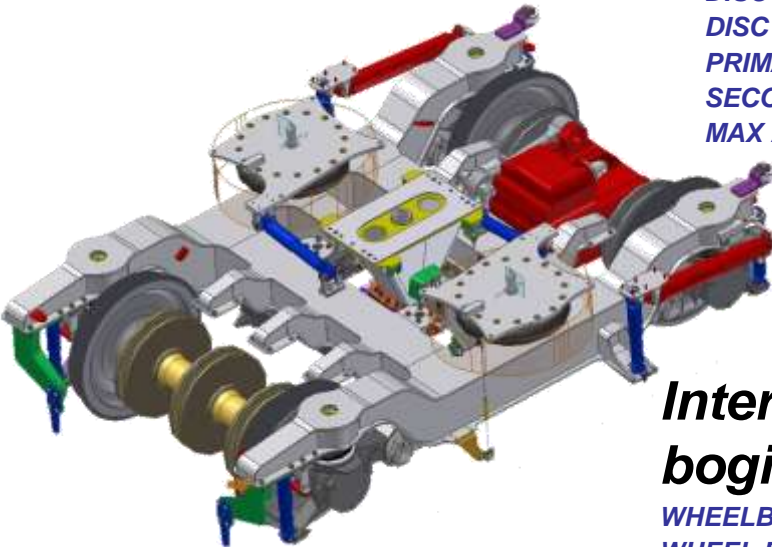
## Intermediate motor bogie

WHEELBASE: 2800 mm  
WHEEL DIAMETER (NEW): 860 mm  
WHEEL DIAMETER (WORN): 800 mm  
DISC BRAKE N.: 3 + 2  
DISC DIAMETER: 640 mm  
PRIMARY SUSPENSION: helical springs  
SECONDARY SUSPENSION: self leveling air springs  
TRACTION: helical bevel gear unit  
MAX AXLE LOAD: 21.300 kg



## End motor bogie

WHEELBASE: 2800 mm  
WHEEL DIAMETER (NEW): 860 mm  
WHEEL DIAMETER (WORN): 800 mm  
DISC BRAKE N. : 3 + 2  
DISC DIAMETER: 640 mm  
MAGNETIC BRAKE SYSTEM: 1  
PRIMARY SUSPENSION: helical springs  
SECONDARY SUSPENSION: self leveling air springs  
TRACTION: helical bevel gear unit  
MAX AXLE LOAD: 21.300 kg





## ***AERODYNAMIC & STYLISH DESIGN*** ***DSB-AB-Pininfarina design shops cooperation***



## UP TO FOUR UNITS MULTIPLE CONFIGURATIONS



***“Scharfenberg Type 10” TSI automatic coupling system***



***Movable cover shields***



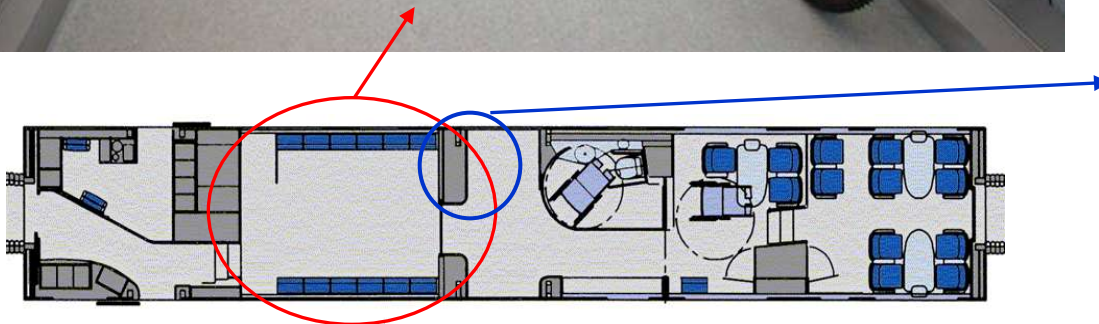
# IC4 DMU for DSB: Flexibility

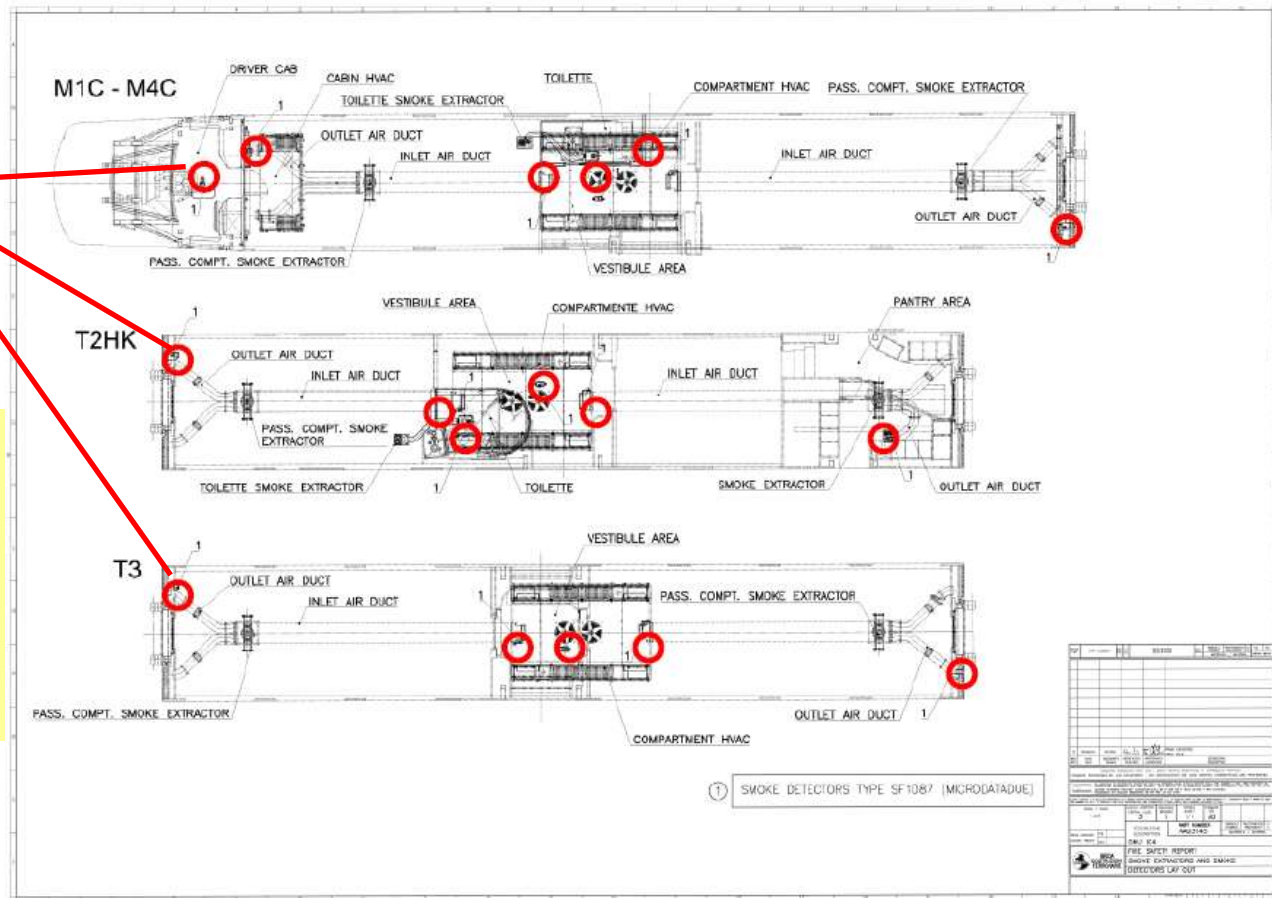


✓ *Flex area, with provision for bicycles and vending machine*



✓ *Low floor access coach*





## TEST ON IC4 FIRE DETECTION



**Incoming smoke test**

### ONE OF THE FIRST TEST EXECUTED AT VEHICLE LEVEL IN EUROPE

- ✓ According to Directive ARGE “Fire Detection in Rolling Stock”
- ✓ Performed on a real vehicle and with the main systems operating (HVAC, doors,..)

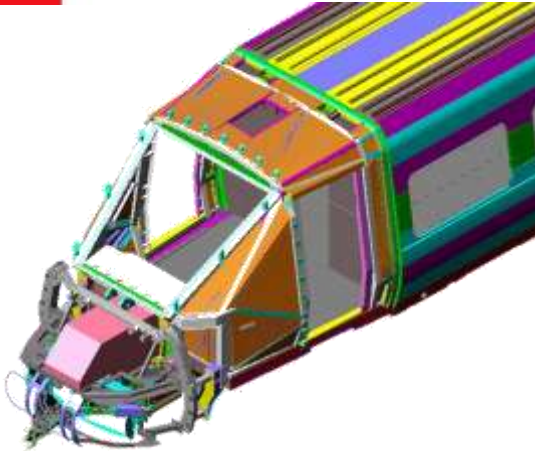


**Inside smoke test using combustion of  
polyurethane TF4**



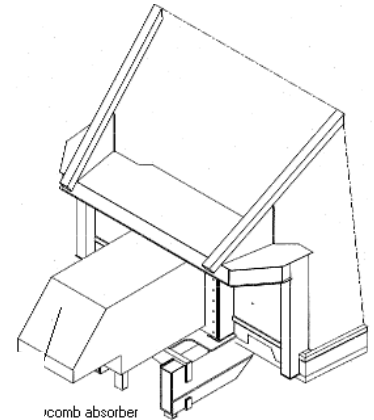
- ✓ Using real smoke sources (combustion of polyurethane TF4 in critical areas inside the train)
- ✓ Using a "smoke machine" to simulate outside incoming smoke



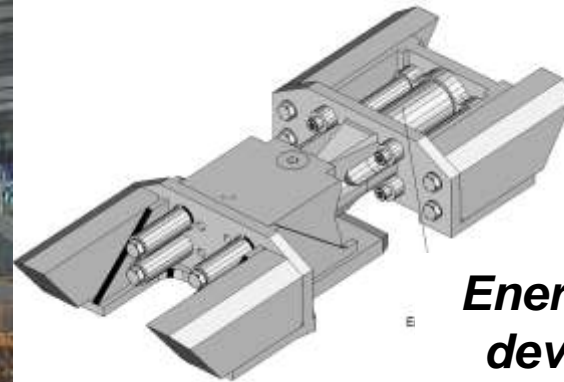


## PASSIVE SAFETY

**COMPLIANT TO TSI HS  
2002 PASSIVE SAFETY  
REQUIREMENT**



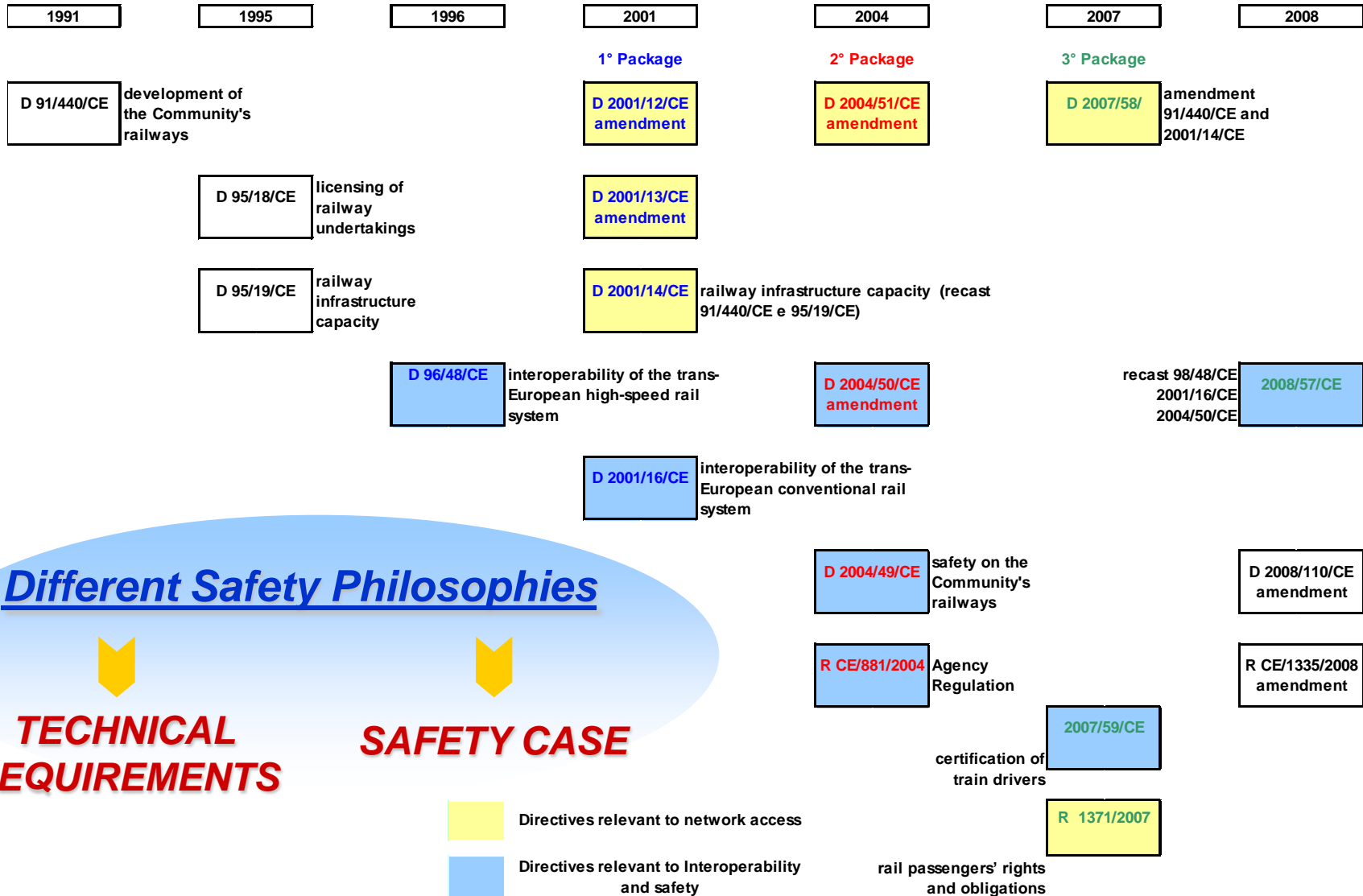
**Front end  
honeycomb  
absorber device**



**Energy absorber  
devices on the  
cars intermediate  
joints (three for  
each trainset)**

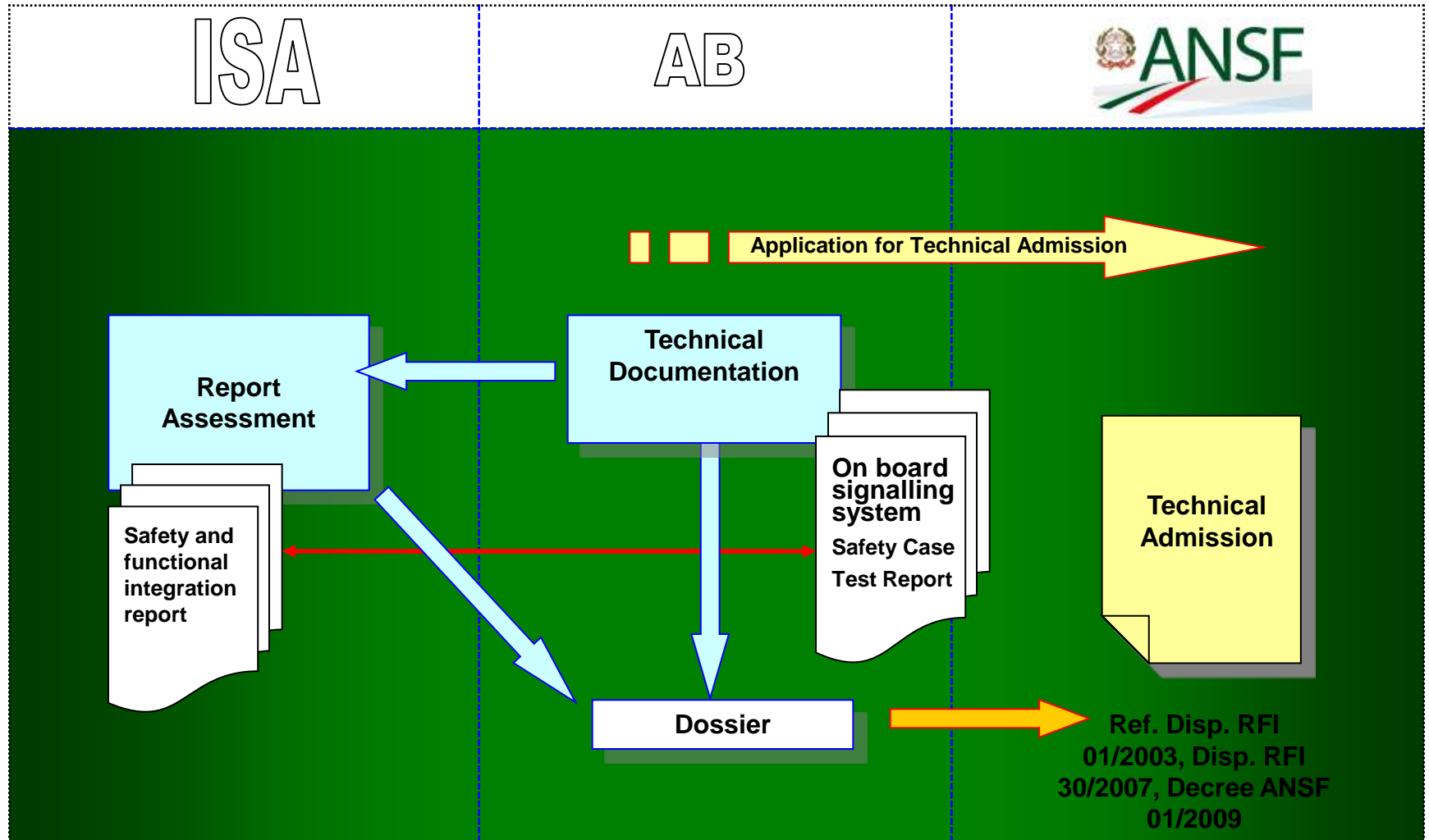


# EU Railway Safety & Interoperability Packages

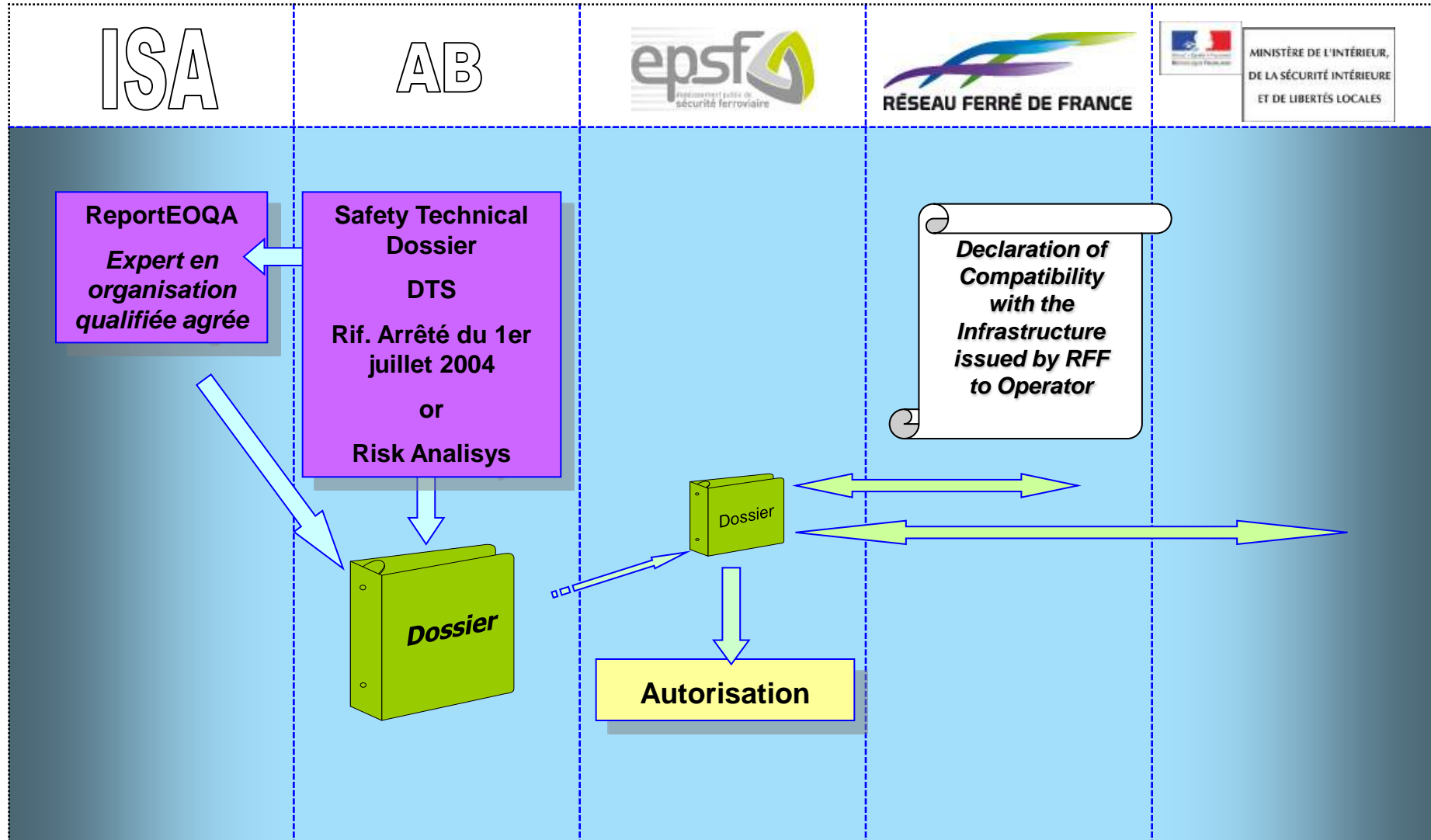




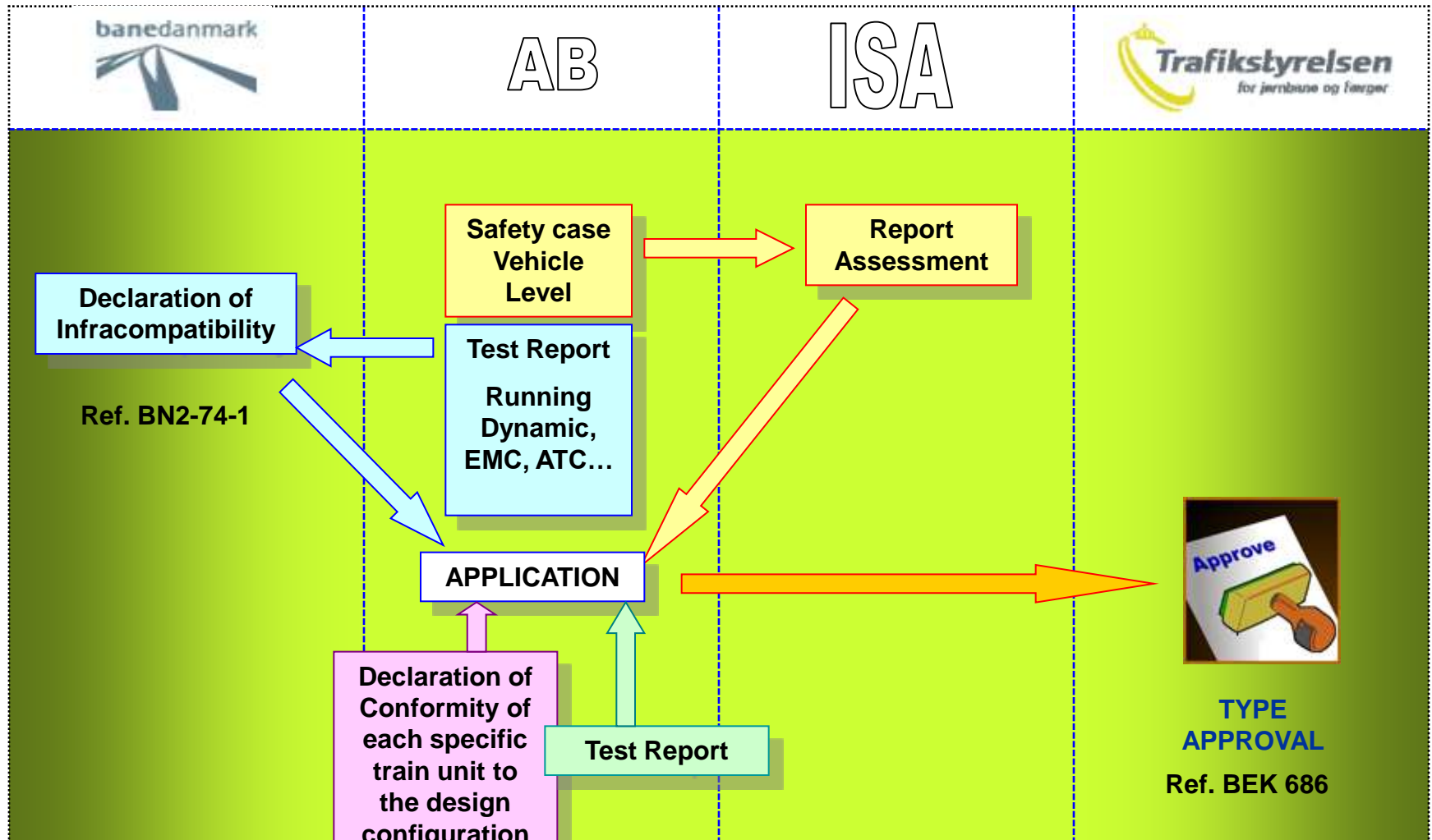
# Approval Process in Italy



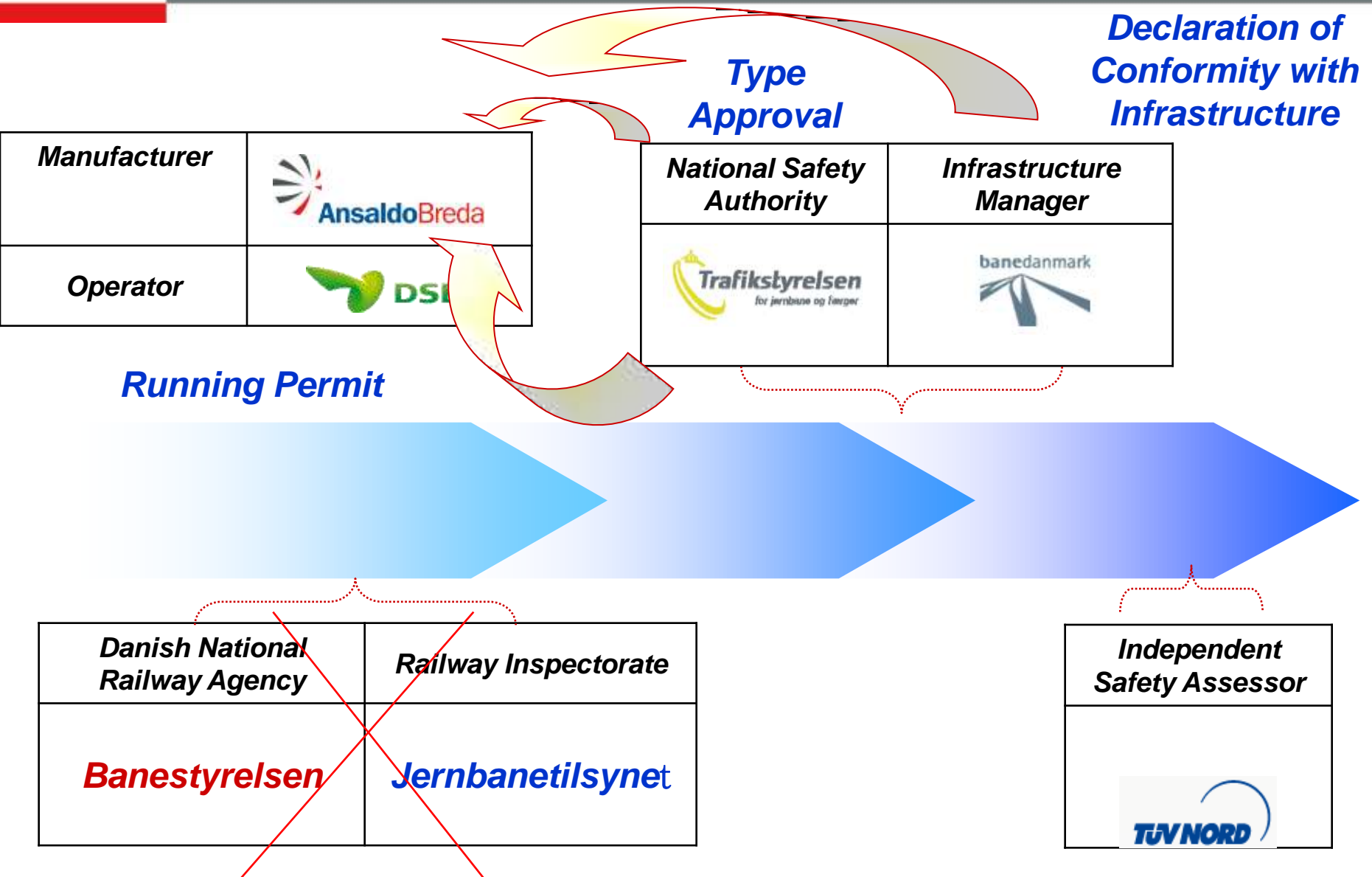
# Approval Process in France



# Approval Process in Denmark



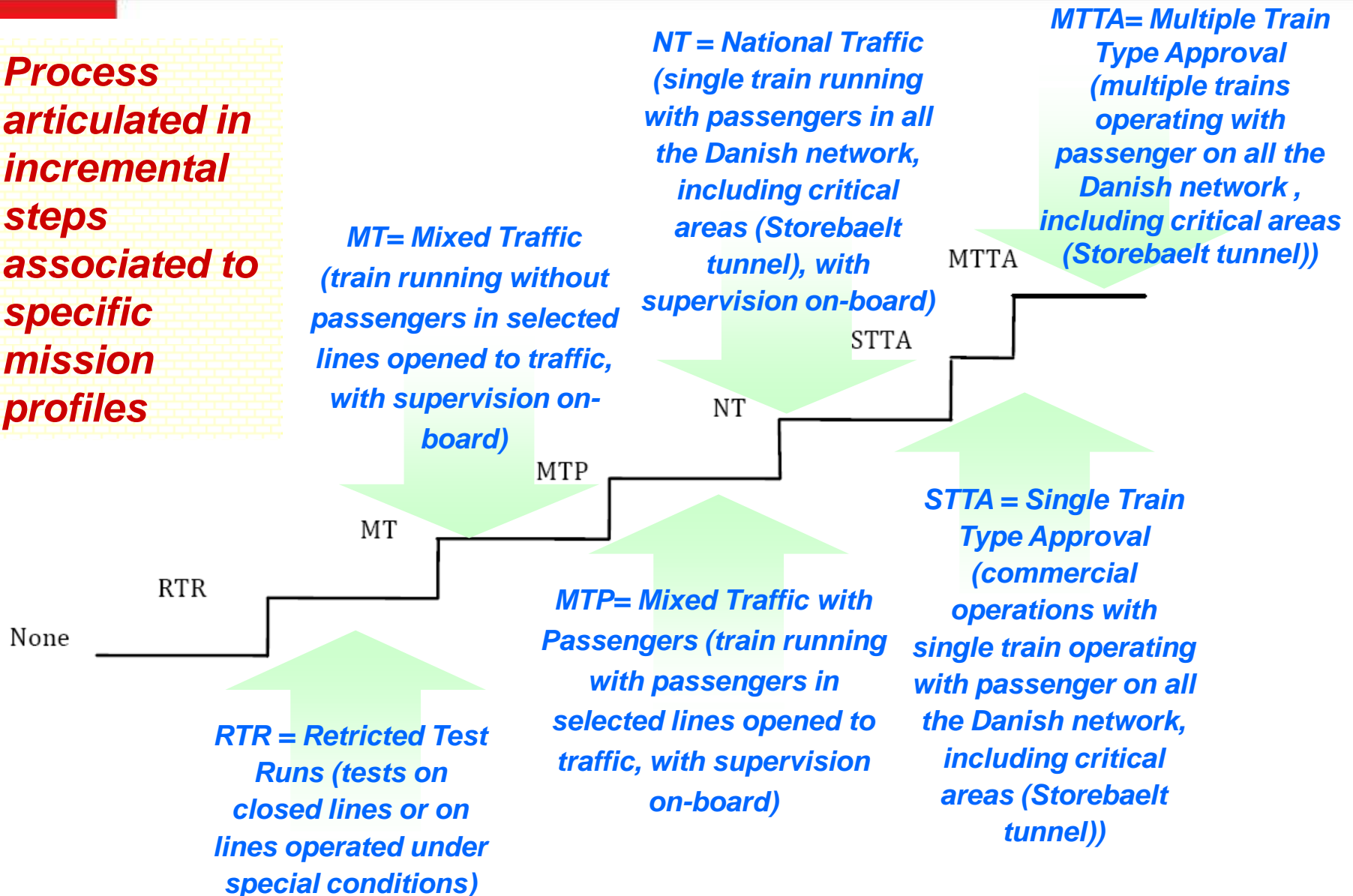
# IC4 Approval Process: stakeholders & evolution



# IC4 Approval Process: mission profiles



**Process articulated in incremental steps associated to specific mission profiles**





# IC4 Approval Process: Configuration vs mission profiles



## “Configuration Pack 6” :

- **Supervised test operation in mixed traffic without passengers, single train, max 160 km/h on the lines *København H – Ålborg*, *Fredericia – Padborg*, *Lunderskov – Esbjerg* (i.e MT)**
- **supervised test operation in mixed traffic with passengers, single train, max 160 km/h on the lines *København H – Korsør*, *Nyborg – Ålborg*, *Fredericia – Padborg*, *Lunderskov – Esbjerg* ( i.e. MTP).**

## “Configuration Pack 7 Single Train - Type Approval”:

- **commercial operation - *single train*, max *160 km/h* on the entire National Network, including “critical area”( i.e. *Storebaelt tunnel*).**

## “ Configuration Pack 7 Multiple Trains Type Approval”:

- **commercial operation, *multiple train*, max *180 km/h* on the entire National Network, including “critical area”( i.e. *Storebaelt tunnel*).**



# IC4 Approval Process: Main Steps

*AnsaldoBreda submit the following documents to the Authority; these are the basis of the Authority Approval for each **Application** relative to the above phases:*

## **Running in Closed Track and Restricted test Run**

- Third Party Statement on Safety Case and Safety Requirement List handling procedure
- Train Declaration of Conformity
- Declaration of Conformity Assessment (only for first train in a new configuration)

## **Supervised Operation**

- Third party Safety Assessment Report for supervised operation.
- Safety Case.
- Declaration of Conformity of the train
- Assessment on Declaration of Conformity (only for first train in new configuration)

## **Commercial Operation**

- Safety Case
- Safety Case assessment report
- Application for type approval
- Declaration of Conformity of the train
- Assessment on Declaration of Conformity (only for first train in new configuration)

**TS issue *TYPE APPROVAL* for a defined train configuration**

**DSB applies for a *running permit* for each train unit and for each relevant approval step**

**TS issues *RUNNING PERMIT***

**+ Declaration of Compatibility with the infrastructure**

**DSB issues an *internal running permit* for each train unit and for each relevant approval step**



# ***IC4 Approval Process: Type Approval***



**First Single Train Type Approval (C-STTA) issued on 27.01.2009**

**First Multiple Train Type Approval (C-MTTA) issued on 7.05.2009**

**The IC-4 fleet is presently operating daily on the Danish network. A total fleet of 83 trains is foreseen.**



*Thank you for your attention*

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