Transrapid Maglev Technology

Presentation to the
ATLANTA-CHATTANOOGA
HSGT/MAGLEV STEERING COMMITTEE

June 16, 2010

Walter E. Buss
Transrapid International - USA, Inc.

ThyssenKrupp Transrapid

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Atlanta – Chattanooga – Nashville
High Speed Corridor

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ThyssenKrupp Transrapid and Maglev Technology

1. Transrapid System Characteristics
2. Testing of new Maglev Vehicle TR09
3. Production of Maglev Vehicle
4. Guideway Girder Technology
5. Future Aspects

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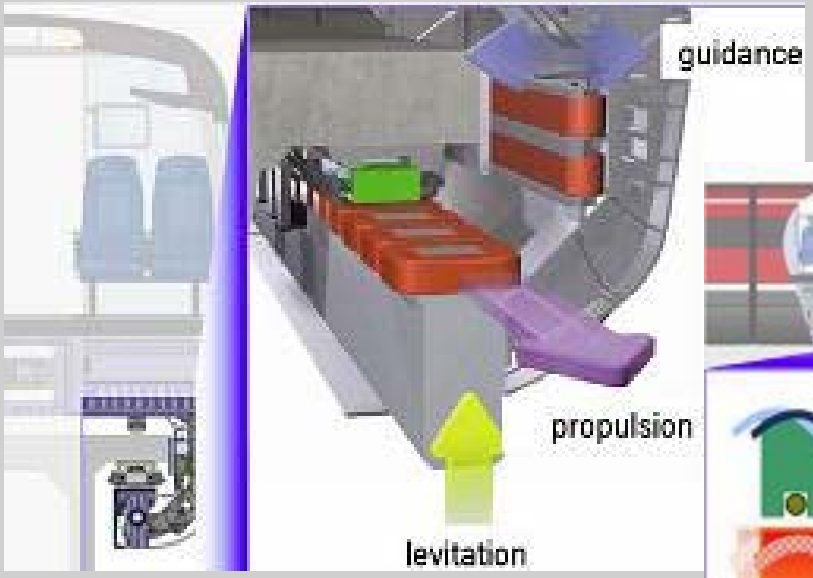
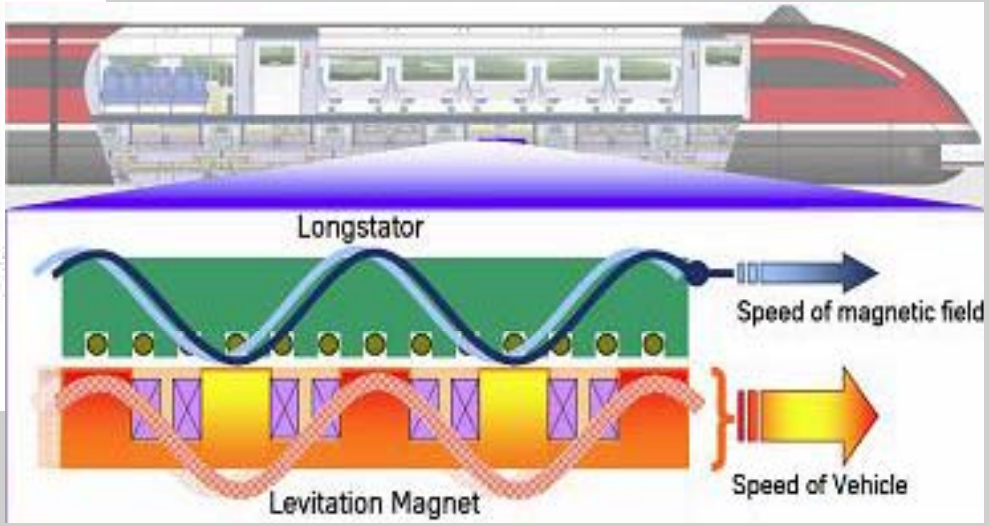
Transrapid Maglev

- A truly transformational technology in high speed passenger transport.
- A proven technology in commercial application in Shanghai.
- A unique opportunity to create a new local industry and highly qualified jobs.



Levitation and guidance system in the vehicle

Long stator linear motor in the track



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Transrapid Maglev

Project Performance versus High Speed Rail

- **Shorter travelling time, or more intermediate stops**
- **Smaller size of vehicle fleet and smaller space demand** for stations and yards
- **Lower energy demand** and l**ower noise emission**
- **Flexible Alignment** due to **smaller curve radii** and economic option for an **elevated guideway**
- Integration of **solar panels** to the guideway feasible
- **Lower operation and maintenance expense**
- **Potential** for significant **reduction of investment cost**

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Transrapid Maglev
System Development by ThyssenKrupp

- The Transrapid Technology has been developed under the leadership of ThyssenKrupp since 1978.
- ThyssenKrupp owns all relevant Patents and Specifications.
- Ninth vehicle generation now in operation.
- Experience from 30 years of testing and
  5 years of commercial / revenue operation in Shanghai.

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Transrapid Maglev
Shanghai Project

Project Data

Route	19 miles (30 km) 2 Stations
Vehicles	3 vehicles, 5 sections each
Top speed	268 mph (430 km/h)
Trip time	8 minutes
Headway	10 minutes

Operations Data through May 2010

Distance Travelled	4.7 million miles (7.5 million km)
Passengers carried	25 million
Punctuality	> 99.9 %

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Transrapid Maglev
Shanghai Project

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Transrapid Maglev
Shanghai Project

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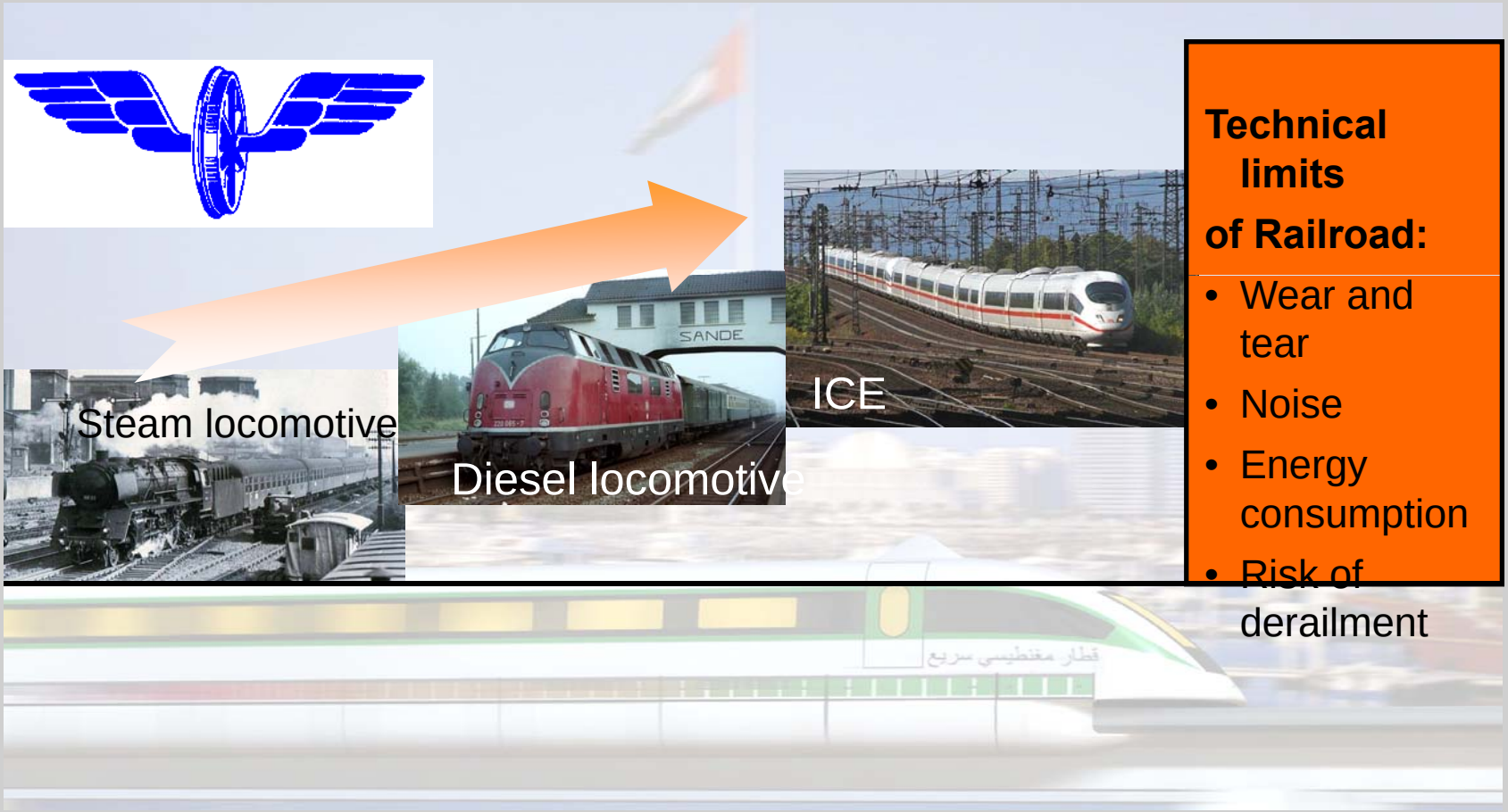
Railway Development and Limitations



Technical limits of Railroad:

- Wear and tear
- Noise
- Energy consumption
- Risk of derailment

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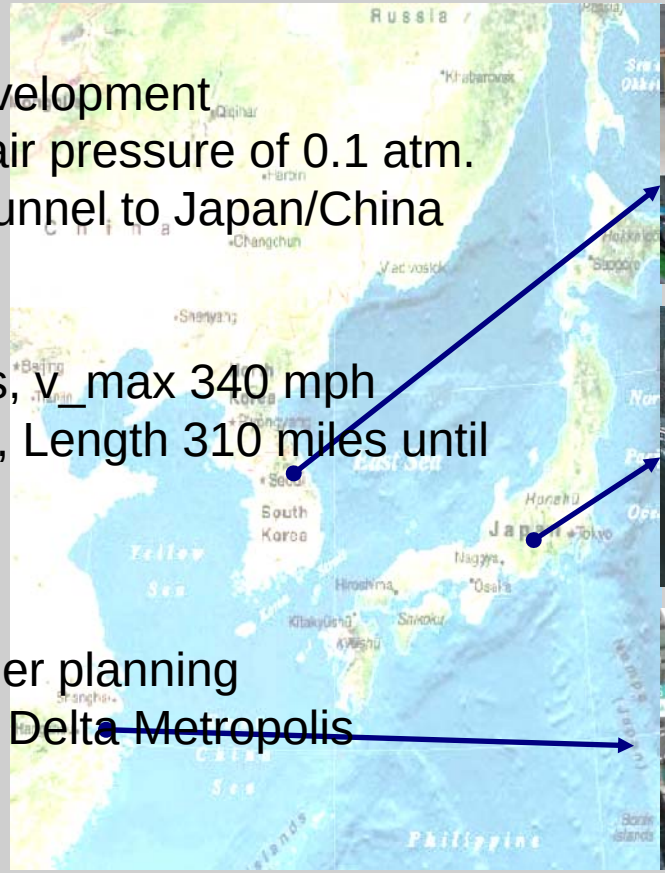
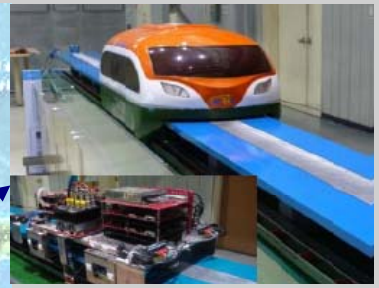
Maglev Application in Asia

Korea
- Super-Speed Tube Train Development
  v_max 435 mph at reduced air pressure of 0.1 atm.
- Vision: Cross Country and Tunnel to Japan/China

Japan
- Maglev Test Track 11.5 miles, v_max 340 mph
- Project Plan: Tokyo – Osaka, Length 310 miles until 2025

China
- Extension to Hang Zhou under planning
- Outlook: Network in Jangtse Delta Metropolis





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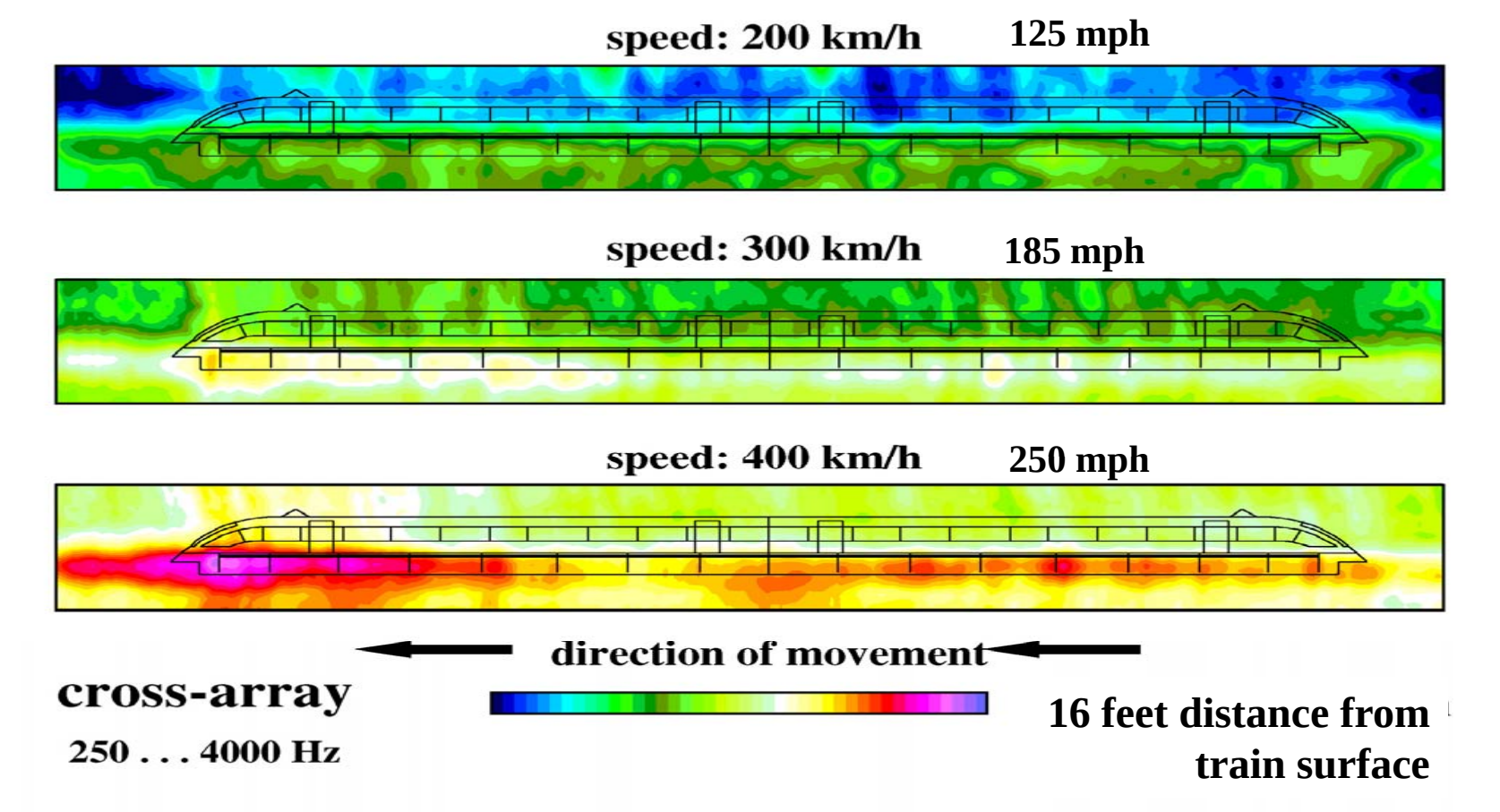
Transrapid Characteristics
Analysis of Noise Emission



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Munich October Festival: > 92 dB(A)

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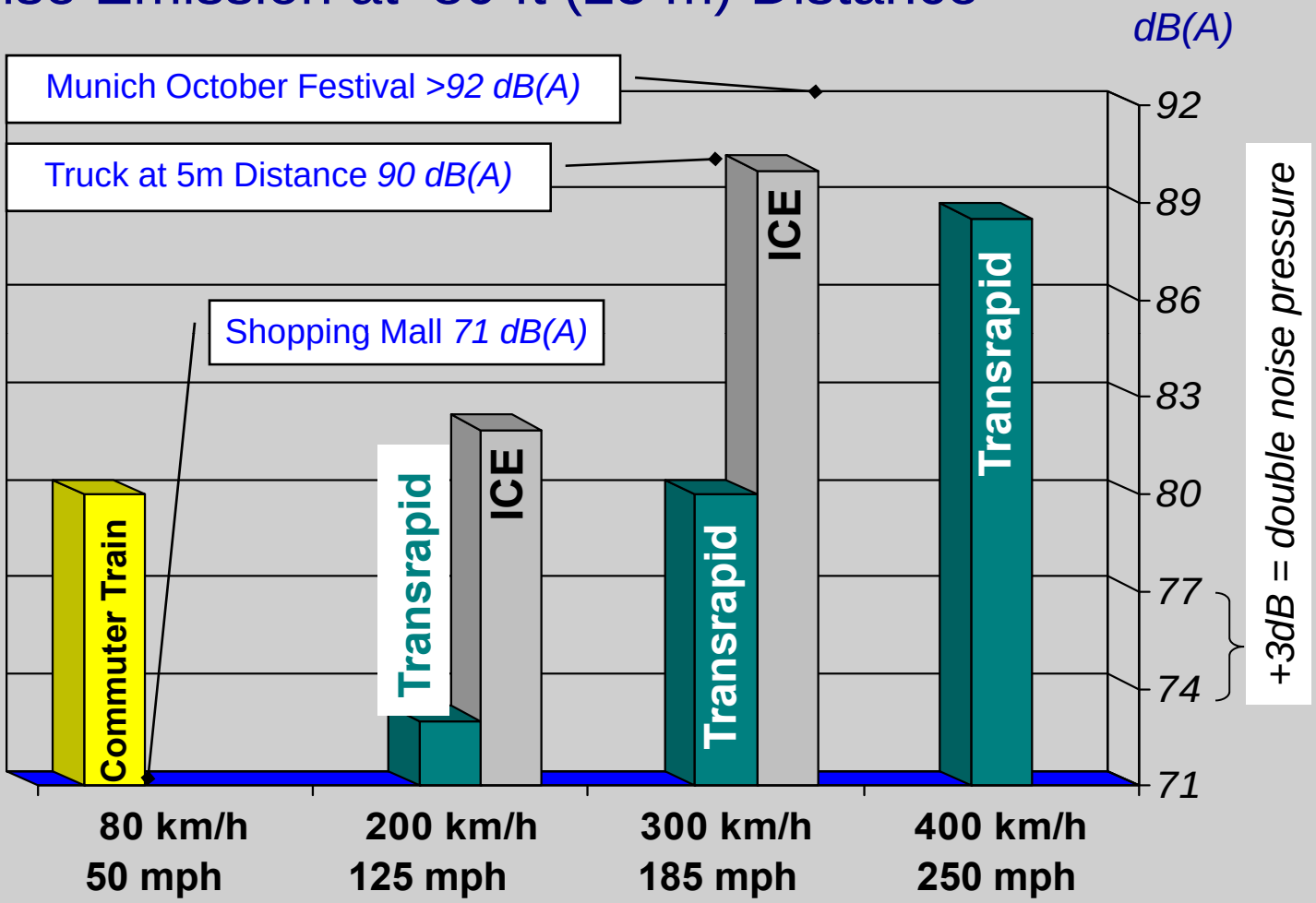
Transrapid Characteristics

Noise Emission at 80 ft (25 m) Distance



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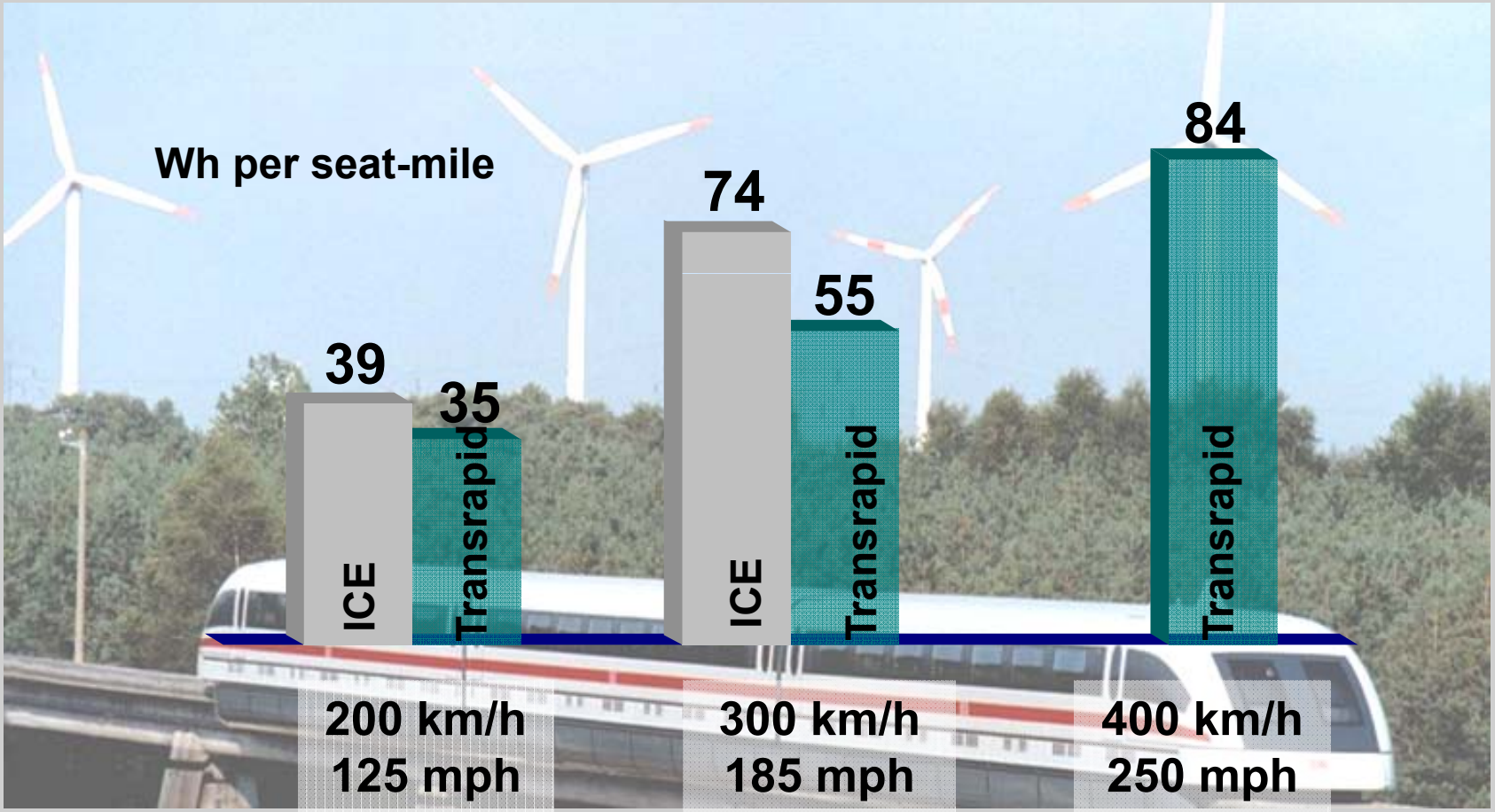
Transrapid Characteristics

Specific Energy Demand



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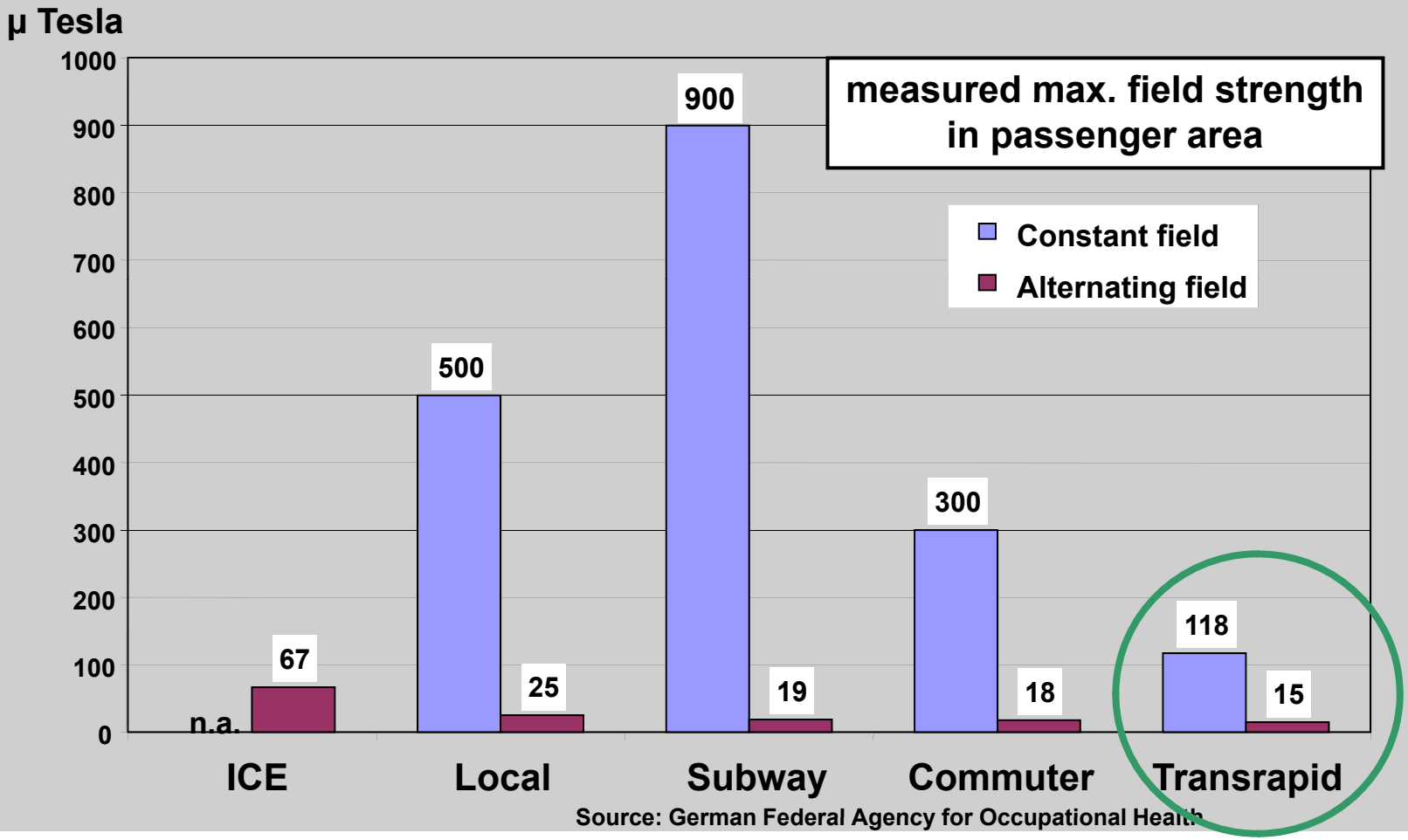
Transrapid Characteristics

Emission of Magnetic Fields



Source: German Federal Agency for Occupational Health

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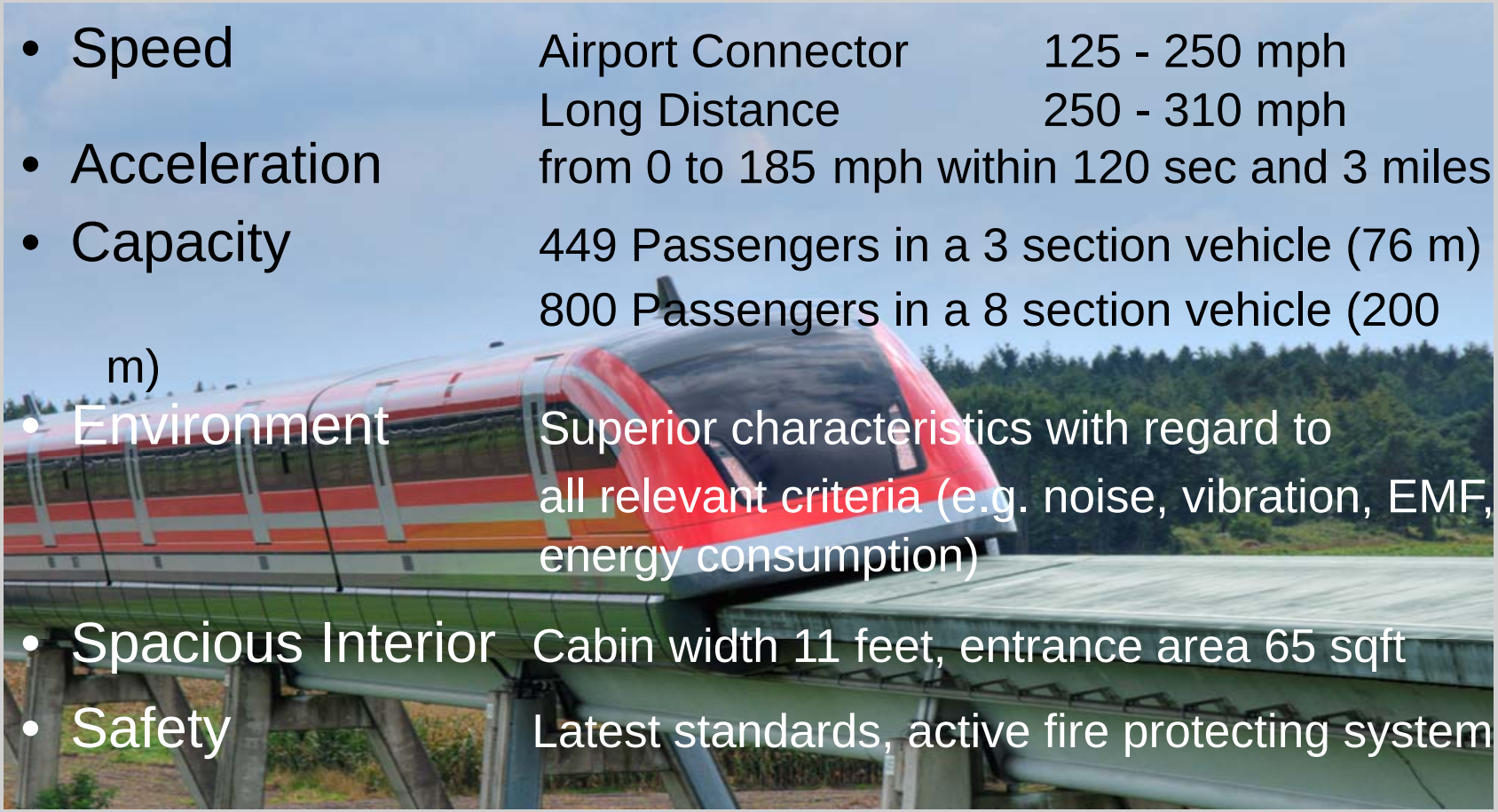
Transrapid 09 Latest Vehicle Generation

The most advanced maglev vehicle in the world



- Speed — Airport Connector 125 - 250 mph; Long Distance 250 - 310 mph
- Acceleration — from 0 to 185 mph within 120 sec and 3 miles
- Capacity — 449 Passengers in a 3 section vehicle (76 m); 800 Passengers in a 8 section vehicle (200 m)
- Environment — Superior characteristics with regard to all relevant criteria (e.g. noise, vibration, EMF, energy consumption)
- Spacious Interior — Cabin width 11 feet, entrance area 65 sqft
- Safety — Latest standards, active fire protecting system

ThyssenKrupp Transrapid

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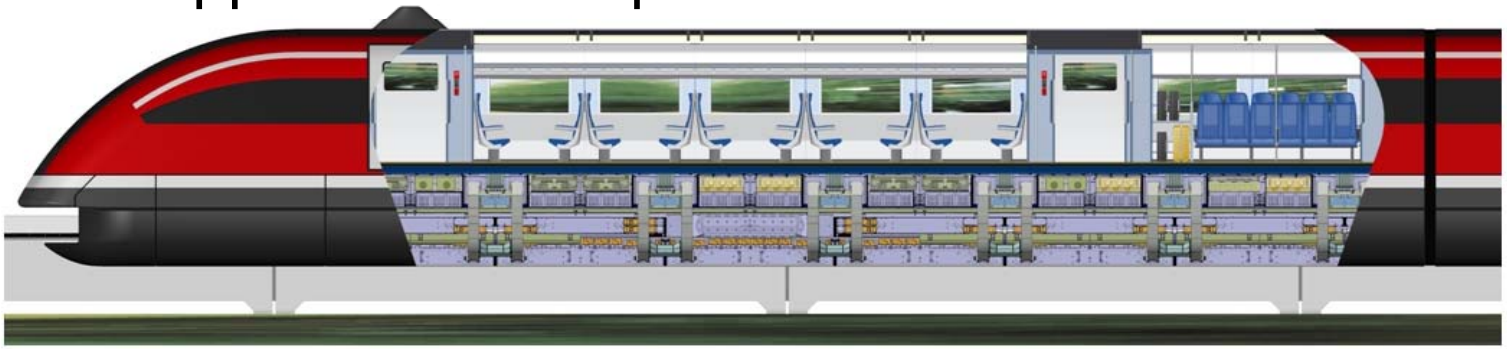
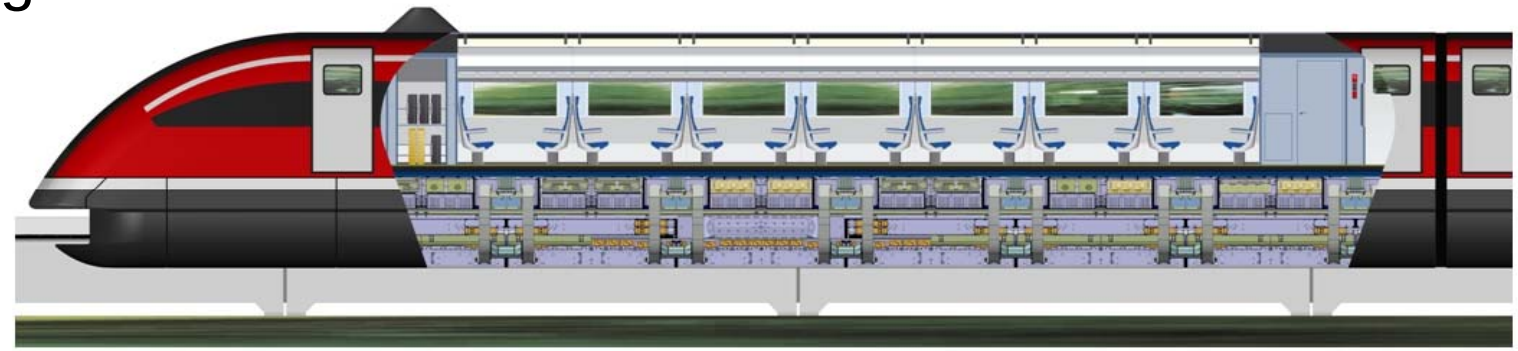
Transrapid 09
Platform Concept

Latest Vehicle Generation

Regional Application or Airport Connector



Long Distance



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Transrapid 09 Latest Vehicle Generation

Vehicle Body Cell Structure

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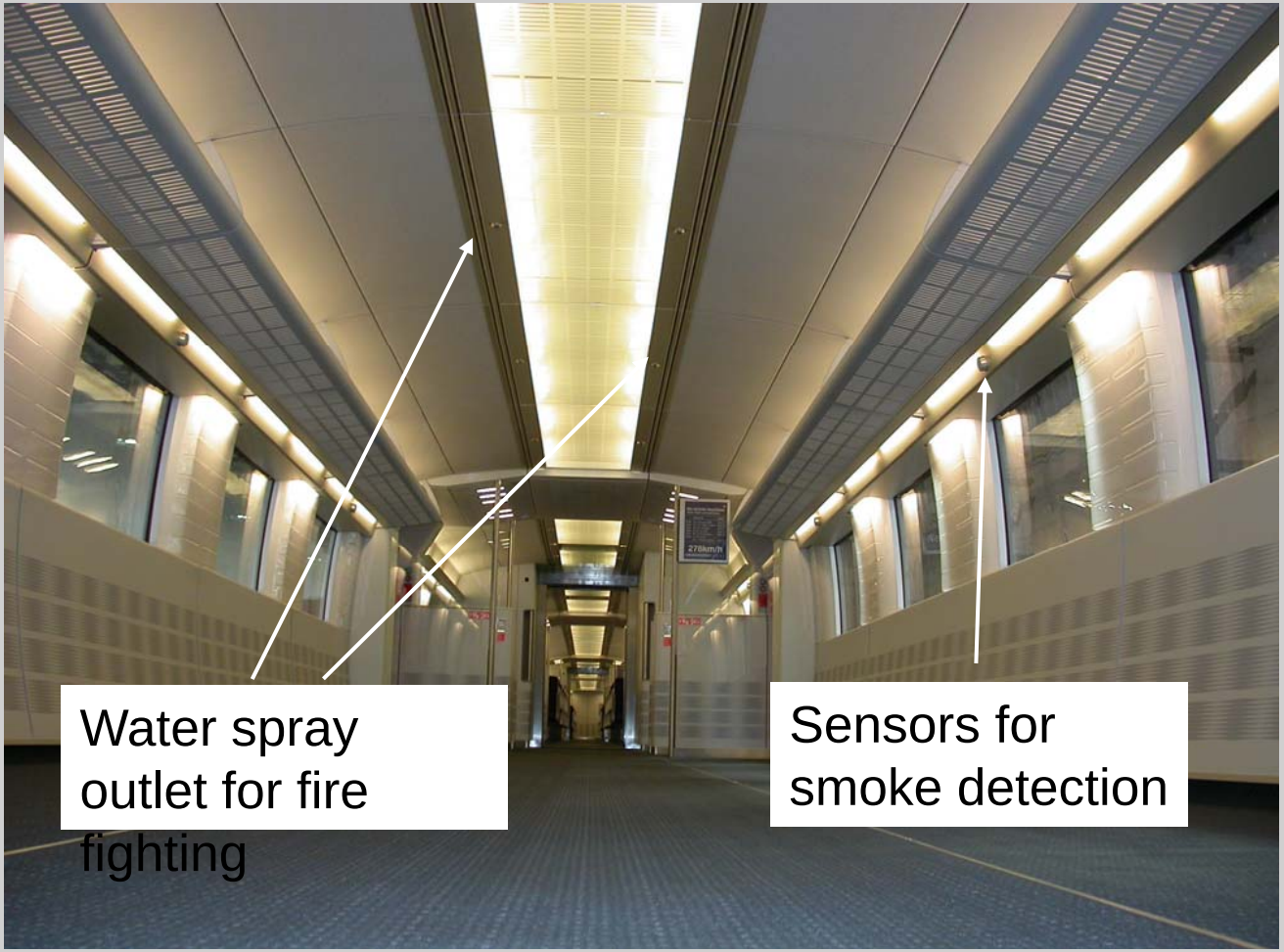
Active Fire Protection



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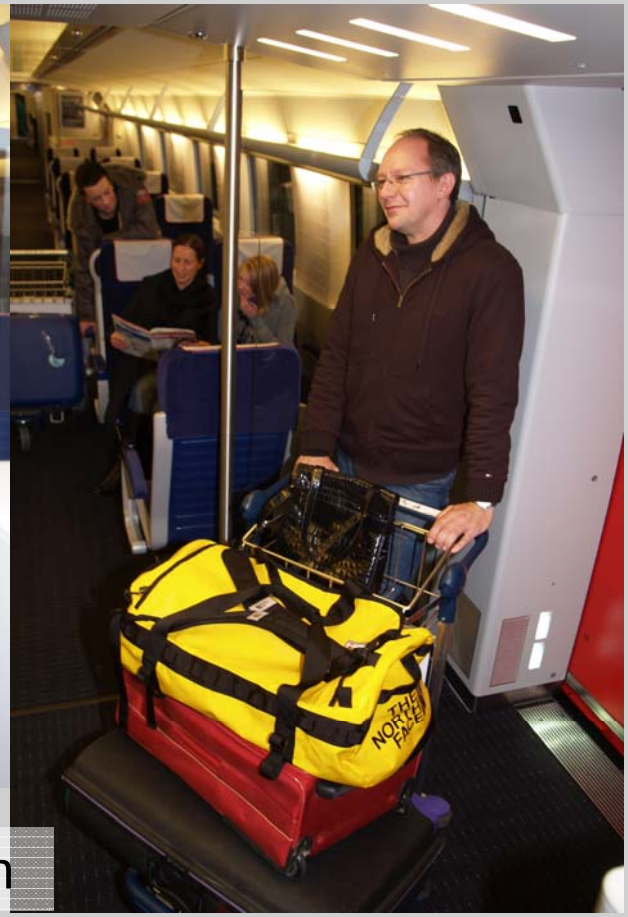
Interior Space Airport Connector



TR09 provides space for trolleys in the cabin

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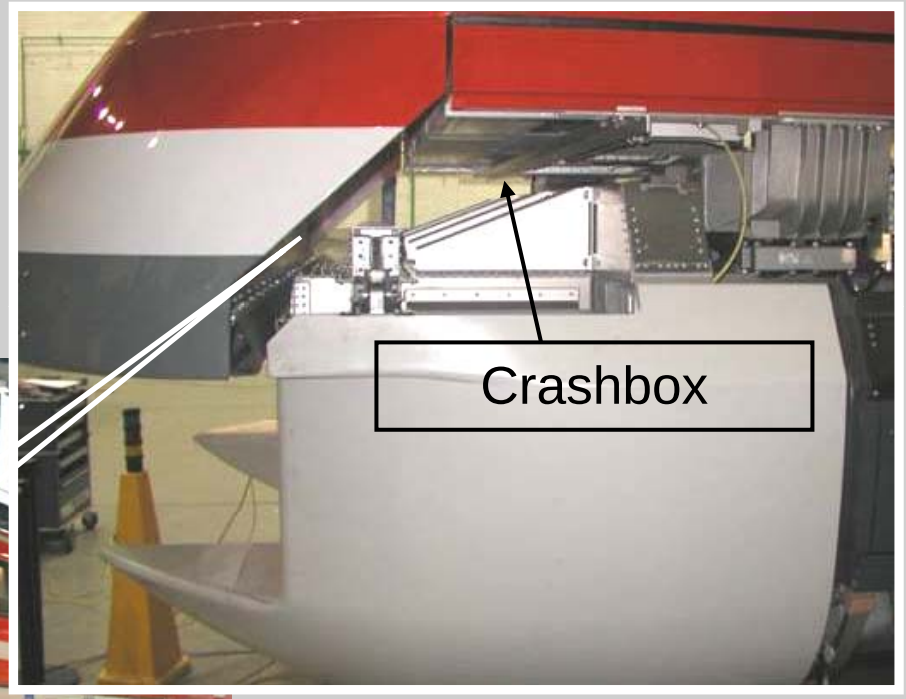
Optimized Front End

Design Aspects:

- **Noise emission**
- **Protection against collision**
- **Operation at wintry conditions**



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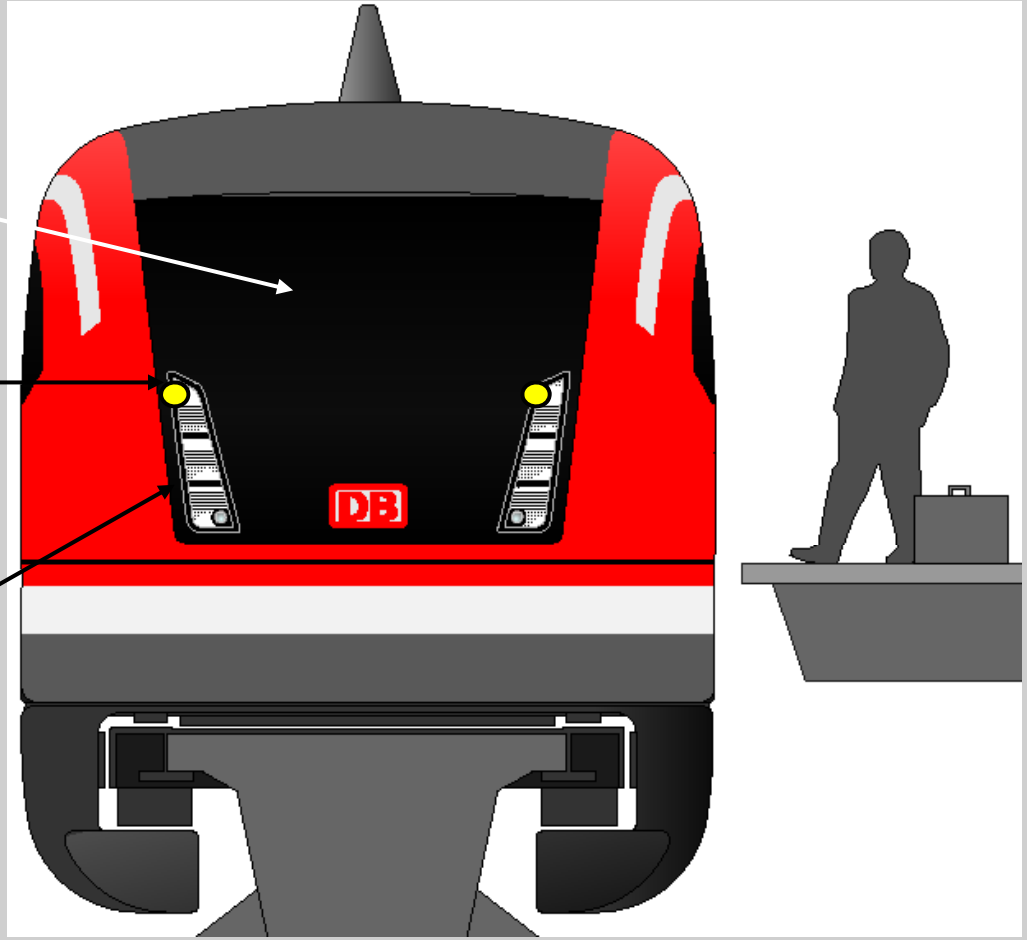
Transrapid 09
Front End

Latest Vehicle Generation

Front without window

Camera for front sight monitor

Front Signal / Rear Signal made of Light Emitting Diodes



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Transrapid 09 Latest Vehicle Generation

Test Operation at the Emsland Test Facility (TVE)

Objectives:

- Verification of new systems and components
- Validation of vehicle functions
- Safety Assessment (Eisenbahn-Bundesamt)

Data of Test Operation:

- Testing schedule starting July 2008 until May 2009
- Accumulated testing distance: 30.000 miles
- Safety certification completed in Summer 2009

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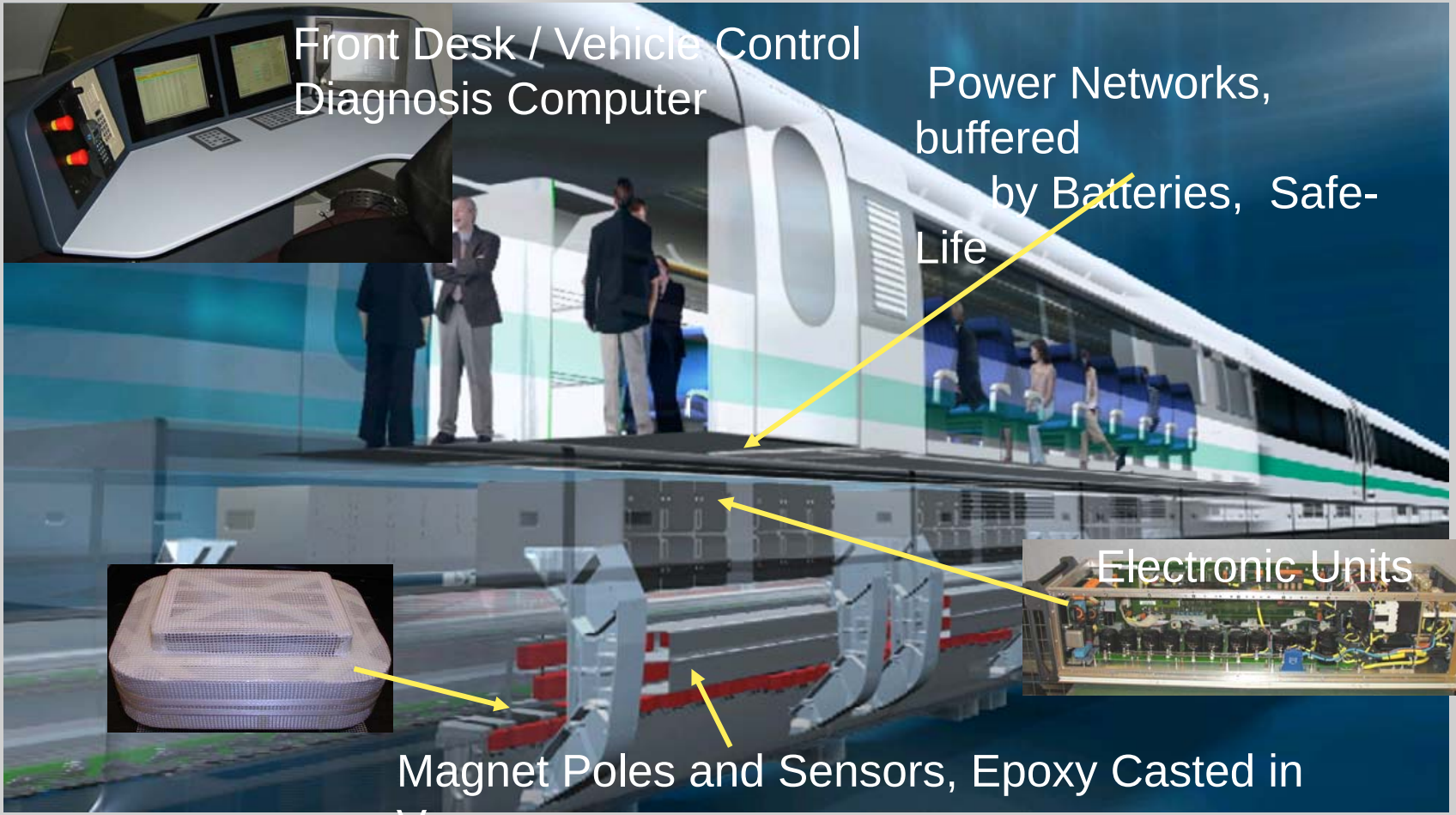
Vehicle Components



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Transrapid Assembly Sub-floor Structure

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Transrapid Preassembly Traverse-Module

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Vehicle Assembly

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Transrapid Assembly Carriage Body

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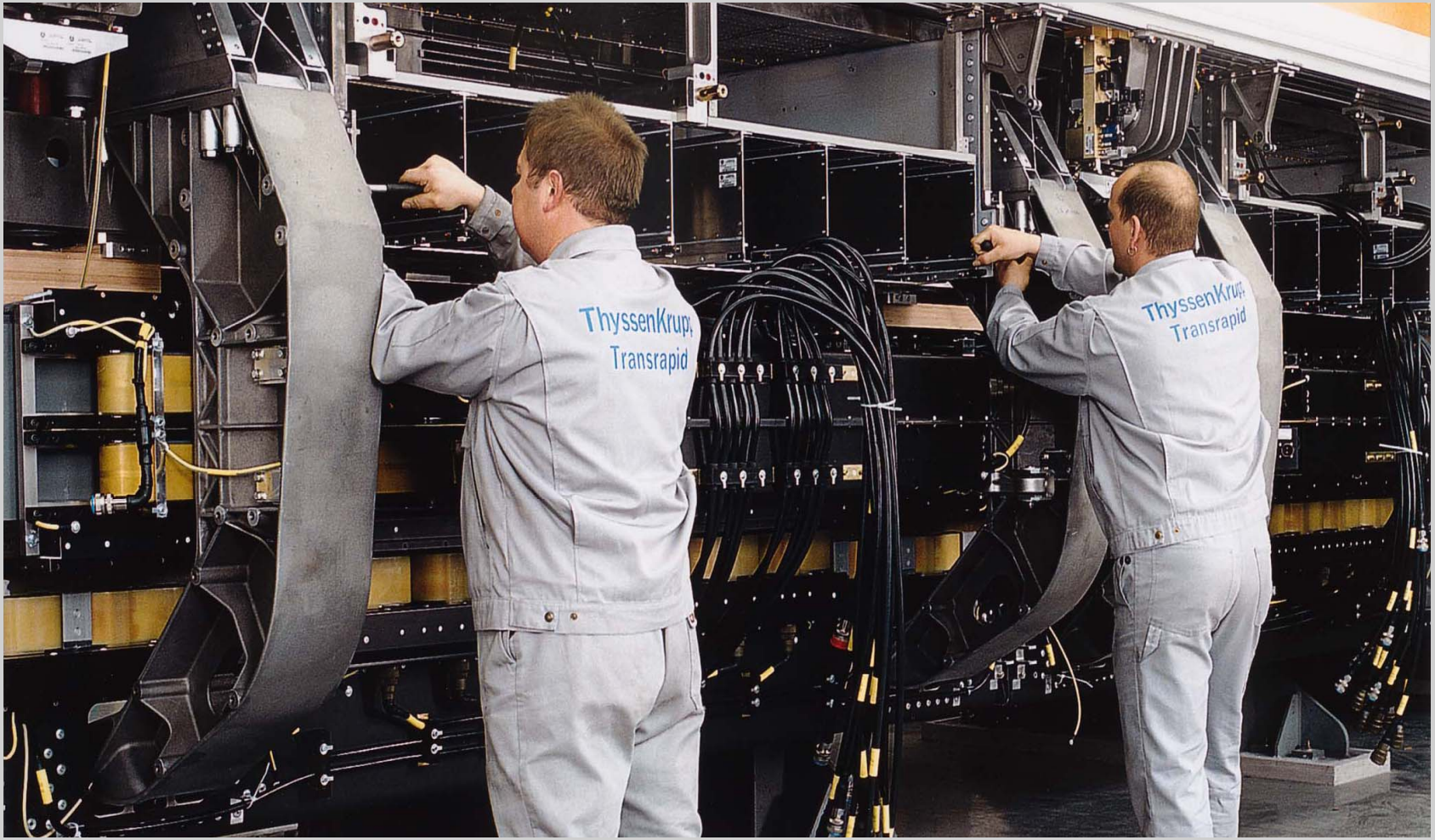
Transrapid Assembly Magnet Modules



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Assembly Vehicle

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Transrapid Assembly Carriage Body

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Transrapid Vehicle Assembly

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Transrapid Guideway
Girder Technology

At-grade type – 30 ft long

Source: MAX BÖGL Bauunternehmung

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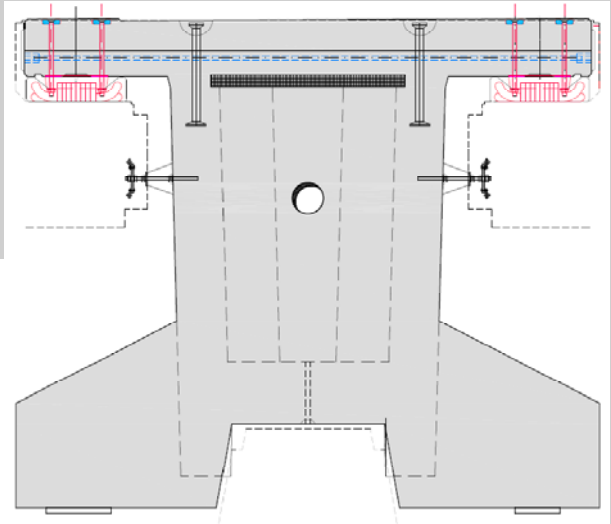
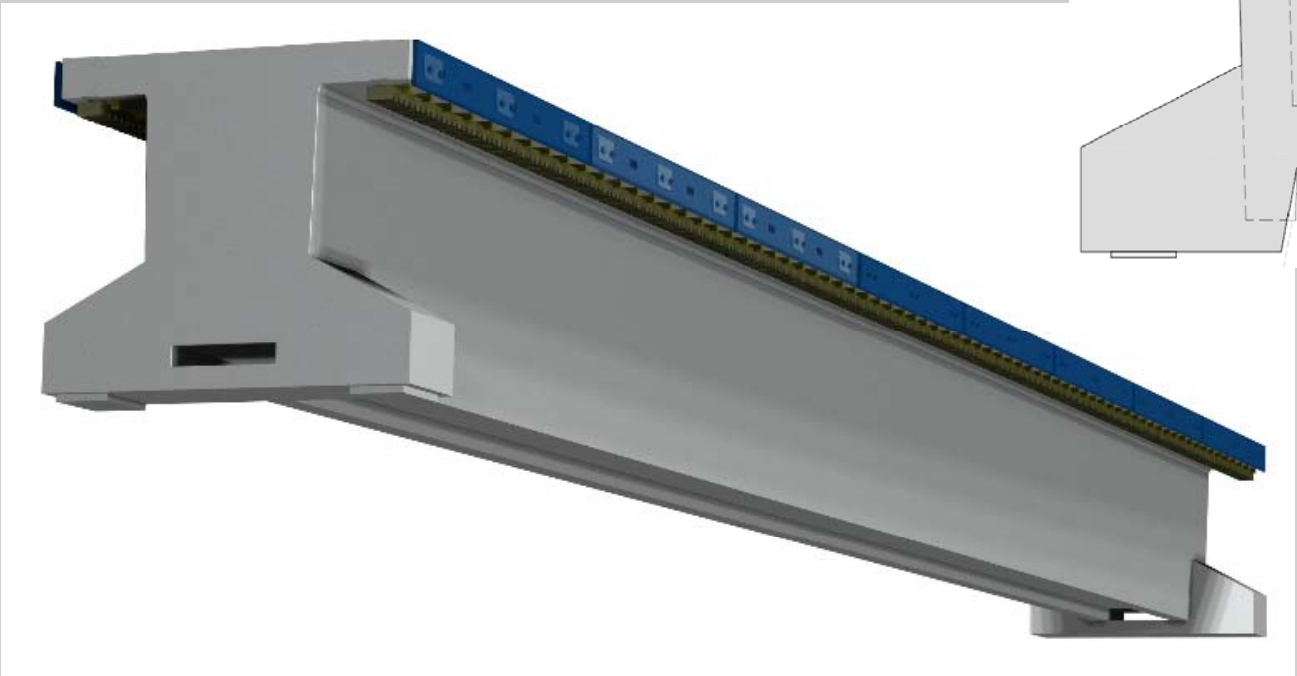
Transrapid Guideway
Girder Technology

Elevated type – 80 ft long





Source: MAX BÖGL Bauunternehmung

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Guideway Girder MAX BOEGL

Integration of Power Supply Cables in the Girder

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Guideway Girder Technology of MAX BOEGL

Factory Production of Girders

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Guideway Technology
Preparation of the Long Stator Winding

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Transrapid Guideway
Environmentally Friendly and Cost Efficient

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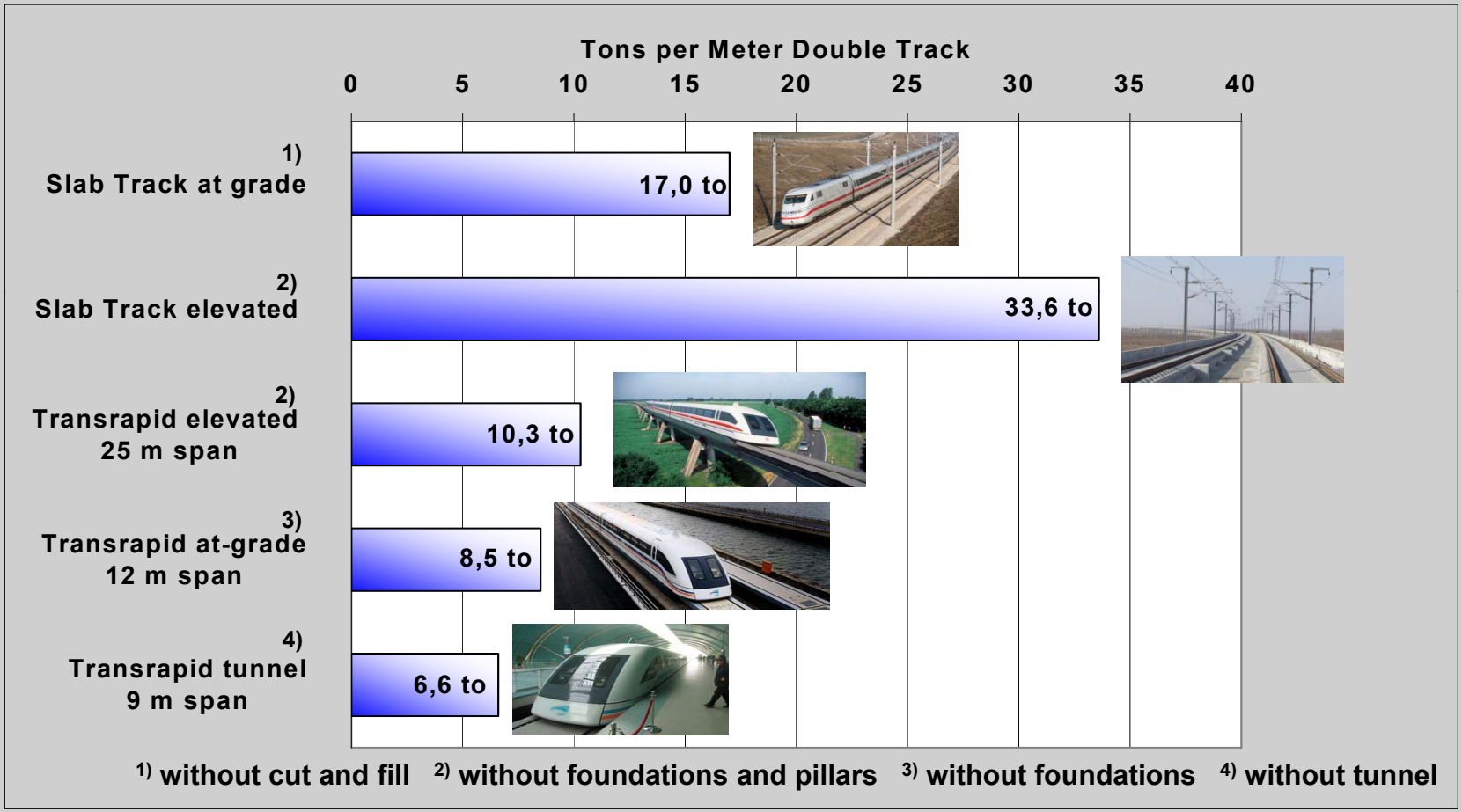
Transrapid Guideway
Comparison of Quantities



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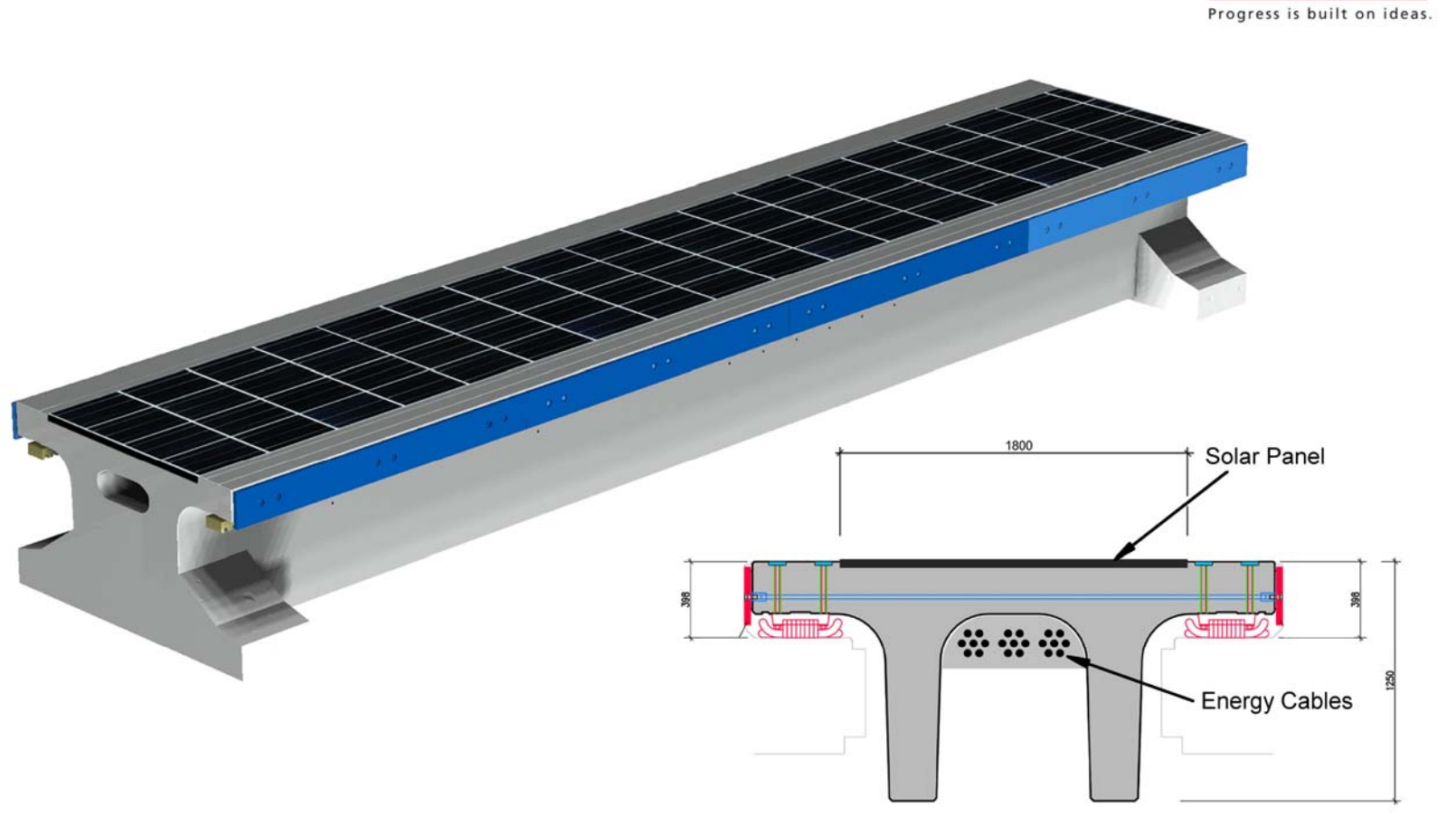
Guideway Girder BOEGL
Option with Solar Panels



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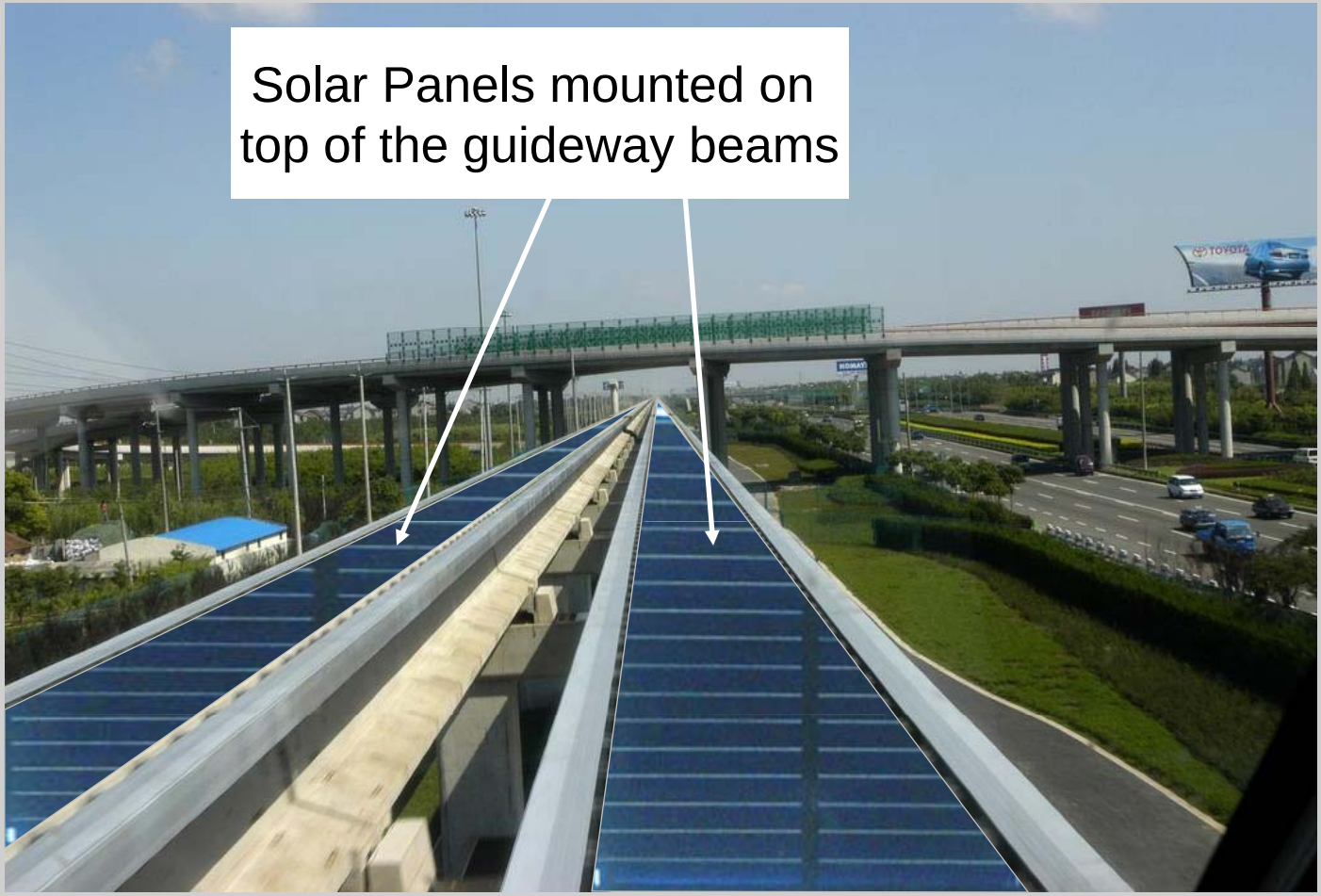
Transrapid Guideway
with integrated Solar Power Supply



ThyssenKrupp Transrapid

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ThyssenKrupp Transrapid and Maglev Technology

1. Transrapid System Characteristics
2. Testing of new Maglev Vehicle TR09
3. Production of Maglev Vehicle
4. Guideway Girder Technology
5. Future Aspects

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Transrapid Technology
Potential for Future Improvements

Electronics, increased density of elements and functions:

- Reduced production cost of units
- Reduced volume and weight of units

Further potential of cost reduction results from
use of automotive components: cars with hybrid or fully electric drive at similar onboard network voltage.

New materials and techniques of low-weight design

- Reduced weight
- Reduced cost of production
- Improved behavior with regard to noise and vibration

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Transrapid Technology
Localization / Americanization

A Transrapid Maglev Project in the US will provide great job opportunities for localized manufacturing, creating a new industry:

- close cooperation with FRA with regards to Rule Making Process and Safety Assessment, expanding on already completed EIS work for other US Maglev projects,
- cooperation with local partner companies during planning and construction, as well as later operation and maintenance,
- transfer of know-how to US-manufacturers,

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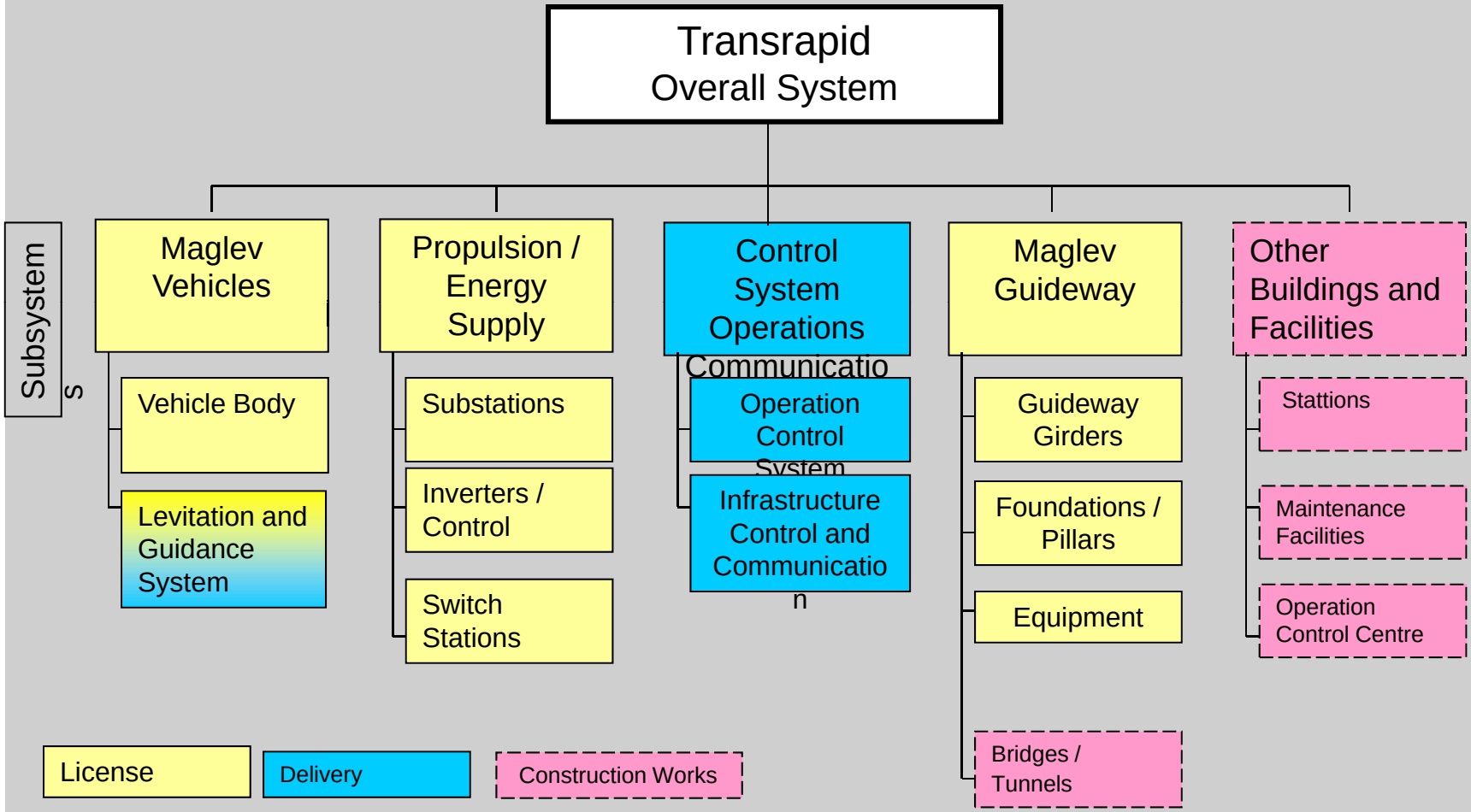
Transrapid System Structure



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