Gröna Tåget
(Eng: Green Train)

Overview and Technical Aspects

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- Heavy rail investment program (11 billion Euro)
- Capacity enhancements
- Upgrading of existing lines
- High-speed links & freight corridors.

Still, on most lines high-speed trains will **share tracks with heavy freight trains** (axle load to up to 25 metric tonnes).

A new generation of long-distance trains is foreseen to be needed and introduced within in the next 5 – 10 years.

Other Nordic countries (Denmark, Finland, Norway) have similar needs, possibly possibly later.
Why not simply use a train from continental Europe?

- Sweden has a modest population density with major cities and regions located some 300 – 600 km apart. There is a great need for efficient and sustainable passenger transportation.
- Trains for introduction within 5 – 10 years are yet not developed.
- We should be able to influence train development and European standardisation.
- Sweden is one of the 6 - 8 countries worldwide, having the ability of developing trains for speeds above 200 km/h.
- European standardisation (TSI, EN) is lacking some important requirements for Swedish (Nordic) conditions.
Additional requirements to European standards

- **Mixed traffic** with heavy freight trains, as well as **frost upheaval** would produce larger track defects. Requires **track-friendly trains** (low track deterioration, smooth ride on non-perfect track).

- The **modest population density**, and varying traffic demands, requires **flexible trains** (3 – 12 cars). This means at least two pantographs (current collectors) at short distance.

- Reliable operation under harsh **winter conditions**.

- Requirements on **economic efficiency** is high.

- Requirements for **disabled passengers** are high (low entrances and/or convenient lift facilities).

All this is **compliant to required European standard**, but is not specified in TSI and EN.
Desired features for Swedish (Nordic) conditions

- **Short travelling time** (on upgraded and new infrastructure); top speed 250 km/h or higher. **Tilting carbody** is needed.
- Improved **passenger comfort** (seating and working ability, noise & ride, pressure tightness, reduced motion sickness).
- **Space-efficient, flexible** and attractive **interiors**.
- Improved **environmental performance** (energy, noise):
  - **Energy** consumption (per seat-km) should be reduced.
  - No higher **noise level** at higher speeds (cf. 200 km/h).

**Opportunity** (according to proposed EN):

- The Swedish (and Nordic) rail network allows **wider trains** than continental Europe (in Sweden approx 0.55 m). Important for economic efficiency!
Finally

- **Reduced cost** (per seat-km) by 20 – 30 %, as to compete successfully with low-cost airlines, and for increased market share.

All this requires advanced technical research and development, and also research on economic and passenger issues.
2005 – 2008 particular focus on

• **Track-friendly bogies** (passive self-steering + mechatronic)
  
  **Track forces** + running stability
  measured by instrumented wheels

• **Ride qualities** on non-perfect track (active lateral suspension)
  
  Simulation, hardware and testing.
Further 2006 – 2008

- Noise reduction (external + internal)
- Current collection
  (improved pantographs on existing overhead catenary)
- Aerodynamics
- Winter climate protection at high-speed operation.
Improved radial steered bogies

Bogie noise shield

Modified existing radial steered bogies with Active Lateral Suspension

Mechatronic bogies based on existing bogies

Bogie noise shield

Testing 2006 – 2008: Modified ”Regina” wide-body EMU train

STEP 1
2006-07

STEP 2
2007-08

Source: Bombardier
Further research & development until 2010

- **Carbody tilt** systems performance & measures to reduce motion sickness.
- **Permanent magnet motor drives.**
- **Reductions of energy consumption.**
- Studies on **market demands**,  
  - **performance** requirements (speed, cant deficiency, power),  
  - possible **train concepts**,  
  - **cost & revenue** analysis,  
  - **capacity** in mixed rail traffic (high speed and heavy freight).
- **Attractive passenger facilities** (interiors).
- Considerations of the **European standard**.
- Development of appropriate **specifications**.