# Gröna Tåget and Regina 250
# Test rides summer 2008

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# Content

# Overall test set-up for REGINA 250 during summer 2008


| DMA-car | | DMB-car | |
|---|---|---|---|
| ▪Track friendly soft bogie<br>▪Active lateral suspension<br>▪Modified secondary suspension<br>▪Instrumented wheel set | ▪Track friendly soft bogie<br>▪Active lateral suspension<br>▪Modified secondary suspension | ▪Track friendly soft bogie<br>▪PM - motor drive | ▪Track friendly soft bogie |

There are many partners involved striving for the same goal.





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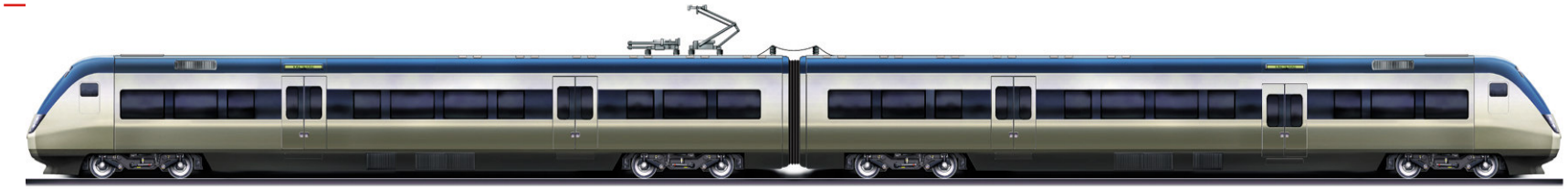
# Overall test planing 2008 for REGINA 250



| Jun-Jul | Jul-Aug | Sep-Oct | Nov-June |
|---|---|---|---|
| **Pre-testing** | **Type test** | **Reliability test** | **Service op.** |
| **PM-motor** on vehicle for the first time<br>—Trimming<br>—Control<br>—EMC<br>—Braking<br>—Performance<br>**ALS**<br>—Trimming | **ALS** undertaking UIC 518 test and evaluation<br>**PM-motor** drive will be on the vehicle during test period. Final UIC test with **soft bogie**.<br>**High Speed** test runs. | **PM-motor drive and mechatronic bogie** undertaking a reliability test before going into service operation | PM-motor drive and mechatronic bogie going into service operation including winter conditions |

**This step by step process has to be carefully managed with check points and clarified criteria at each gate.**





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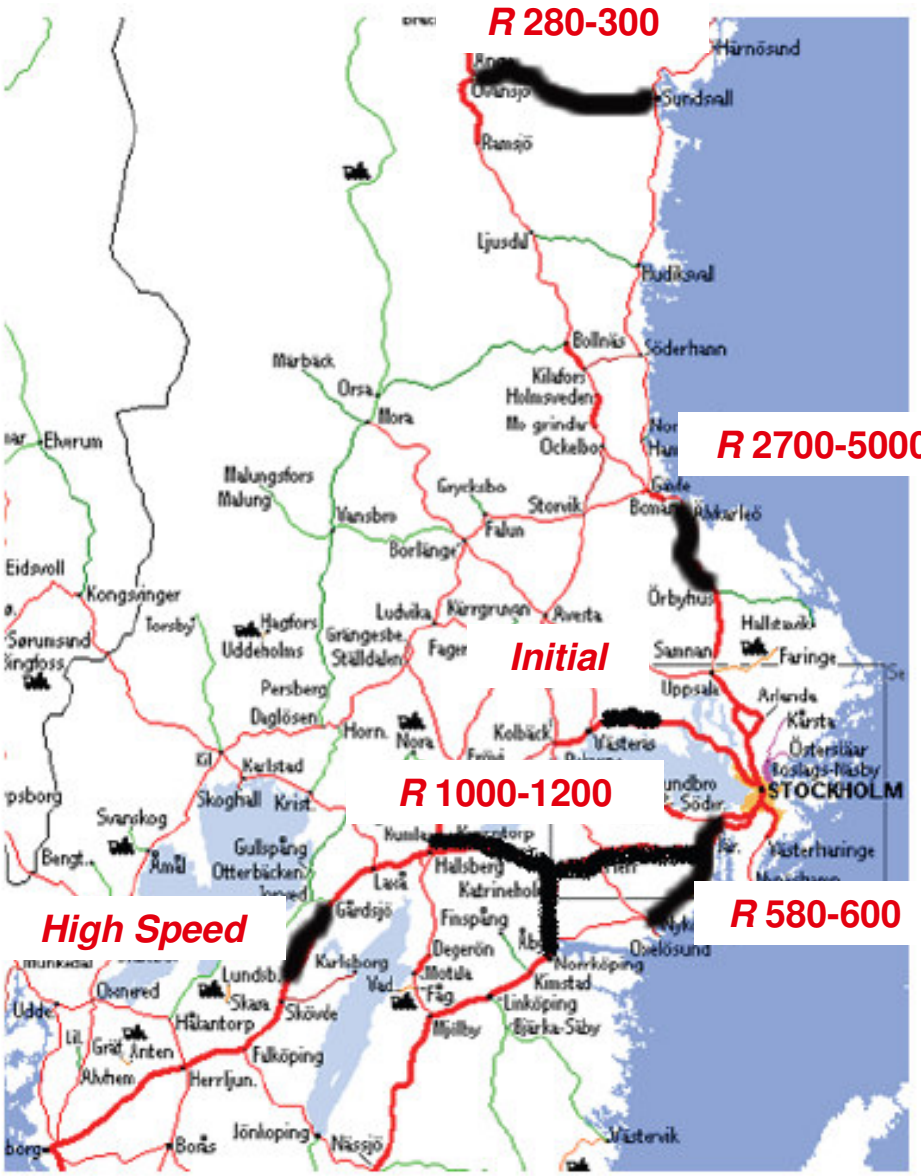
# Test lines for UIC 518

- **Tested for:**
  - **Soft bogie with passive radial steering**
  - **Active lateral suspension**
- **Test conditions**
  - **Admissible speed**:250 km/h
  - **Admissible cant deficiency**: 168 mm (1.1 m/s2)
  - Testing at + 10 % (speed on straight & cant def).





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# New high speed record

- On July 23 on the test track Skövde – Töreboda the *REGINA* 250 reached the new high speed record of 295 km/h (282 km/h 2007)
- This was done on track certified for 200 km/h operational speed
- Further high speed test runs are planned






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# MITRAC Permanent Magnet motor Summary

- **PM motor offers environmental and economical advantages**
  – which in future has the potential to increase in relevance
- **The *MITRAC* PM motor design is based on industry standard with unique features which provide Unique Selling Propositions**
  - Wide application range
  - High degree of versatility for optimized utilization of complete system
  - Compatibility with existing systems
  - Reuse of reliable and proven *MITRAC* induction motor

MITRAC *Permanent Magnet Motor*

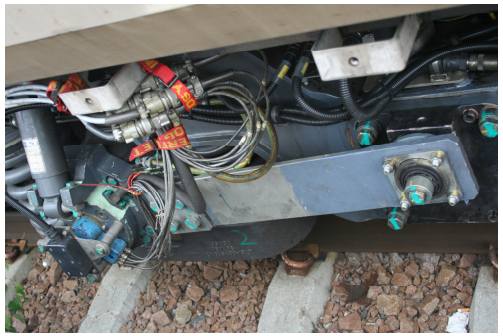
- **Successful tests confirmed the advantages of *MITRAC* PM motor and the expected benefits**

# Future track access charging

- **Track-friendly trains enable**
  - Lower track deterioration
  - Smoother ride on non-perfect track
  - Lower wheel wear
- **Banverket** is pushing for low track deterioration and a model for the cost of track deterioration **likely being the basis for future track access charging**
- Most important vehicle features  for track deterioration
  - Axle load
  - Radial steering capability in curves
  - Speed and cant deficiency
  - Unsprung mass

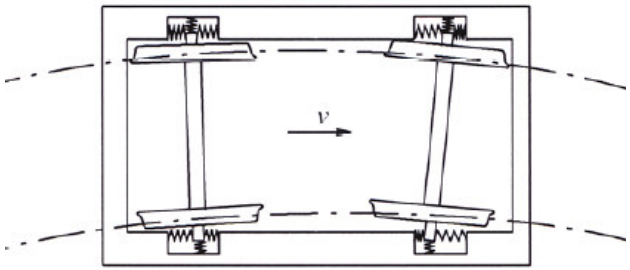
# Track force measurements

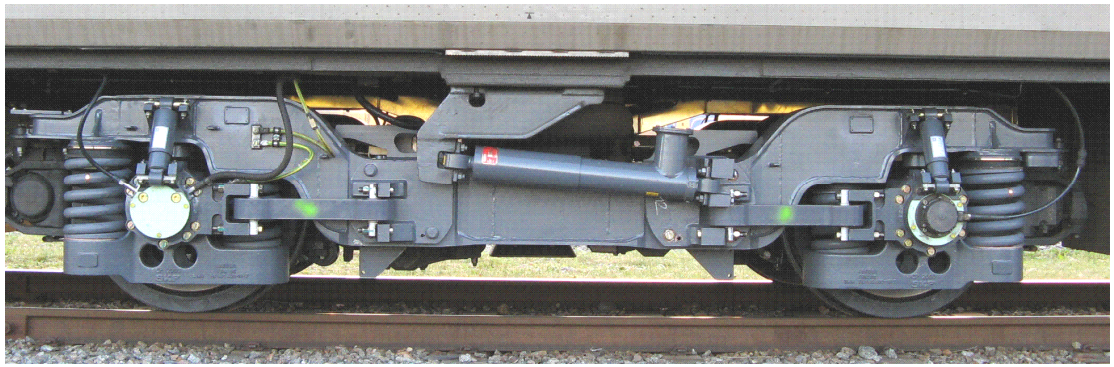
- Instrumented wheels on two axles for continuously measuring vertical and lateral forces.
- Accelerometers according to UIC 518. In addition some accelerometers for comfort evaluation in carbodies.



# Track-friendly soft bogie for *REGINA* 250

- Based on 25 years of experience with track friendly soft bogies
- Meets UIC518 requirements for **250 km/h**
  and cant def **168 mm** (1.1 m/s2). Track forces 50-60 % of limits.
- Has been running 295 km/h (new record in Sweden)







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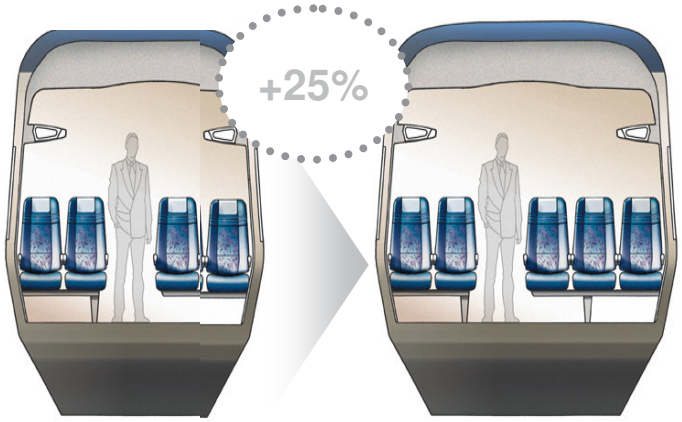
# Active Lateral Suspension (ALS)

- **Two functions in one hard ware**
- **1) Keep carbody in centred position in curves**
  ⇒ Move in bump stops
  → Wider carbody possible
  → Better cross wind stability
  ⇒ Improved lateral ride comfort by avoiding bump stop contact
  ⇒ Possible to run at high speeds in curves
- **2) Improve lateral ride comfort**
  ⇒ Same ride comfort at 250 km/h as without active lateral suspension at 200 km/h




- **Wider carbody**
  - **3,6 m in Gröna Tåget (draft, + 0,1-0,15 m)**





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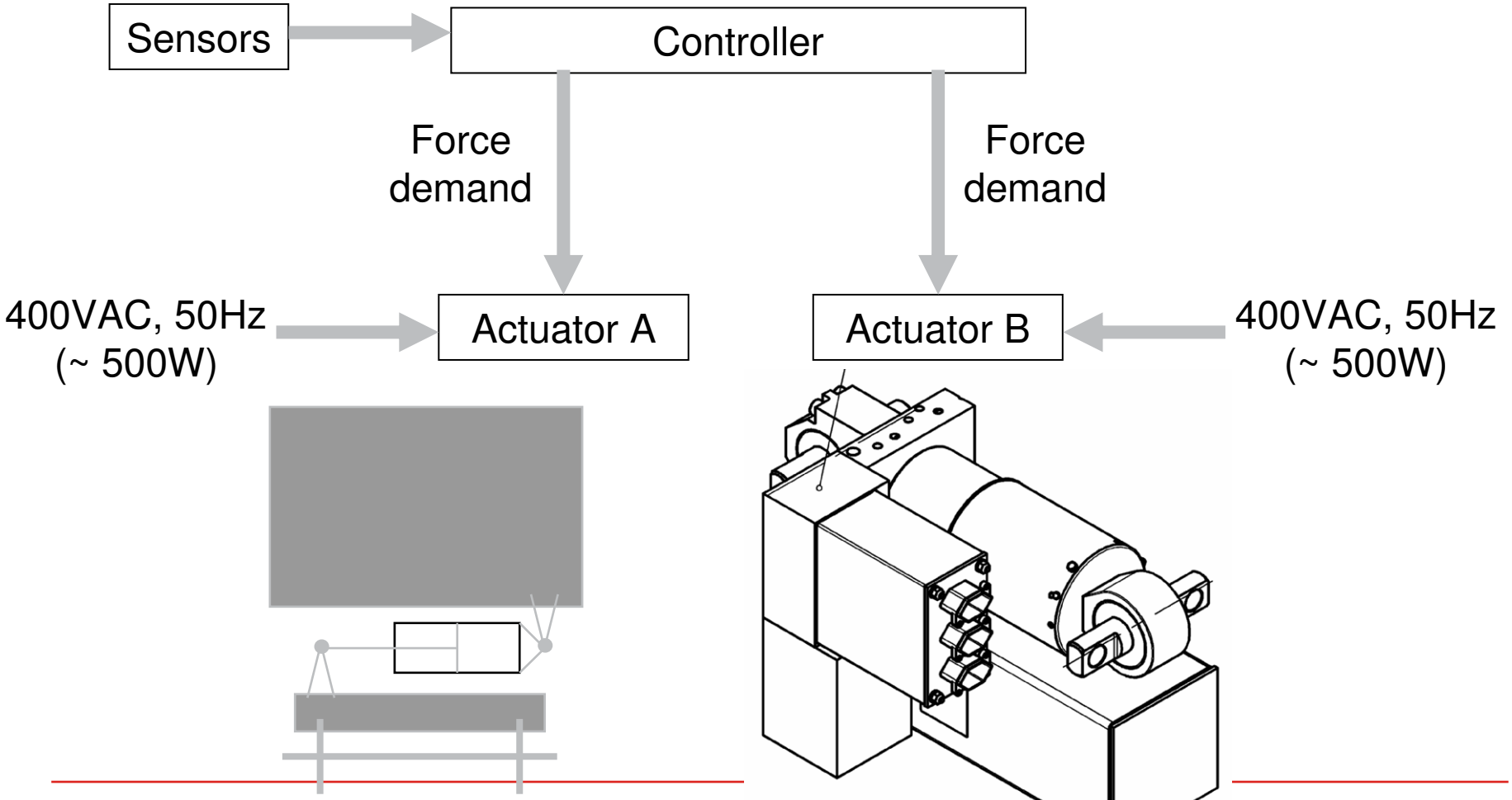
# The ALS system





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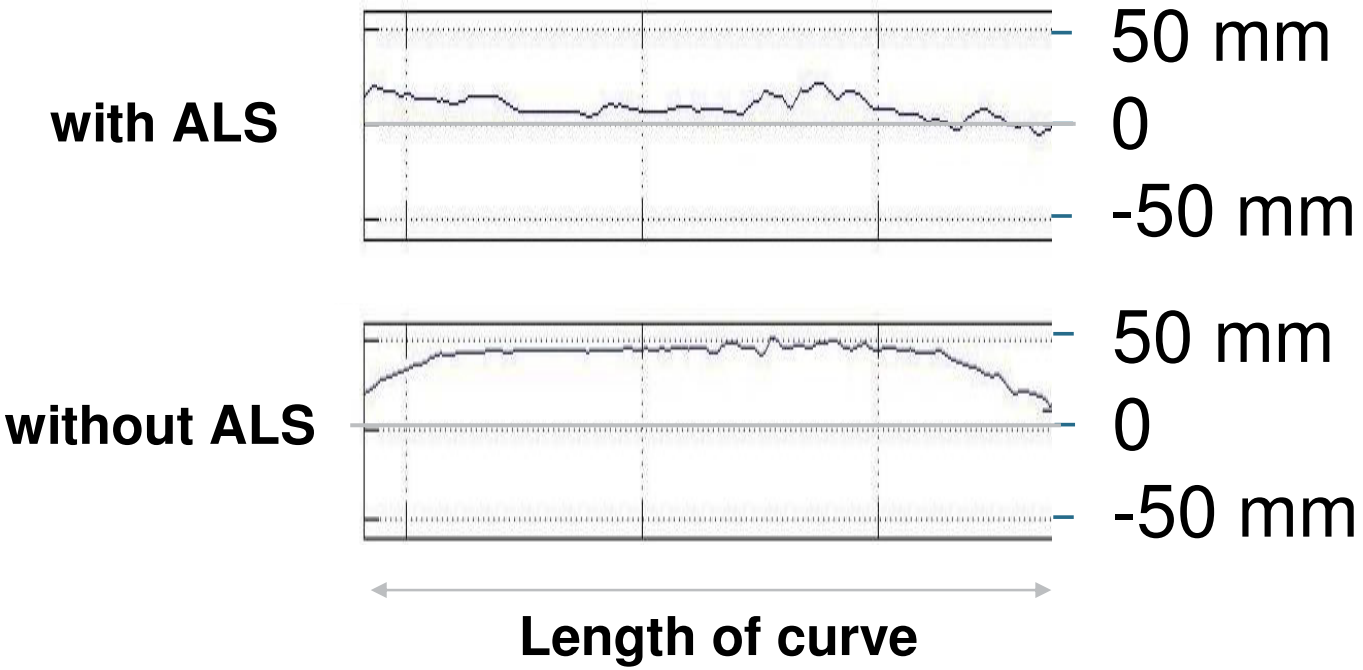
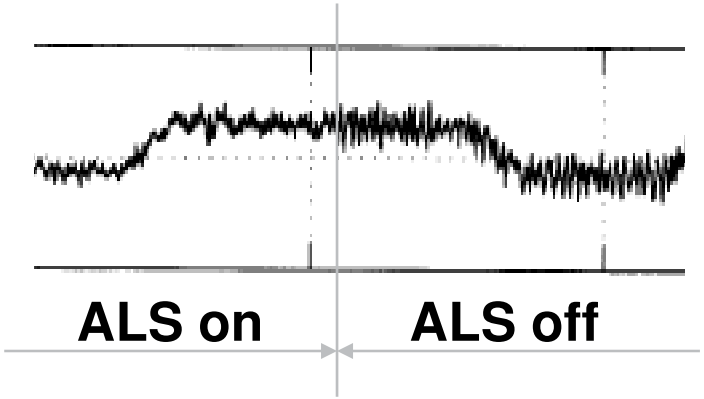
# Test result:
# ALS keeps the carbody in centred position in curves

Displacement bogie - carbody



# Test result for lateral ride comfort

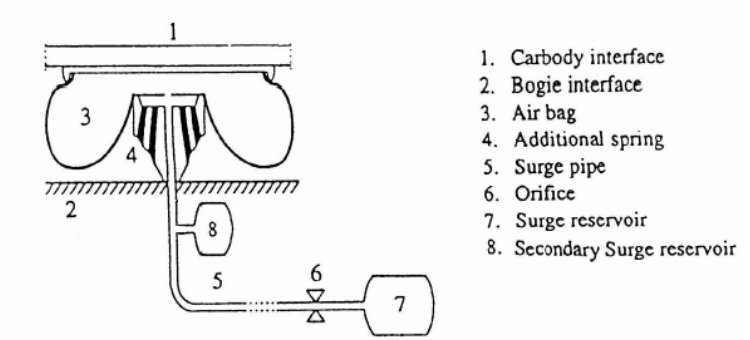
**10 – 47% reduced lateral carbody acceleration**
**frequency weighted according to ISO, to Wz units 0.1 – 0.3**




**Carbody acceleration**

# Test for improved vertical comfort

- **A study has shown that an improvement of the vertical ride comfort can be achieved by adding a second auxiliary volume (8) as well as an orifice (6) to the secondary suspension system.**




1. Carbody interface
2. Bogie interface
3. Air bag
4. Additional spring
5. Surge pipe
6. Orifice
7. Surge reservoir
8. Secondary Surge reservoir





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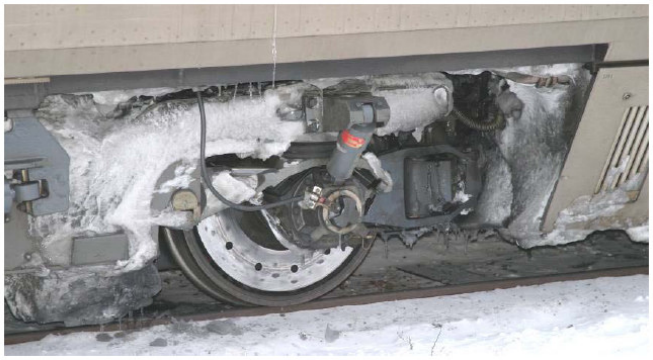
# Vertical ride comfort

- Tests have been made during the summer in order to verify earlier calculations
- The tests show that adding a second auxiliary volume improves the ride comfort in the car body
- The results show an improvement of 0.1 to 0.2 units in Wz
- The modified secondary suspension system will lower the vibrations in the car body and by that improve the overall comfort felt by the passengers

# Nordic climate conditions

- Trains in Sweden has to face the Nordic conditions
- Low temperature, - 40 degC
- Ice and snow
- Winter test in 250 km/h
- Winterisation Guidelines



# Summary

- **Gröna Tåget presents model for passenger attractive, environmental-friendly and cost-efficient trains**
- **New technologies gives opportunities for the railways**
- **Unique cooperation in Gröna Tåget gives win–win solutions**
- **Implementation can start already now!**
- **Gröna Tåget is the fastest way towards the future**


***Test rides with REGINA 250 shows that the aims are realistic***





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