

# **KTH Railway Engineering Research: Experiences, Visions, and Challenges**



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**KTH Väg – och Banteknik**

# Overview

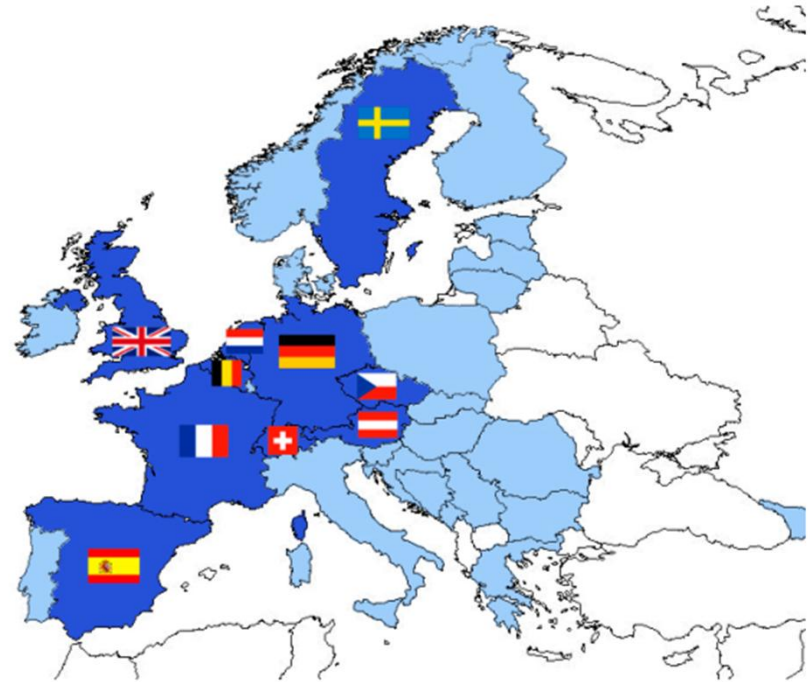
- Experience of EU-project INNOTRACK
  - SP2 – Track support structure
  - SP3 – Switches and Crossings
- Visions
- Research areas
- Collaboration



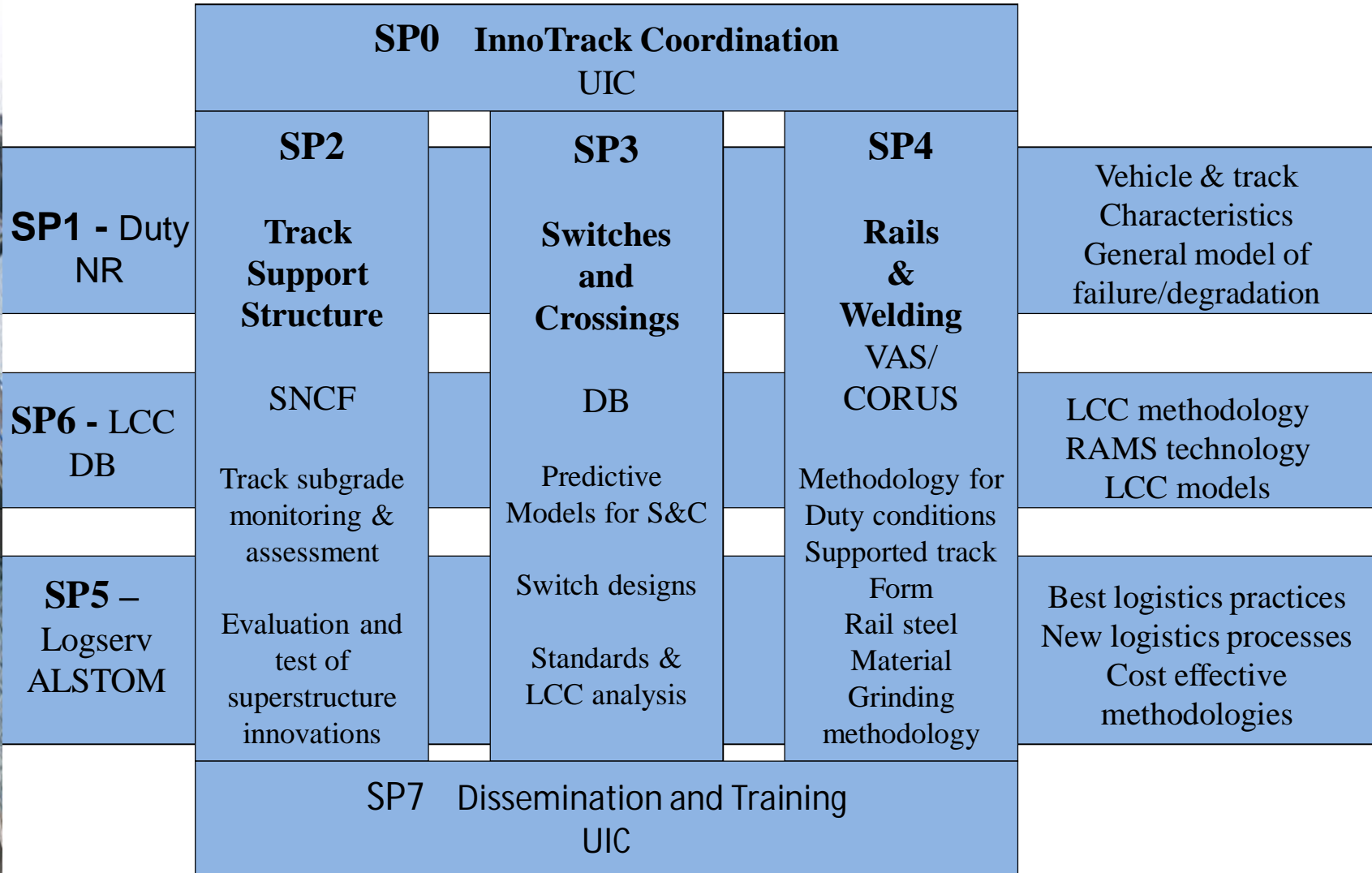
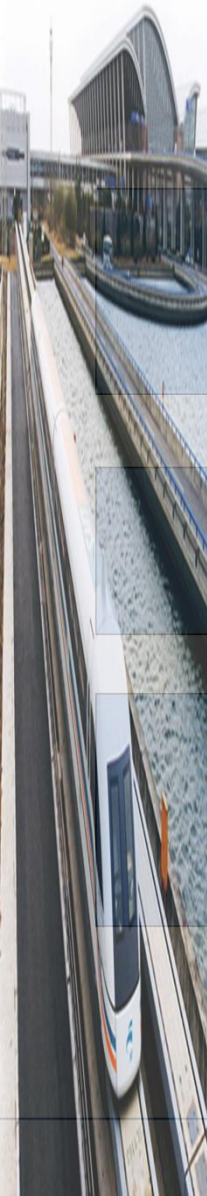
# Experience of EU-project INNOTRACK

## INNOTRACK - main features

- First European project with **comprehensive** cooperation between Infrastructure Managers and Industry regarding the **complete** track construction
- Total budget €18,6 m with EC funding of €10,0 m in 3 years period
- 36 partners from 11 countries
  - Infrastructure managers - 9; e.g. DB, SNCF, NR, ADIF, OBB, BV, ProRail
  - Supply industry - 11; e.g. VAE, Corus, Alstom, Vossloh-Cogifer
  - Constructors - 3; e.g. Balfour Beatty, Carillion
  - Universities and other expertise - 13; e.g. Chalmers, KTH, MMU, TUDelft

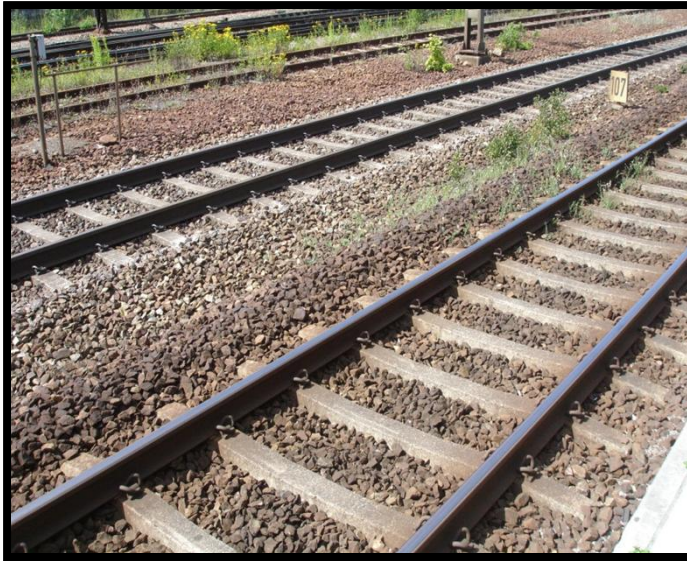


# INNOTRACK - project organisation

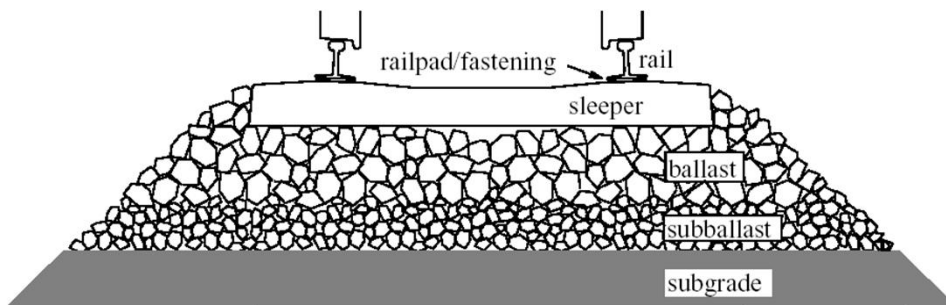


# SP2-Track Support Structure

## Ballasted Track

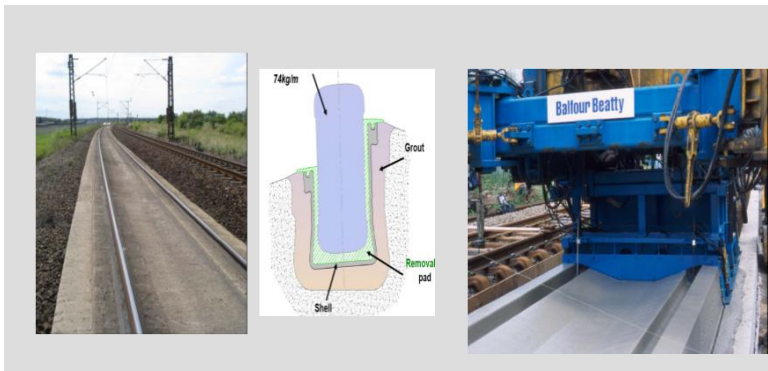
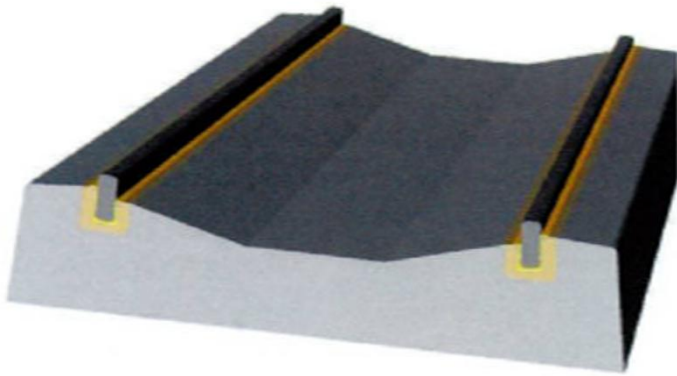


## Slab Track



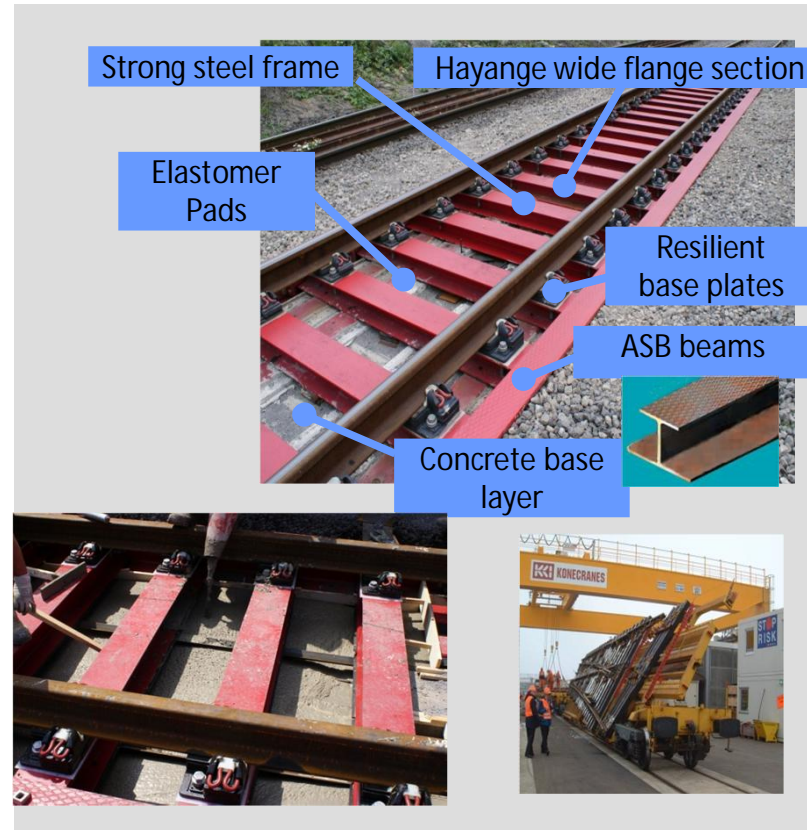
# Innovative track forms

Balfour Beatty embedded track - BBest



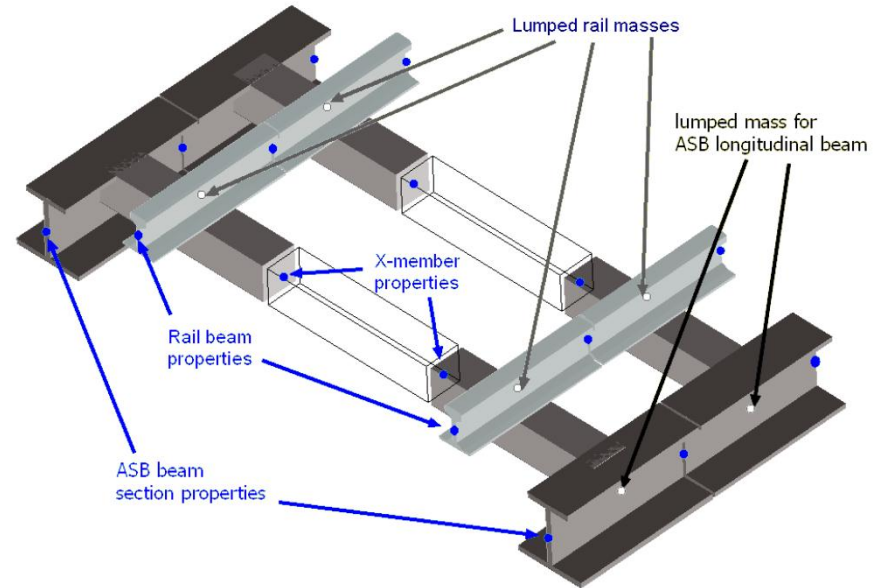
Section of test track

Steel - Concrete Two Layered Track (Corus)



# Steel - Concrete Two Layered Track (Corus)

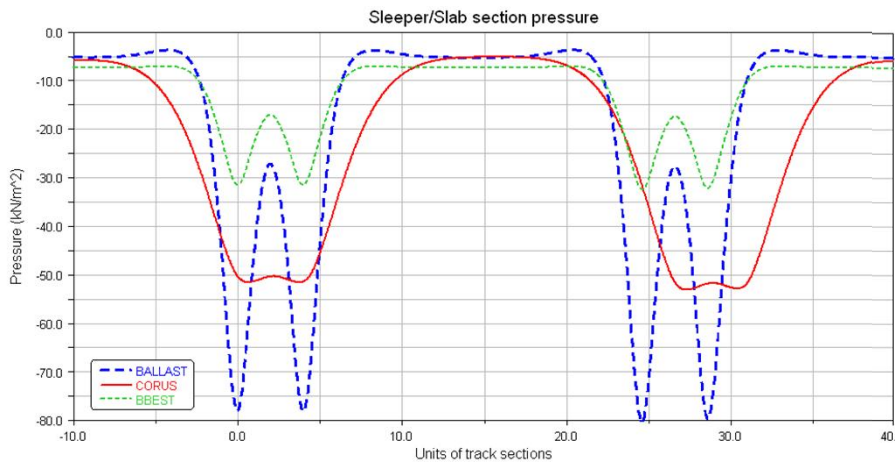
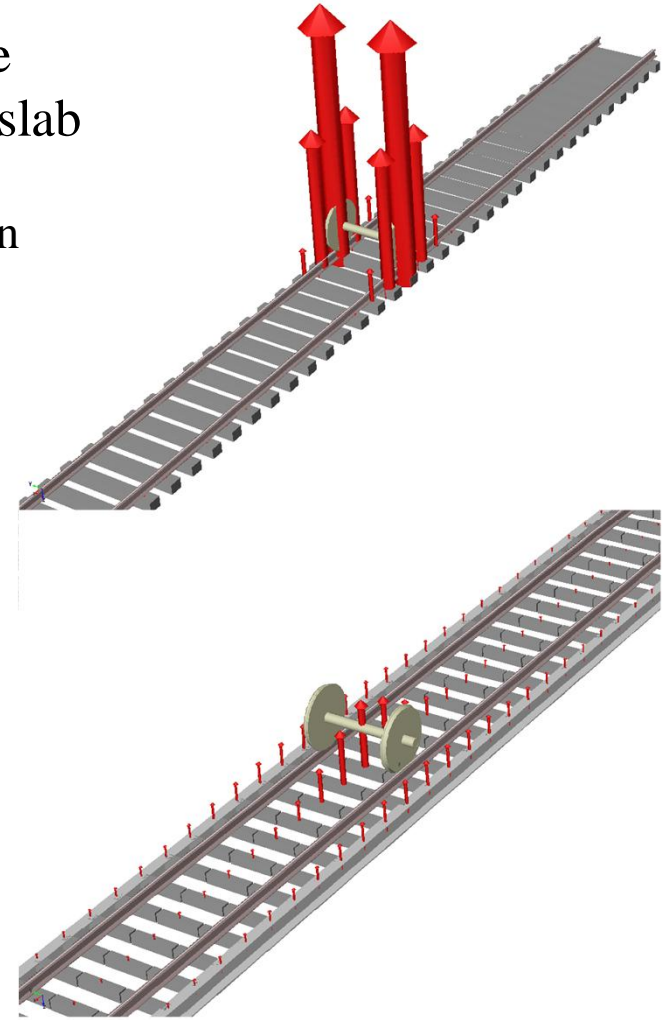
- innovative superstructure track form made of a steel structure embedded into concrete
- can be used for particular location with poor support condition of the subgrade
- offer a more consistent support to railway vehicles
- offer a bridging support to the load thus reducing or eliminating the increased vehicle-track forces and track deterioration
- intended to be used for switches and crossings where high lateral impact forces are present and where a more consistent support may help reduce such interaction forces



# Slab track construction and its benefits

Comparison of force distribution between the conventional ballasted track and Corus steel slab

- A more efficient spreading of the loads between the vehicle and the ground through the steel superstructure, leading to a reduction of the maximum stresses onto the ground

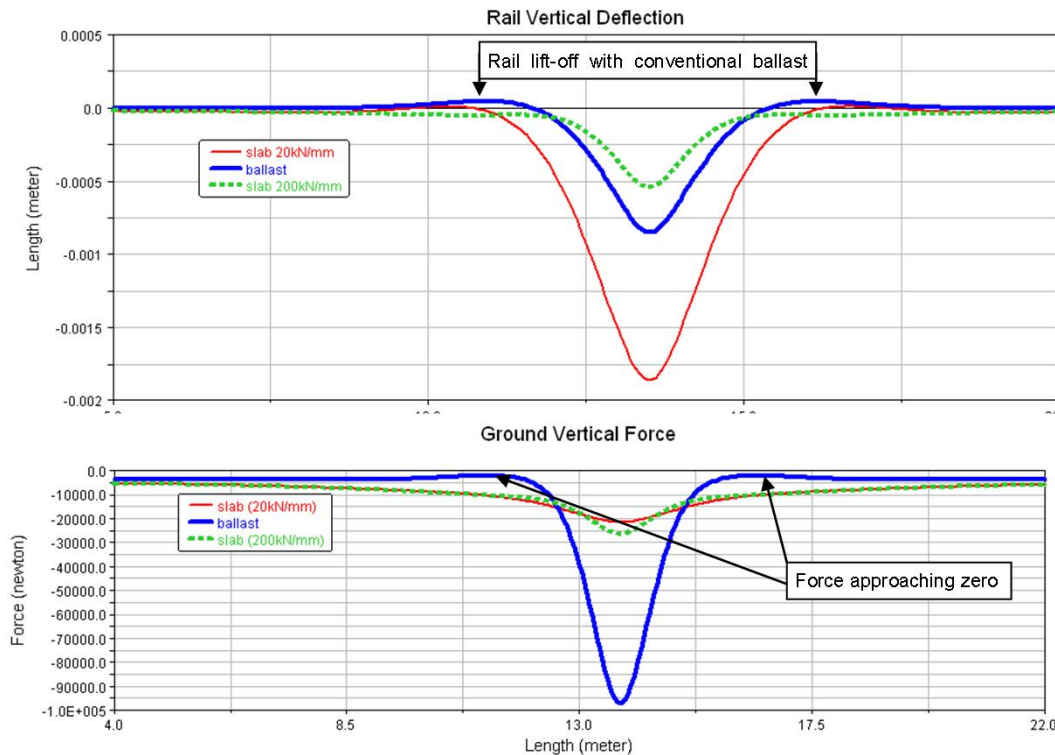


reduction of pressure on the supporting ground with both innovative track forms

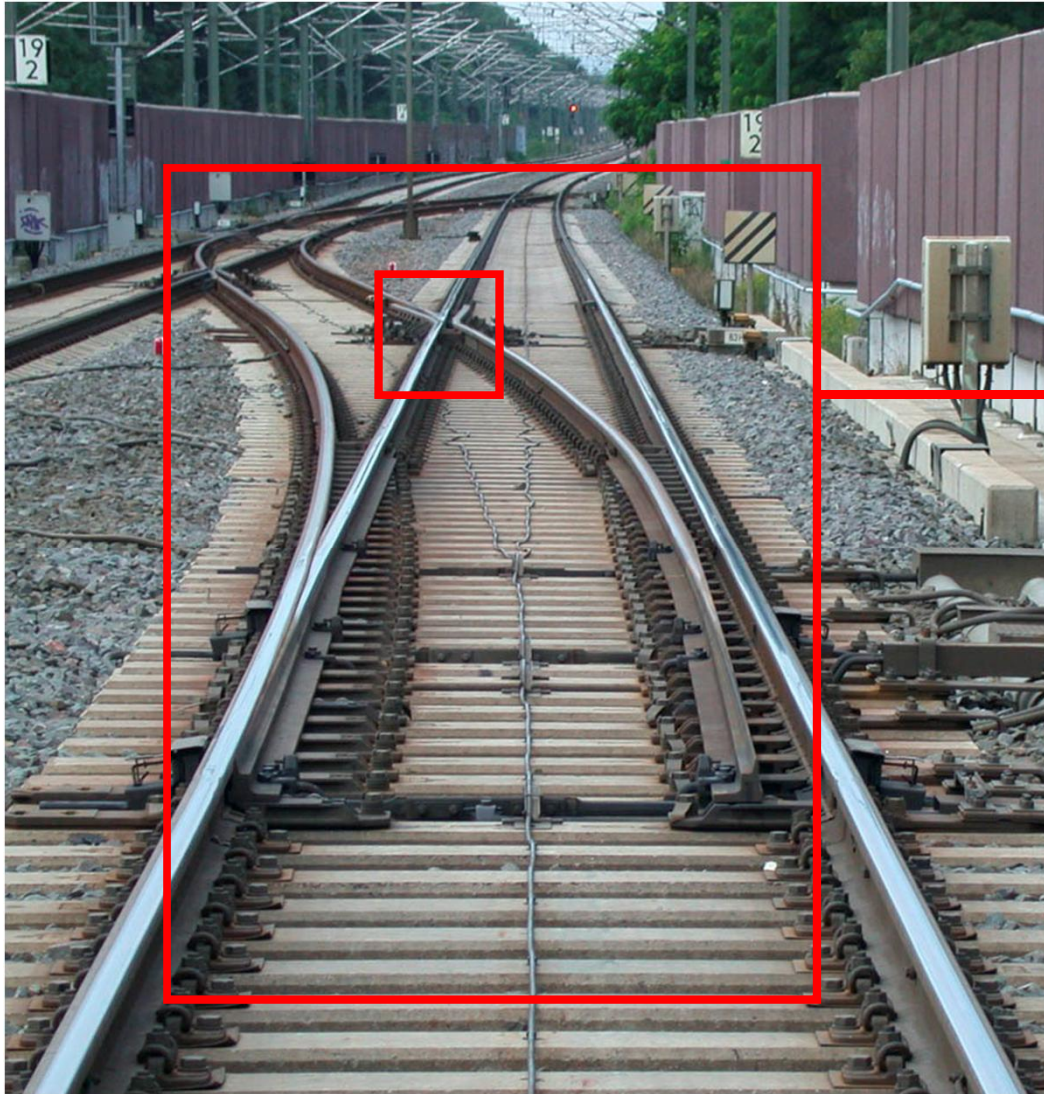


# Slab track construction and its benefits

- The rail pad stiffness may be significantly reduced without compromising on the level of vertical bending stresses experienced by the rail
- Reduction or elimination of the rail bow-wave effect or lift-off
- Elimination of the superstructure lift-off from the supporting ground that potentially leads to voiding



# SP3- Switches and Crossings

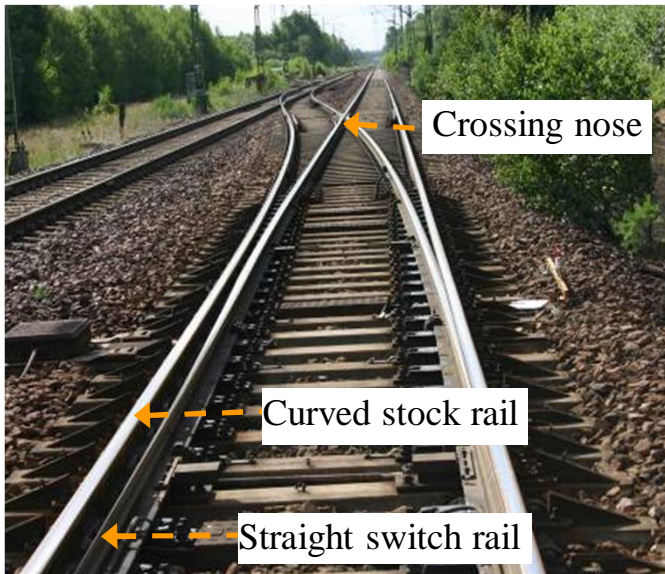


## WP 3.1 - S&C

- global and local geometry
- materials
- maintenance

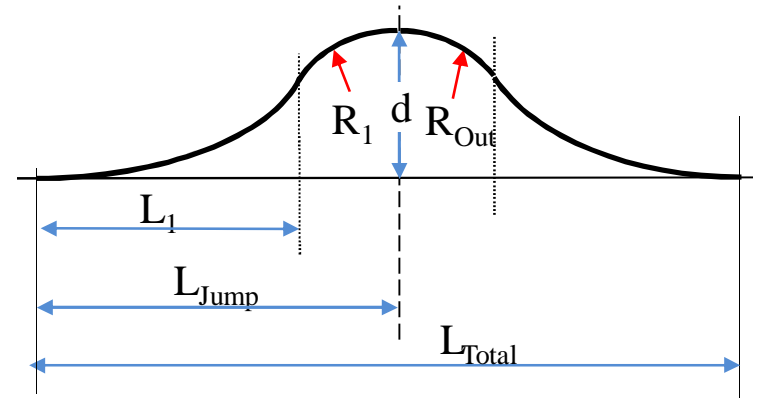
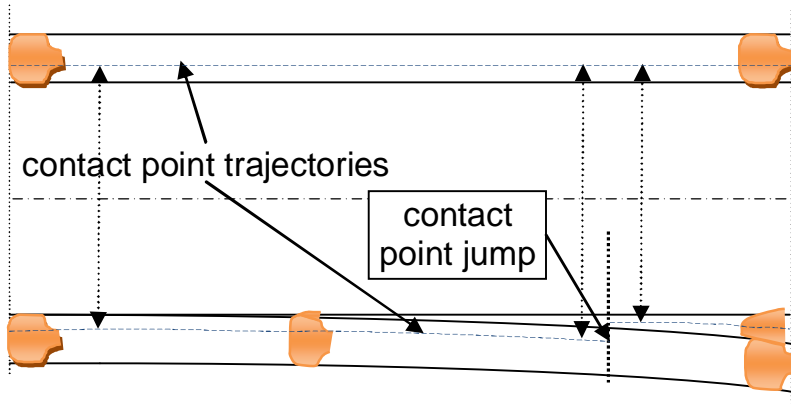
# Switches and Crossings

A railway turnout situated close to Halmstad in Sweden

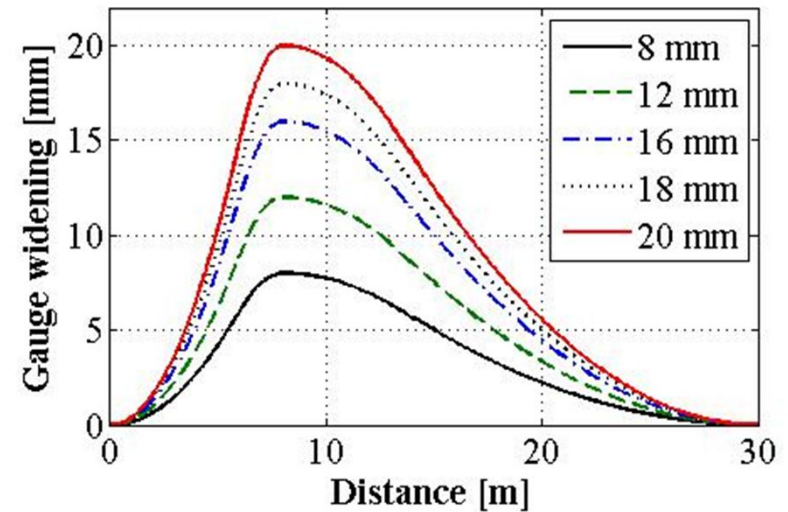


- S&Cs are subjected to high concentrated loads from passing vehicles. This makes S&Cs sensitive to damages
- S&Cs are highly represented in operational failure statistics and a S&C failure will cause major operational disturbances
- The “Health” of a switch depends on several influences: vehicles, substructure, maintenance at the right time

# Track gauge optimisation

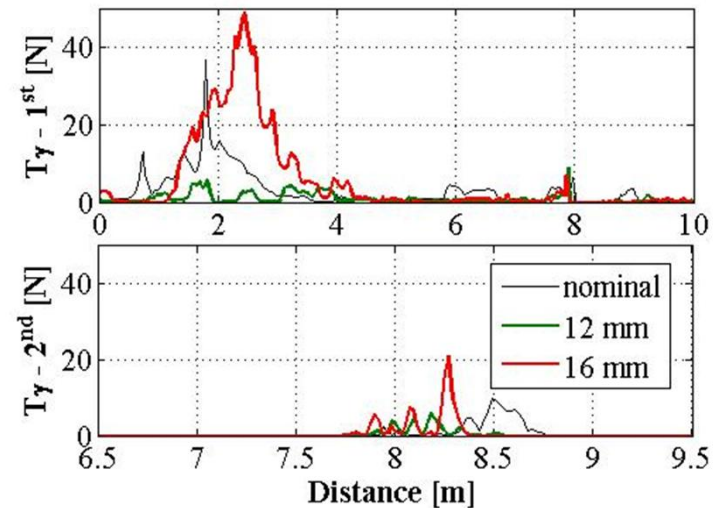
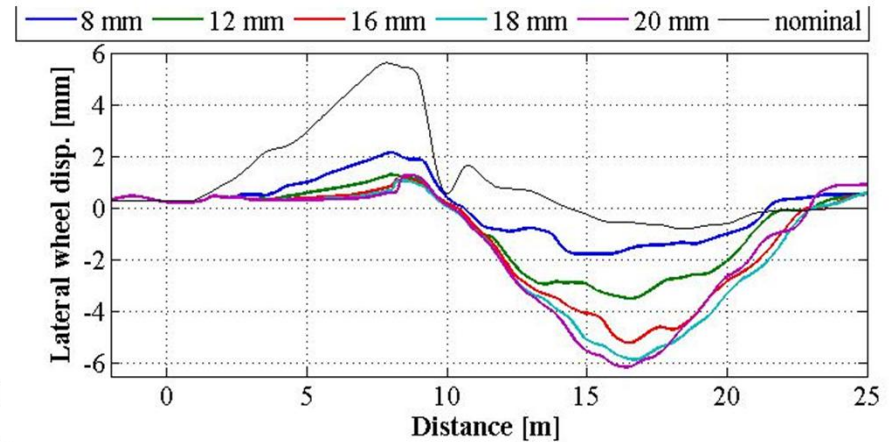


The geometry for gauge variation is represented by three variables:  $L_1$ ,  $R_{out}$  and  $L_{Total}$



# Track gauge optimisation benefits

- it balance the artificial gauge increase (dynamic gauge widening) at the switch entry which reduces wheelset displacement
- relieves the flange contact with the switch rail at the early stage by steering the wheel towards the other rail
- the gauge widening leads to a significant improvement in the wear index



# Our visions

- To be a leading group in Railway track research
- To provide with a high level and advanced courses within the highway and railway engineering
- To support railway industries in their staff development course
- To provide a high quality support and advise to industries
- To start Nordic Association of rail research – Universities and Industries

## Undergraduate

- Undergraduate programme
- Tailored courses
- Short courses

## Graduate level

- Masters courses
- Professional development courses
- Introducing with researches

## Research

- Doctoral courses
- Research supervision

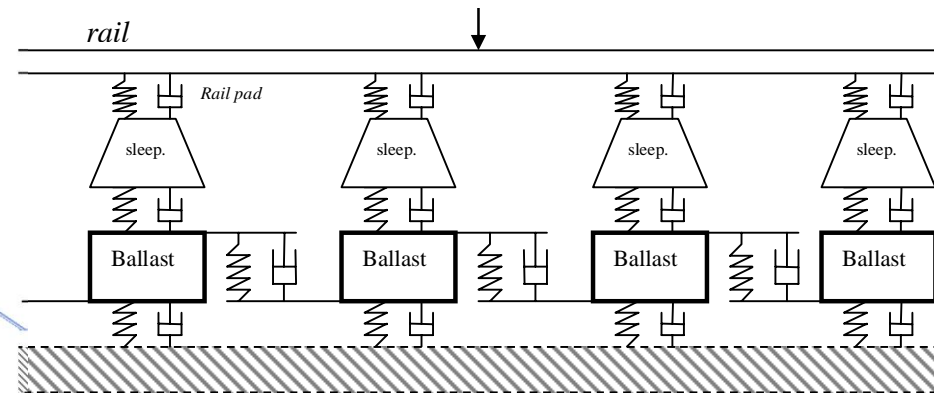
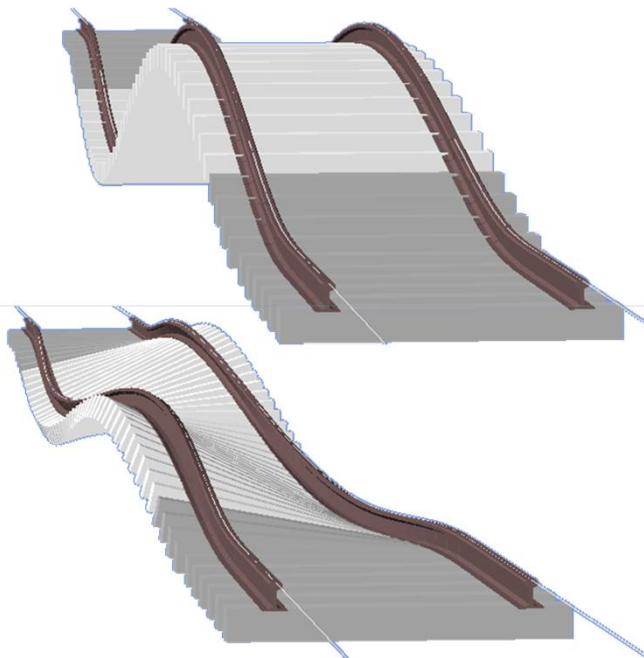
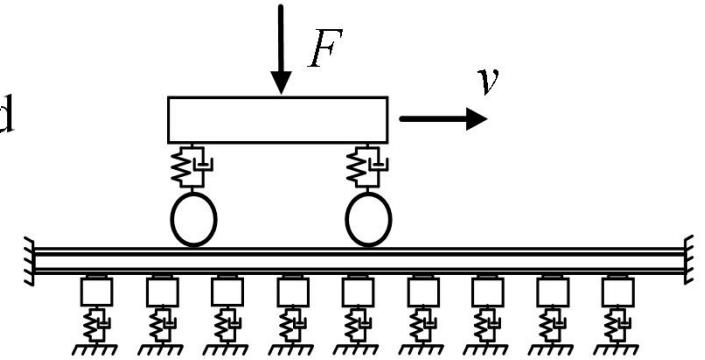
# Areas of research and education

- Railway operation and maintenance courses
- Introduction to Highway and Railway Engineering course
- Advanced pavement and track design



# Areas of research and education

- Innovative track support forms
- Permanent way design – geometry and structure
- Green track
- High speed track





# National and International Collaboration

## **KTH group involvement**

- Centre for operation and maintenance ‘Centre för Drift och Underhåll’ (CDU)
- KTH Railway Group (KTH Järnvägs grupp)
  - Rail vehicle, train traffic, railway traction and machine design groups

## **National collaboration**

- Charmec (Chalmers järnvägsmekanik)
- Jvts (Luleå Järnvägsteknisk centrum)
- Trafikverket

## **International collaboration**

- Rail Technology Unit, University of Southampton (ISVR), and Imperial College London, UK
- Beijing Jiaotong University, China