KTH
VETENSKAP OCH KONST

Järnvägsgruppen

Invitation to KTH Railway Group seminar (+lunch)

When: Thursday 21st September 2017 at 09.15-11.50

Where: KTH, Teknikringen 8, ground floor, Vehicle Engineering Laboratory

09.15-09.30	Coffee etc
09.30-09.35	Welcome
09.35-10.00	Minghui Tu, Ulf Olofsson and Jens Wahlström: *Field tests about airborne particle concentration of railway traffic*
10.05-10.30	Yezhe Lye, Ellen Bergseth, Minghui Tu and Ulf Olofsson: *Effect of humidity on the tribological behaviour and airborne particle emissions of railway brake block materials*
10.30-10.45	Information from the Director
10.45-10.55	Break
10.55-11.20	Visakh V Krishna, Mats Berg and Sebastian Stichel: *Derailment risks in operation of long freight trains*
11.25-11.50	Mats Berg: *Key Performance Indicators for the impact of Shift2Rail*
11.50	Lunch

For participation in the seminar and lunch, please inform Mats Berg at mabe@kth.se by 18 September at the latest.

Welcome!

Sebastian Stichel and Mats Berg
2017-09-07

Field tests about airborne particle concentration of railway traffic

PhD student: Minghui Tu, minghuit@kth.se
Main supervisor: Ulf Olofsson
Co-supervisior: Jens Wahlström

A field test and two pre-tests were performed to measure the particle concentration at newly built commuter train stations in June and July 2017. New platform doors as shown in Figure 2 were used at the new stations on Odenplan and Stockholm city from July 10th, 2017, which is a good opportunity to investigate the effect of new train stations and platform doors to the particle concentration.

The two pre-tests were performed on June 21st and June 28th. The particle concentrations on the Odenplan station platform and in the train tunnel were measured by OPS device during the first pre-test. During the measurements, the platform was empty and there was no train passed by. For the second pre-test, particle concentration was measured on the Odenplan platform. During the measurements, a test train was running back and forth 10 to 20 times in a short distance and the train stopped every time at the Odenplan station with train doors and platform doors opened and closed in a short time to simulate the real operating process.

During the formal test, in order to measure the particle concentration around general passengers, an OPS device was put into a backpack and using a long rubber tube to sample the particles as the height as passengers' mouth, which is shown in Figure 1. The OPS was carried with experimenter to get on and out of the trains and walk and sit on the platforms from Sonla to Älvsjö station for four days from July 16th. Then, two-days measurements were performed at Odenplan station for four hours per day to get the changing of particle concentration when train stopped and when platform doors opened and closed.

Figure 1. OPS in a backpack with rubber tube

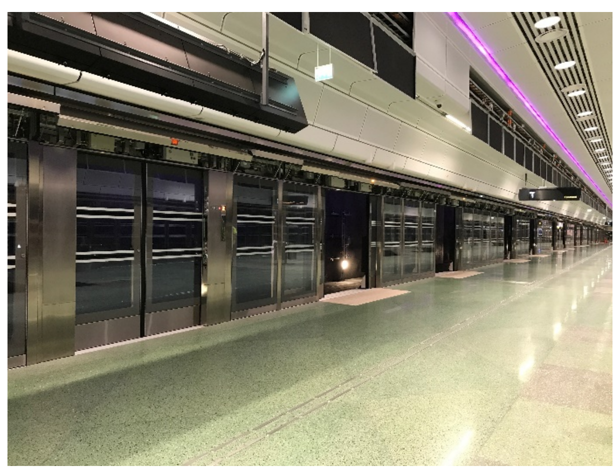

Figure 2. Platform doors at Odenplan station

Effect of humidity on the tribological behaviour and airborne particle emissions of railway brake block materials

Yezhe Lyu*, Ellen Bergseth, Minghui Tu, Ulf Olofsson

Department of Machine Design, KTH Royal Institute of Technology, SE 100 44, Stockholm, Sweden

A pin-on-disc tribometer placed in a one-way ventilated chamber was used to investigate the effect of relative humidity on the tribology and airborne particle emission of three commercial railway brake block materials (grey cast iron, organic composite, and sintered). Cast iron showed the highest friction coefficient, particle emission and wear loss and organic composite exhibited the lowest. The generation of oxide layers on the worn cast iron surface resulted in a decrease in friction, particle emission and wear. Moisture adsorption by the organic composite leads to decreased friction coefficient and particle emission with increasing humidity. Relative humidity does not affect the friction coefficient of the sintered brake block, whose particle emission and wear loss significantly decline with increasing relative humidity.

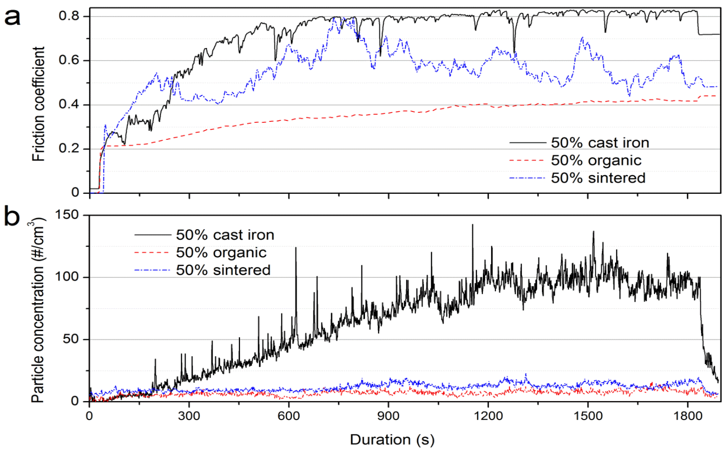

Fig. 1 Time history records of (a) friction coefficient and (b) particle concentration of three brake block materials at 50% RH

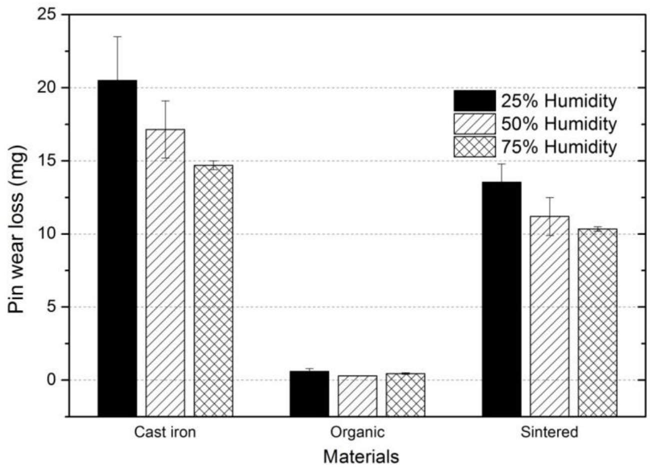

Fig. 2 Wear loss (mean value and standard deviation) of three brake block materials tested against rail steel at different RH

Derailment risks in operation of long freight trains

Visakh V Krishna, Ph.D. student, visakh@kth.se
Supervisors: **Prof. Mats Berg**, **Prof. Sebastian Stichel**, KTH Rail Vehicle Division.

Efficient and safe operation of freight trains require assessment of its running behavior. As the freight trains get longer the Longitudinal Train Dynamics (LTD) part become more pronounced on its running behaviour, in particular if the traditional pneumatic (P) braking system is kept. The LTD for a freight train system is complex and depends on varying parameters related to (Figure 1):

- **Vehicles** such as wagon construction, buffer and draw gear characteristics, suspension characteristics, loading conditions, brake block material.
- **Infrastructure** such as curve radius, track cant, gradients.
- **Operation**: braking/traction scenarios, load distribution and wagon/locomotive placement throughout the train.

As a part of the Shift2Rail project DYNAFREIGHT, KTH is involved in the proposal for safety precautions in long freight train operations by performing three-dimensional simulation and analyzing the derailment risk. Significant input is taken from the propelling test specifications in the standard UIC 530-2 (Figure 2) on the running safety of wagons for the formulation of a generalized methodology. A multibody simulation (MBS) model is constructed using GENSYS and 3D simulations are performed for varying wagon configurations on different curves such as S-curves and horizontal curves with constant radius. Open-type wagons of the 'Falns' type, used for transporting bulk commodities such as coal, is analyzed for demonstrator test cases. The derailment modes of the critical wagons in each case are studied (Figure 3) and the corresponding static Longitudinal Compressive Force (LCF) limits are tabulated.

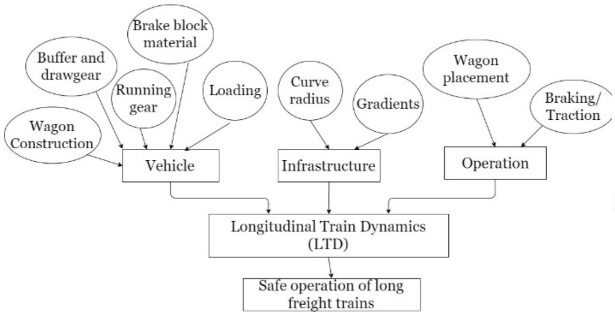

Figure 1: Longitudinal Train Dynamics of freight trains

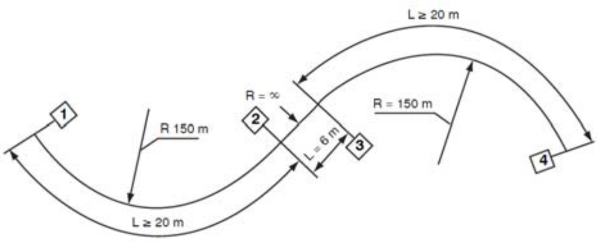

Figure 2: UIC 530-2 S-curve for propelling tests

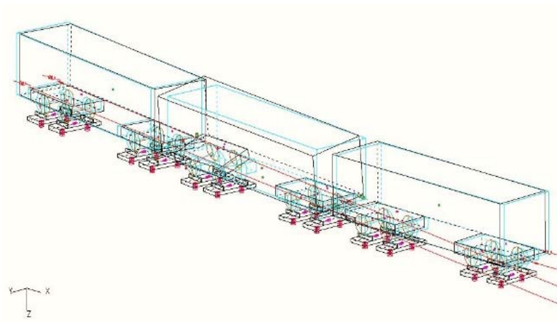

Figure 3: Derailment risk while passing through an S-curve

Key Performance Indicators for the impact of Shift2Rail

Prof. Mats Berg, KTH Railway Group, mabe@kth.se

The ongoing Shift2Rail research programme is to monitor the impact of its research and demonstration activities. For this purpose Key Performance Indicators (KPIs) are to be used. In particular, three high-level KPIs have been defined and quantified:

- **Capacity** of the European rail system should be doubled.
- **Life Cycle Cost** of the system should be halved.
- **Reliability** of the system should be improved so that the lack of punctuality is halved (e.g. increasing punctuality from 80 to 90%).

To coordinate these efforts a so-called Cross Cutting Activity through the project IMPACT is launched. Trafikverket is one of the partners in this project and Trafikverket has engaged VTI and KTH in the project. VTI is studying socio-economic effects of a modal shift to rail as well as definition of baseline (reference) rail systems. KTH is involved in the KPI definitions starting from the high-level ones above.

A challenge in the KPI definitions is that the Shift2Rail research is very broad in scope covering all components (infrastructure, vehicles, operation etc) in the rail systems which in turn comprise of urban, regional and high-speed passenger systems as well as rail freight. The research is organized in more than 40 so-called Technology Demonstrators (TDs) and in principle each TD should contribute to the goals listed above.

In this process, each TD leader has been asked to indicate which (low-level) KPIs the TD has defined and how these can be linked to the high-level KPIs through so-called intermediate KPI proposed by the IMPACT project. A draft example is given in the figure below for TD1.4 Running Gear. Here the blue boxes are the high-level KPIs, also including "Attractiveness", the orange boxes the intermediate KPIs and the green boxes the low-level KPIs. Also units for the KPIs are proposed whereas the arrows indicate relations. In this and other TDs the arrows are then to be represented by mathematical relations, followed by a challenging merging process of the contributions from all the TDs to the high-level KPIs.