Introduction of the PantoSystem

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2016-10-14
How our railway customers can:

- prevent some accidents caused by defect pantographs
- cost savings using predictive maintenance concerning the carbon strips
About us

• Pantoinspect A/S is the company behind the PantoSystem, developed for infrastructure owners and train operators within the railway industry.

• Our history started in 2008 where we initiated the first work and development with Banedanmark.

• The development of our core technology and the production of the PantoSystem is made in-house at our property in Copenhagen.
Example of an accident that will cause passenger delays and high costs

- the wire is down (ex. tangled in a train’s pantograph) - no trains can run until the broken equipment is cleared away.........

- significant costs are incurred as a result of each de-wirement incident, such as penalties and costs incurred repairing damaged equipment......... and bad press!
Example of Overhead wire problems from september 2016 in Sweden

- incident outside Malmo in south Sweden where the train traffic was stopped several hours caused by a de-wirement

  The overhead wire is down

  This train had to stand still 3 hours before evacuation

- the total number of incidents in Sweden caused by defect contact overhead wires is 400/year

- the number of delayed hours have increased from 6000 hours 2013 to 8000 hours 2015 caused by increased train traffic

Source and pictures: The daily local newspaper Helsingborgs Dagblad 2016-09-04
Example of an accident from October 2016 in India

The pantograph got entangled with an overhead Bringing the train to an abrupt halt

- The incident took place at 12.32 pm, when a pantograph of the Kalyan-CST down train became entangled with an overhead wire between Kurla and Sion stations

Source and pictures: www.mid-day.com By Vedika Chaubey
When Overhead Wires Are Torn Down ...

- Repair Costs
  - Overhead wires
  - Train pantographs

- Traffic delays
  - Cost of service contracts
  - Refund of passenger fares
  - Cost of lost business
  - Brand damage (Bad press)

- Risk of person injuries
More effective replacement of the carbon strips

Reduce the lifecycle cost of the pantograph carbon strips

- effective and automated condition monitoring of the pantograph
- in combination with the use and analyzing of captured data against the individual pantographs

Predictive maintenance will reduce maintenance costs
Pantosystem and the advantages for the users?

Rolling Stock owners
- predict, when maintenance should be performed. This approach promises cost savings over routine or time-based preventive maintenance.

- get an indication of a defect or wrong adjusted pantograph

- protect your image and increase the customer experience by less by lower rolling-stock stops

- More effective use of the depots

Infrastructure owners
- prevent that damaged pantographs can cause overhead wiring tear-downs

- avoid some of the costly network delays

- avoid costly infrastructure repairs

- avoid timely and costly manual inspections

- avoid bad press
Measurements of:

- Carbon surface shape
  — Dangerous cracks and chips
  — Thickness of remaining carbon
- Pantograph uplift
- Pantograph yaw
- Horn presence

Additionally the scanner captures a regular image of the pantograph to allow for manual visual inspection.

Each train and pantograph is identified
How The PantoSystem Works

1/2

The Pantolinspect frame is made of stainless steel and can be serviced without requiring interruption of train traffic by means of a lifting module (other servicing modes are available).

Grafik: Martin Kirchgaessner - Kilder: Image House
How The PantoSystem Works
2/2

Lasers and cameras provide images of the laser lines as well as a NIR photo using a diode flash. Photos and data are transferred to a central server. The server analyses the images for defects and damages.

NIR (near infrared) photo available for visual verification

Graphics: Martin Kirchgässner
Examples of a pantograph and damaged carbon strips
The PantoSystem is Unique in Several Ways

- Delivers real-time condition monitoring of trains during operation
- Designed and proven for outdoor 24/7 use - all year
- Detects large carbon defects, small cracks and measures a rich set of wear features
The WEB based PantoClient

• Provides access to measurement data through an easy to use graphical interface
  — Which is prepared for integration to custom IT and maintenance systems

• Allows an individual configuration of thresholds and other settings

• Receives alerts and subsequently manages workflow
Example of alarm

PantoSystem
Traffic Alarm Report

Main Report
PantoSystem Traffic Alarm Report · Train D 6139 · Location Thomsen Up · Time 2015-02-10 17:15:29

ID: D 6139, vehicle: 1
Pantograph 1
Pantograph type: A/B/SEG

Pantograph image. Train Average Velocity: 76 km/h = 47 mph.

Pantograph 1
Carbon strip 2

Alarm
Remark

Status Report
# Analysis Status Value
1 Yaw angle Ok 0.3°
2 Horn deformation (left) Ok 3 mm
3 Horn deformation (right) Ok 2 mm
4 Carbon thickness Ok 8 mm
5 Uplift Ok 3 mm
6 Uplift force Ok 97 N
7 Edge chip Alarm (medium severity) Width: 26 mm Depth: 2 mm Width: 26 mm Depth: 32 mm

www.Pantoinspect.com

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Missing Carbon in Australia
March 3, 2015

At 17:34

At 06:53 next day ...
Example of false alarm rate

High Threshold – i.e. less sensitive analysis, only major defects detected:

- True Alarms: 12 corresponding to 0.027%*
- False Alarms: 2 corresponding to 0.004%*

The number of false alarms is less than 1 of 20 000

* All test results based on live customer data from the PantoSystem Test Library
Number of train passes tested: 6 542 (during 48 days)
Number of carbon strips tested: approximately 45 000
• 40 years = lifetime of a locomotive
• At least once in its lifetime every locomotive gets a dangerous pantograph
• Assuming 4500 locomotives running, the infrastructure owner may have ca. 115 dangerous pantographs in the net every year!
• Approx. 10% of this locomotives will turn down the wire
• Approx. 12 accidents x 100 000,- €
• **Approx. costs = at least 1.2 mio. € every year!**
• Image (bad press) loss and costs because of missing train operation are not taken into account
PantoInspect is Currently in 4 Countries

- **Denmark Banedanmark**
- **Australia Sydney Train**
- **South Africa Transnet**
- **Austria ÖBB**
Thank you!

Questions?

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