Mid-Term conference – 04/12/2013

Task 4.5 – Track based monitoring and limits for imposed loads

Diagnostic of the Railway infrastructure

The main scopes of Railway Infrastructure Inspection and Monitoring are:

- To discover critical defects (defects that can have impact on safety)
- To guarantee a high quality of the railway infrastructure by removing critical defects
- To drive maintenance operations
- To check the results of maintenance operations

To achieve this goal the best practice is to monitor the conditions of the infrastructure:

- Adopting appropriate inspection frequency
- Using high quality, reliable measuring systems
- Without stopping or limiting the operations of commercial trains

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Different practices and polices

Safety monitoring

- Focus only on last surveys, not taking account of history

Predictive maintenance

- Condition based preventative maintenance, driven by deterioration of the structure, rather than the widespread practice of using time-interval based maintenance
- Anticipate the failure and optimize the maintenance

Advantages of condition based maintenance

More effective inspection, maintenance & renewal activities

- Increased inspection frequency and more consistent inspections
- Prioritized & focused activities
- Avoid of unneeded activities
- Extended rolling stock service life

Advanced diagnostic of Railway infrastructure

- **Replace “FIND and FIX” with “PREDICT and PREVENT”**
- **Replace “INSPECT” with “MEASURE”**
- **Measure TREND and not only DEFECTS**
- **Implement automatic controls wherever practical**
  - reduce human variability / fallibility
  - reduce track worker safety exposure
  - reassign skilled staff to maintenance
  - measure and verify quality of work execution

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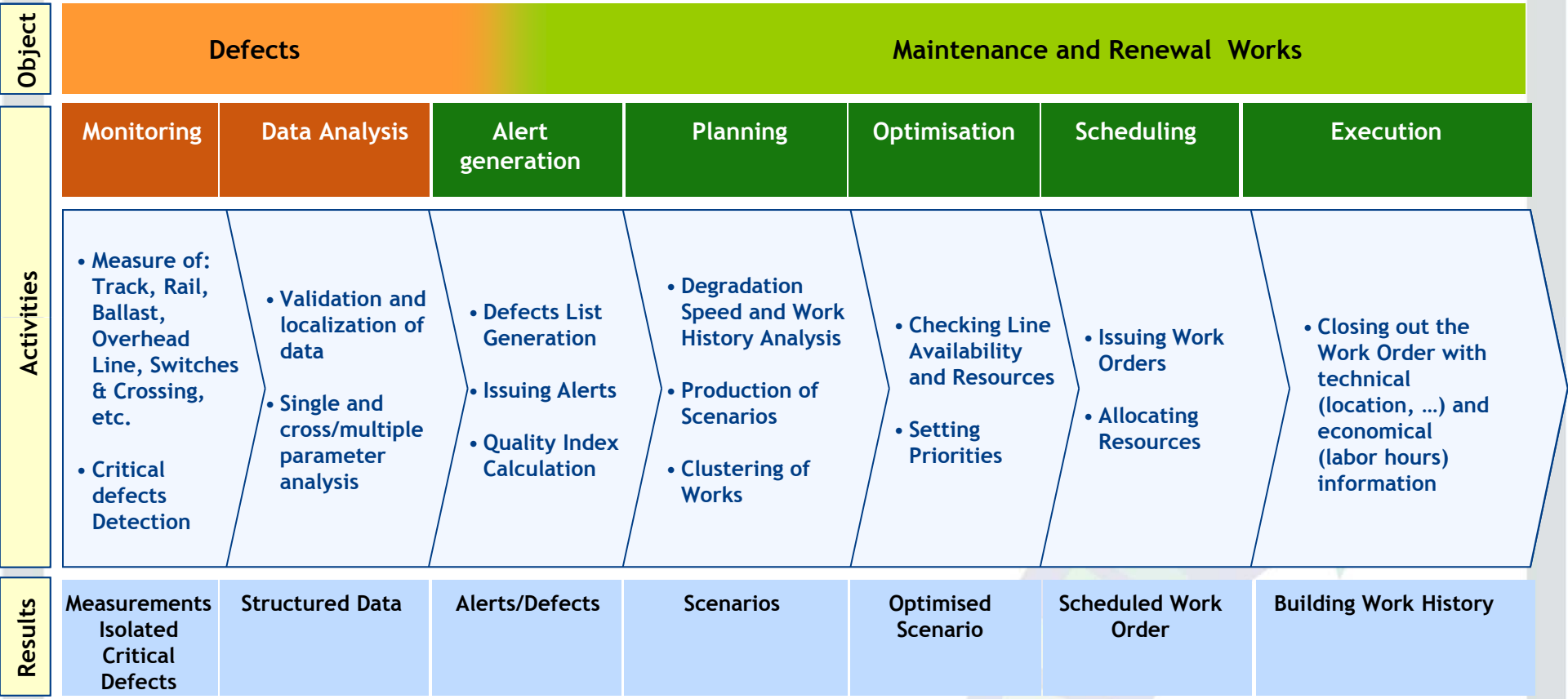
Enhanced Condition-based maintenance



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Track Monitoring Systems

Instrumenting a test vehicle

- On Board monitoring systems
- Determine if the track is imparting abnormal loads to the vehicle
- Sensors and monitoring systems placed in trains in regular traffic can help to make daily inspections of the track components and the track geometry without generating added track access as special inspections vehicles do.

Instrumenting the track

- Wayside monitoring systems
- Determine if any particular vehicle is imparting abnormal loads to the track
- Enhanced wayside monitoring systems can give early-warning on defect vehicles and redirect them to a workshop based on economic maintenance limits

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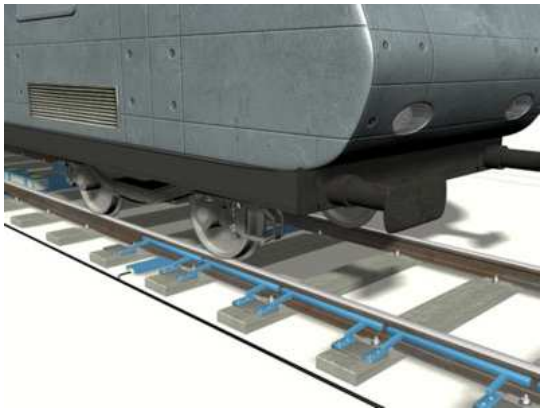
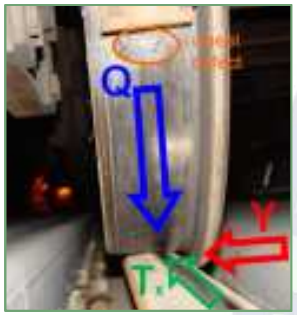
Examples of wayside monitoring technologies

- Static/Dynamic Train Weighing Measuring System & Wheel Flat detection based on Strain gauge or Braggs gratings (ALC/WILD)
- Wheel Profile & Diameter Measuring System based on optical triangulation measurement principle
- Brake Pads Wear based, Brake disk and shoe-gear wear
- Wheel temperature trending
- Wheel defects detection based on machine vision technology





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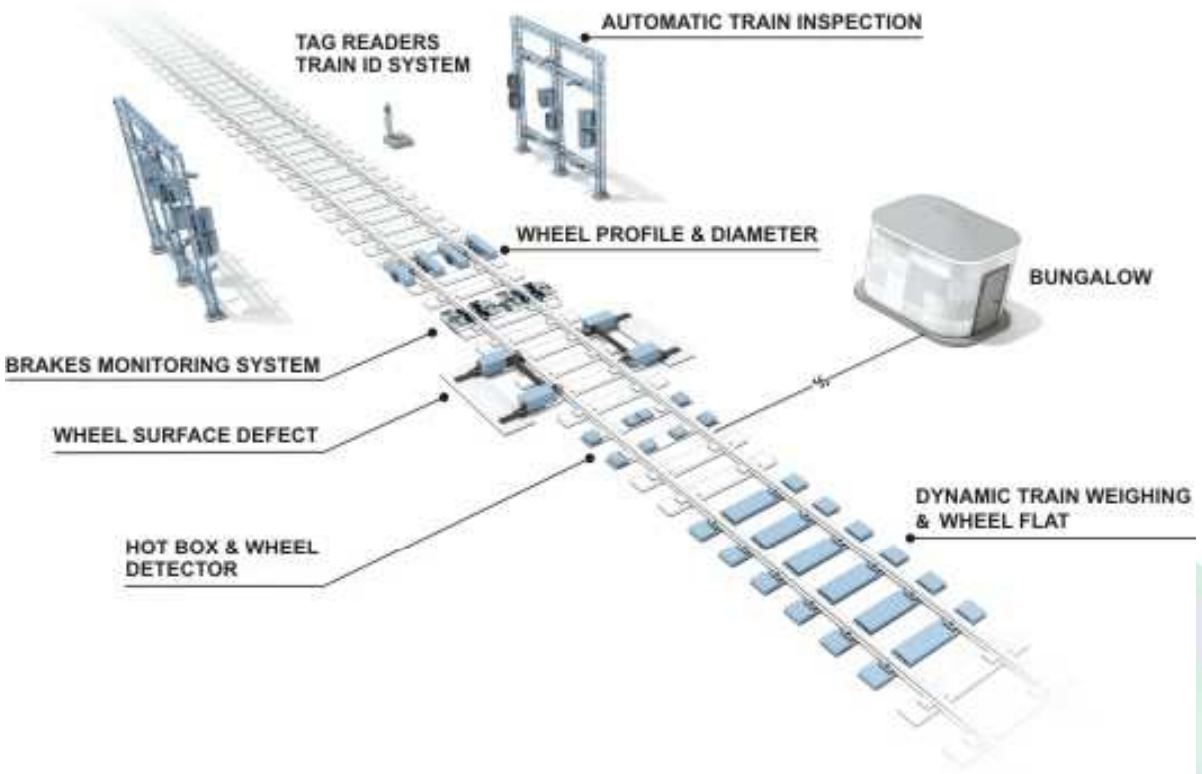
Monitoring inspection station



- Implementation of complementary monitoring sub-systems
- Fleet data management database
- Provides a comprehensive and meaningful evaluation of the performance of freight wagons

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Objective and development of a “weight station”

- Provide capability to reduce the uncertainty associated with critical parameters characterization; reflect their evolution (helpful for new designs and track optimization)
- Identification of best practice; Recommendations about limits and safety criteria; Definition for range of actual loads imposed by trains
- Lead to maintenance costs reduction without compromising safety

Develop a “weigh station” for railway track

- Indicate if abnormal loads caused by a variety of factors are being delivered to the track system by passing vehicles
  - Overloaded vehicles, excessive velocities, or vehicles with damaged wheel sets or suspension components.
- Produce data and statistics on the track utilization
  - Input to track maintenance planning and the prediction of track degradation
- Guidelines for the location of installations
- Optimization of the whole system LCC

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Inputs from other European projects

Innotrack

- Define Minimum Action Rules

Axle Load Checkpoint

- Define wheel load detection
- Define intervention levels (vertical and lateral loads)

Sustainable bridges

- Use of sensors for the monitoring of structural condition

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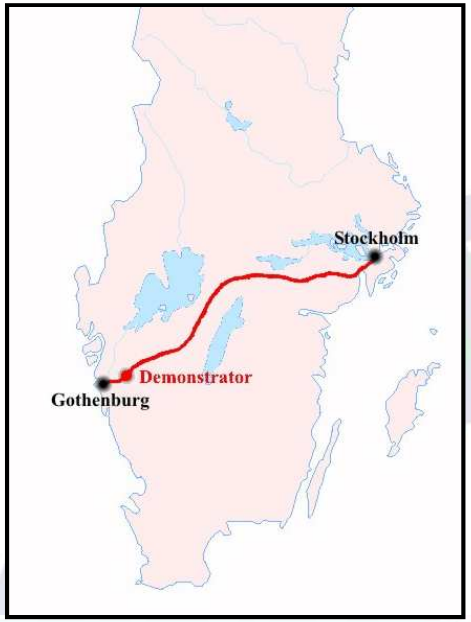
Damill monitoring station

Background

- Damill has developed and installed a wayside monitoring station for Innotrack
- The station is still in service for demo purposes and development tests
- It is placed on the Swedish western main line between Stockholm and Gothenburg
- The line carries a broad spectra of different vehicles, i.e. mixed traffic

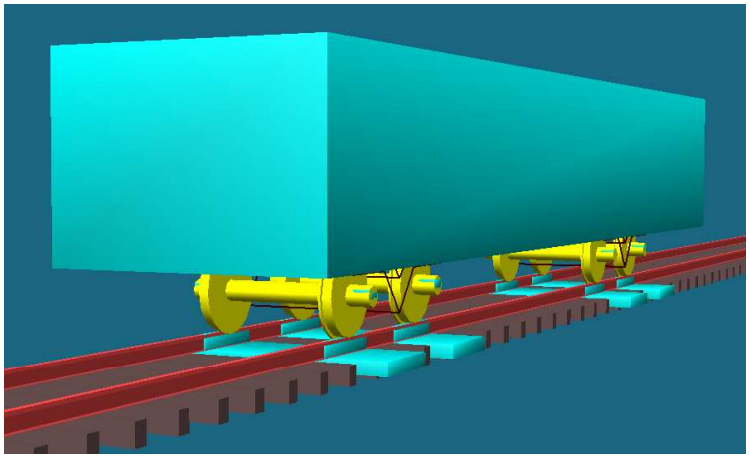


Current Output

- Speed & axle counting
- Loco type identification
- Vertical & lateral forces per wheel
- Angle-of-attack
- Wheel defect counting

The station is a great data source available for statistics

Other contributions



KTH proposed activity- Simulations using MBS software GENSYS;

Model of freight wagon with Y25 bogie

UoH Dynamic smart washer - allowing for the instrumentation of complex systems, in particular switches, whilst in operation and with a wide range of dynamic loading – adapting condition evaluation algorithms for railways

Conclusion

Objectives:

- Focus on limits for imposed loads
- Link with other Tasks (New track design, S&C…)
- Increase sensors performance (accuracy, location, limits, data processing and exchange)
- Improve effectiveness of information from measurements about physical defects
- High reliability rule sets for automation of maintenance planning

Benefits:

- Reduce the number of unplanned stoppages
- Safety improvement
- Increase maintenance productivity by closer targeting of critical components/vehicles
- Increase railway capacities

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Thank You!