Railway equipment
- Adapting to climate change

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Agenda

1. Rolling Stock
2. Infrastructure
3. Process
4. Conclusions
Rolling stock issues – reliability, availability & safety

- High temperatures
- Sand and dust
- Humidity and salt
- Strong winds
- Big weather variations
Adaptation of Rolling Stock to extreme conditions

- Resizing of the electric and the electronic equipment
  - Temperature of functioning of the standardized interface equipment
  - Cooling of the power supply system, power converter, engine
- Protection of electronic control panels
- Sanding equipment
  - Cyclonic filters, blades, bellows
  - Roof air supply
- Reinforcement of thermal isolation (car shell, windows)
- Reinforcement of the air-conditioning system
- Installation of window-blinds
- Condensation protection
- Management of air-flow
Adaptation of Rolling Stock to extreme conditions: Traintracer

- **Real-Time** condition monitoring – understanding the health of a train at any moment and the trends
- Turning railway data into *meaningful information* for operators and maintainers
- Supporting *predictive* maintenance
- Optimising *fleet management*
- Anticipating train movements and troubleshooting
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Infrastructure issues & solutions: Track

- Desert conditions – sand in the ballast
  - Add vegetation; fencing
  - Use of slab track

- Track buckling
  - Rail expansion joints and fastenings
  - UV testing
  - Composite materials

- Urban track
  - Concrete durability
  - Reinforcement
  - Depth of concrete layer
  - Flooding

- Tracktracer
  - To monitor the state of the track in real time
Infrastructure issues & solutions: Electrification

- Sand storms
  - Sand eats catenary and pantograph pads
  - Enhanced filters against sand/dust

- Heat
  - Redundant systems e.g. back-up cooling systems

- On board cameras
  - To monitor the state of the catenary
Infrastructure issues & solutions: Signalling systems

- Very little track-side equipment with the latest technologies
  - Balises; point machines; some lights

- Need to protect electrical cables
  - Composites
  - Troughs
  - UV tested

- Electronics
  - Redundancy built-in
  - Maintenance is reactive

- Remote health monitoring (ex: point machines)
  - Monitor current needed to move the rail over time
  - Alert mechanism
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Climate Change Impact Assessments and Adaptation reports

The start of a trend in railway system procurement

- Identification of project-specific climate change risks
- Identification of risk mitigation measures
- Outlining how risk mitigation will be addressed through the design process to reduce risks to “low” where practicable
Climate Change Impact Assessments and Adaptation reports

- Assessing primary risks specific to a project/alignment e.g.
  - Temperature: incl. increase in annual average temperature and heatwaves
  - Rainfall: reduction in annual average rainfall, increase in extreme rainfall events and associated flooding
  - Storm events: including hail, lightning and severe winds
  - Sea level rise and storm surge
  - Other impacts: e.g. increased CO₂ in the atmosphere and increased solar radiation

- Assessing current controls
- Proposing adaptation actions
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Conclusions

- We need to design for an increased frequency of extreme events
- Tell us what conditions you need us to design for and we will do it
- Important to monitor the health of key equipment – to predict issues
- Careful planning needed to ensure rapid restoration of service after extreme climatic events
- Extreme conditions represent constraints and cost but we already have a portfolio of proven solutions