Managing Extreme Weather at Transport for London

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Long Term Climate Change

- 1. What TfL Does
- 2. UK Government (Adaptation Reporting Power (and reviews), National Adaptation Plan)
- 3. Environment Agency (Thames Estuary 2100 and threshold approach, Infrastructure Operators’ Adaptation Forum), ClimateWise
- 5. TfL Risk Identification (Analyse climate projections)
- 6. LU Comprehensive Flood Risk Review
- 7. Communicating and assessing key risks in workshops
- 8. Communicating risks – heat maps
- 9. Mitigating Risks (Design)
- 10. Mitigating Risks (Design) Examples from Northern Line Extension
- 12. Mitigating Risks (Asset management, PAS 2050)
- 13. Mitigating Risks (Cooling the Tube Programme)
- 14. Identifying inter-dependencies

Managing Today’s Extreme Weather

- 15. 54321
- 16. Communications/manage expectations
- 17. Positive Impacts and Opportunities
What Transport for London Does

- 580km of major roads
- 6,000 traffic signals
- Bridges and tunnels
- Congestion Charging Scheme
UK Government Initiatives for Managing Impacts of Climate Change

Climate Change Act 2008

UK Climate Projections 2009

Adaptation Reporting Power
- Key sectors and companies
- Legal duty to report on risk assessment and mitigation

UK Climate Change Risk Assessment
- Detailed analysis of 100 potential impacts of climate change

National Adaptation Programme
- Published w/c 24 June!
Regulator’s Initiatives - Environment Agency

Thames Estuary 2100 Project
- A long-term flood risk management plan for London
- Options identified for first 25 years, middle 15 years and final 50 years

Uses Flexible ‘Threshold’ Planning Approach
- How effective would options be against current projections?
- How effective would options be if projections were to worsen?

Communication
- Infrastructure Operators’ Adaptation Forum
- Climate Ready
London Regional Initiatives – the Greater London Authority

- **London Plan** – spatial planning with adaptation rules for developments
- **Mayor’s Climate Change Adaptation Strategy**
- **London Climate Change Partnership** – forum of key sector representatives
- **Drain London Partnership** to map and manage surface water flooding
- **Ecosystem services** – policy behind green streets, sustainable drainage
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TfL Risk Identification (Analyse climate projections)

- A series of probabilistic scenarios based on all latest research
- Regional data for temperature, rainfall
- Different emissions scenarios
- Analysed and presented numbers to engineers
- Used Greater London region, liaised with GLA
- Checked consistency with existing TfL models eg Tunnel Cooling Programme
London Underground’s Comprehensive Flood Risk Review

- Traditionally our flood risk methods measured the risk of loss of life
- Resulted in identifying low probability, high frequency events
- Now also valuing the risk of loss to business
- Capturing many more vulnerabilities with lower impacts but higher probability
Communicating and Assessing Key Risks in Workshops

- Warmer wetter winters, rainfall becomes more seasonal - Winter 2050’s (high emissions)
  - +1.5 - 2 3°C
  - + 25-30% rainfall

- Hotter drier summers - Summer 2050’s (high emissions)
  - +3°C
  - -30-40% rainfall

- By the 2040s, European summers like 2003 could become normal; by the 2060s they would be cool
  - Increased number of summer deaths during heatwaves (ref 2003)
  - Exacerbated by Urban Heat Island effect

- More frequent extreme weather

- Rising sea levels - increased risk of river flooding

- Poorer air quality - increase in PM10 concentrations in hotter weather
TfL’s Risk Identification and communication

1- Extreme Hot Weather - Key track, signals, & communications assets and staff & passengers.
2- Rain & Flooding - Track & signal drainage
3- Cold & Freeze - Impact on track integrity
4- Rain & Flooding – Key infrastructure drainage
5- Drought - Vegetation impact
6- Snow – track, signalling and depot operations
7- Cold & Freeze - Train system components
8- Cold & Freeze – Slips/trips for staff and customers.
9- Rain, Flooding and snow - Damage to inside of carriages
10- Wind- Damage to infrastructure, track and vegetation.
11- Drought - Ground stability impacts

London Underground Weather-Related Risks

<table>
<thead>
<tr>
<th>Likelihood</th>
<th>Impact</th>
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<tbody>
<tr>
<td>Very Low</td>
<td>Low</td>
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<tr>
<td>Low</td>
<td>Medium</td>
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<tr>
<td>Medium</td>
<td>High</td>
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<tr>
<td>High</td>
<td>Very High</td>
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<tr>
<td>Critical</td>
<td>Very High</td>
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Lessons Learned from Managing Previous ‘Extreme Weather’ Events

• **Partnership working**
  - With boroughs on plans
  - Key routes for buses, access roads to bus garages gritted
  - Plans agreed on how partners should co-ordinate priorities
  - TfL ran trains through the night to keep the tracks open

• **Clear communication strategy**
  - Important to have early multi-agency meetings as soon as first severe weather alert received.
  - Ensured mechanisms to deliver clear and consistent messages to media, business partners, customers
Design Included in developing assets which have long design life

- Crossrail build and operation
  - Train and tunnel temperature
  - Station design
  - Operator specifications

- London Overground capacity improvement
  - Included in sustainability appraisal
  - Sustainable design aims
  - Sustainable Drainage Plan

- Sustainable Drainage in maintenance and upgrades
  - Station enhancements eg Harrow on the Hill
  - Depot enhancements
Managing Risks - Design (Detailed Example from Northern Line Extension)

- Northern Line extension
  - Included in sustainability appraisal for seeking Planning Permission via a Transport and Works Act Order
  - Climate change plan in Environmental Statement of Environmental Impact Assessment

- Covers heat management
- Tunnel ventilation plan
The Power of Procurement Specifications

- Procurement specifications
  - Eg white bus roofs

- Programme delivery
  - Crossrail build and operation
  - Northern Line extension
  - London Overground capacity improvement
  - SUDS in maintenance and upgrades

- Comprehensive Flood Risk Review

- Tunnel Cooling programme

- Resilience, Business Continuity, Emergency Planning, Risk Assessments and management

- Drain London programme

- Environment Agency Sustainable Drainage Partnership
- Drain London
Mitigating Risk - Cooling the Tube Programme

Station Geometry

Network Model

Flow and Temperature Predictions
54321 Extreme Weather Readiness Plans

- Learning from Olympics Planning, network wide overview for first time

Day 5
- Receive weather forecast

Day 4
- Track weather forecast

Day 3
- Actions for Line general managers

Day 2
- Actions for line general managers

Day 1
- Forecasted risk condition begins
Communications, Managing Expectations

- Importance of communication, with customers, partners, businesses
- Employees’ and contractors’ skills, health and safety and quality of work
  - Currently no legal upper temperature limit for workers
- Services, timetables, frequency, emergency planning
- Customer comfort and information (eg snow alerts, Stay Cool LU campaign)
Positive Impacts and Opportunities