Transport for London's Climate Change Adaptation Programme

August 2011

Destination Green

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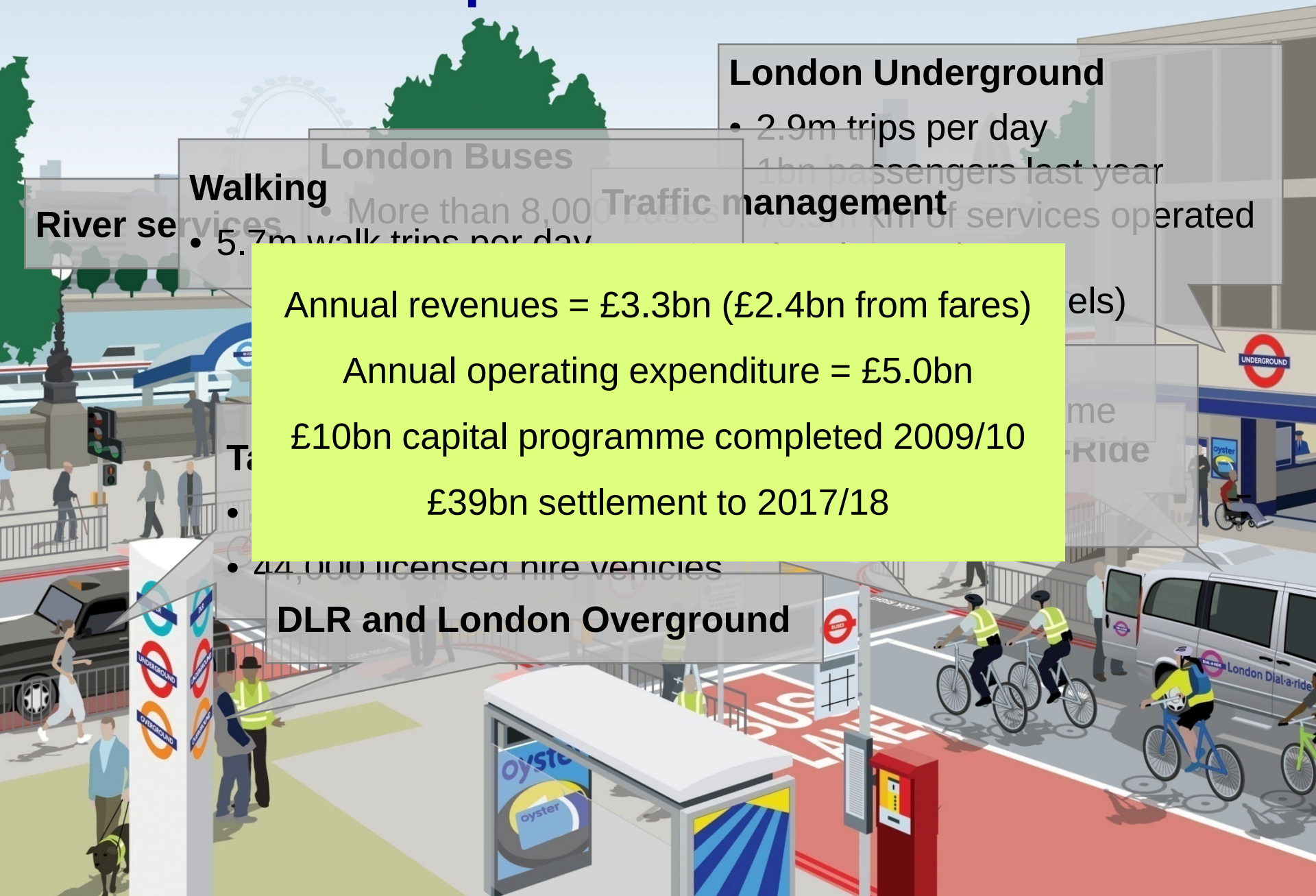
Transport for London



TfL's Existing Adaptation initiatives

Simple interventions where possible:

- White painted roofs on buses
- Industrial-sized fans on the Tube

Tube cooling represents a major challenge:

- Groundwater cooling at Victoria station
- Air-conditioned sub-surface trains
- Testing systems for deep Tube lines

Legal and Political Requirements

- The United Kingdom's Climate Change Act of 2008 requires government agencies (including the publicly owned transit authorities) to report on how they have evaluated and planned for climate change impacts

- The Mayor of London is developing a strategy, which has had its public consultation

Government Requirements for Evaluation

1. Climate change risk assessment is a clear component of corporate risk appraisal;
2. Risk assessment enables authority to make evidence based decisions;
3. Demonstrable use of relevant and appropriate data, information, knowledge and tools;
4. Explicit consideration of uncertainty and response;
5. Risk assessment generates priorities for action;
6. Risk assessment identifies opportunities (where applicable);
7. Clear demonstration of an adaptive management approach to the adoption of measures; and
8. Monitoring and evaluation of adaptation effectiveness.

Reports are evaluated by Cranfield University Risk Assessment Department

TfL's analysis of climate change information

- The UK government provided climate change projections for the country in 2009 that include a range of scenarios and confidence levels

Flooding
Water Resources
Overheating
Air Quality
Subsidence and heave
Wind Storms
Global climate events

Communicated by stories, backed up by data

Eg By the 2040s, European summers like 2003 could become normal; by the 2060s they would be cool

Assets

Tracks
Drainage
Bridges
Embankments
Signals
Stations
Green estate
Surfaces – platforms, footways, pavements
Transport interchanges
And ...?

Planned build eg stations, upgrades

Services, people and customer information

TfL's Climate Change Risk Analysis Workshops

Communicate the climate projections

Assess the impacts on services and assets

Quantify and prioritize the risks

Review the plans

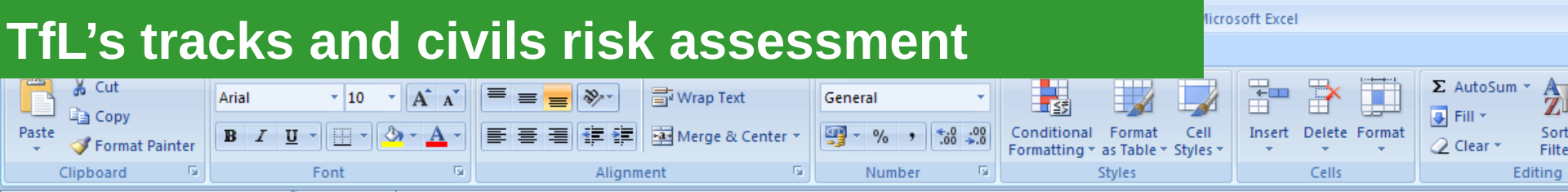
Using TfL's Main Risk Assessment Methodology

Measure	Probability	Cost	Time	Customer	Reputation
Risk	% likelihood occurrence this financial year or numbers of events in terms of year(s)	Decrease in revenue/increase in cost in financial year	Delay to achievement of key milestone	Reduction in customer service	Level or type of media coverage/ impact on relationship with stakeholders
Very high	≥75% Once or more per year	>£250m	≥52 weeks delay	Catastrophic asset loss for several weeks/months, affecting several lines. Repair timescales in months with total loss of service during that time Example: Major inundation of several lines from river tidal surge flooding	Prolonged and targeted hostile media campaign lasting at least 1- 5 years – -aimed at decreasing net advocacy amongst external stakeholders -challenging organisational competence in key public safety areas Example: Sustained media campaign against Railtrack following various safety incidents
High	50% - 75% More than once in 2 years	£175-250M	36-52 weeks delay	Major adverse impact such as: •disruption/loss of customer service on more than one line for several weeks •major event resulting in injuries and fatalities Example: Kings Cross Fire	• Continuous hostile media coverage of up to 1 year • Significant decrease in net advocacy amongst external stakeholders • Major organisational changes resulting from an event. e.g. removal of accountable individuals from post
Medium	20% – 50% Between once in 2 to once in 5 years	£100-175M	24-36 weeks delay	Adverse impact such as: •Loss of train service on one line for several weeks •loss of a single-ended train depot/ train staff depot/ station •no injuries or fatalities •significant & ongoing disruption to core business services Example: Chancery Lane Derailment; Moorgate accident	• Ongoing critical & aggressive media campaign coverage lasting the duration of an event • Decrease in net advocacy amongst external stakeholders. • Significant challenge by regulators & stakeholders into relation to management of organization. • Targeted and critical parliamentary questions being asked • Severe & ongoing disruption actions taken by internal stakeholders (employees, unions, equality groups etc)
Low	5% - 20% Less than once in 5 years	£50-100M	12-24 weeks	Disruption to customer service for several days, or series of days Example: •series of network-wide 1 day strikes loss of train service on one line for several days	• Sporadic media coverage triggered by related events e.g. in print for several days over a period of time • Regulators and stakeholder intrusion is heightened by the event • Greater scrutiny by regulators & stakeholders in relation to management of organisation • Internal stakeholders (employees, unions, equality group etc) carrying out limited industrial action e.g. series of 1 day strikes

Using TfL's Main Risk Assessment Methodology

Very Low	≤5% Less than once in 20 years	Increase revenue/decrease costs by less than £250K in one financial year	Milestone would be achieved less than 13 weeks early	Improvements to customer service eg: •improved ambience/information •minor improvement to journey times •small increases in satisfaction	• Positive 'word of mouth' by customers • Positive public awareness
Low	5% - 20% Less than once in 5 years	Increase revenue/decrease costs by between £250K-1M in one financial year	Milestone would be achieved more than 13 weeks but less than 26 weeks early	Improvements to customer service as above	• Minor/short-term positive local media coverage • Improved relations with regulators & stakeholders
Medium	20% – 50% Between once in 5 years & once in 2 years	Increase revenue/decrease costs by between £1-5M in one financial year	Milestone would be achieved more than 26 weeks but less than 39 weeks early	Improvements to customer service Permanently improved customer satisfaction ratings (between 1-5% improvement on current scores)	Positive media coverage and enhanced relations with regulators & stakeholders eg headline television coverage or front page In Evening Standard for one day
High	50% - 75% More than once in 2 years	Increase revenue/decrease costs by between £5-10M in one financial year	Milestone would be achieved more than 39 weeks but less than 52 weeks early	Noticeable & permanent improvement in customer service resulting in significantly improved customer satisfaction ratings (a ≥5% improvement on current scores)	Significant positive media coverage and enhanced relations with regulators & stakeholders for more than a week
V High	≥75% Once or more per year	Increase revenue/decrease costs by more than £10M in one financial year	Milestone would be achieved over 52 weeks early	Major & permanent improvement in customer service resulting in significantly improved customer satisfaction ratings (a ≥10% improvement on current scores)	Significant positive media coverage and enhanced relations with regulators & stakeholders for a period of weeks

TfL's tracks and civils risk assessment



Track & Civils Climate Change Risk Identification

Weather Type	Potential Change	Asset	Description	Consequence
Extreme Hot weather	Higher temperatures and increased frequency of hot weather	Track	Buckling	Derailments, remove from service, TSR/Suspensi increased cost of maintenance due to more re-str
			Points move, detection system can't cope	more signalling failures
			Lubrication - range of operation - change viscosity	increased friction = higher maintenance. Increase treatment orders due to wheel screech
Drought	Longer periods of drought and increased frequency of drought	Track	shrinkage of timber sleepers (current 30-40%)	loss of rail support - tight gauge = inc wheel wear wheel screech
Rain/Flooding	Heavier rain and increased frequency of high rainfall	Track (3rd party impact over current drainage is main issue) - known high risk areas	Drainage (change in frequency and rainfall patterns) - back surges into our systems	legal & financial impacts
			General track drainage	increased cost of discharge into 3rd party drainag systems - issues over capacity enabled to discha which could lead to need to store water
			Loss of access to track due to extreme wet or heat conditions	
			Track flooded	
			Ballast wash out	
			Wheel rail interface loss	Increased SPADs
Cold/Freeze	Lower temperatures and increased frequency of cold/freezing weather	Track	increase rail breaks in welds and joints	loss of service and potential derailment
Snow	Heavier snow and increased		track covered, increased point failures, difficult	

Example of climate change impacts risk map

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

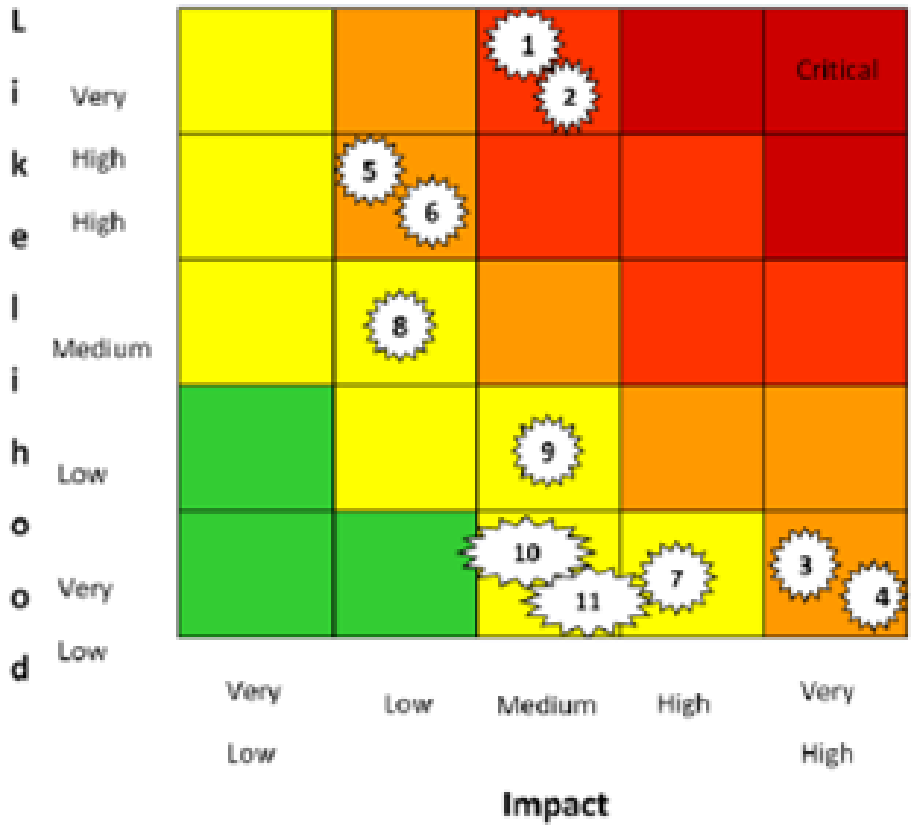
7- Cold & Freeze - Train system components

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



Weather management and adaptation plans

Implemented through:

Emergency Plans and audits

Standards eg Civil Engineering Gravity Drainage Systems

Asset Management Plans eg for stations, signals, rolling stock, civils

The Importance of Communication

Key findings

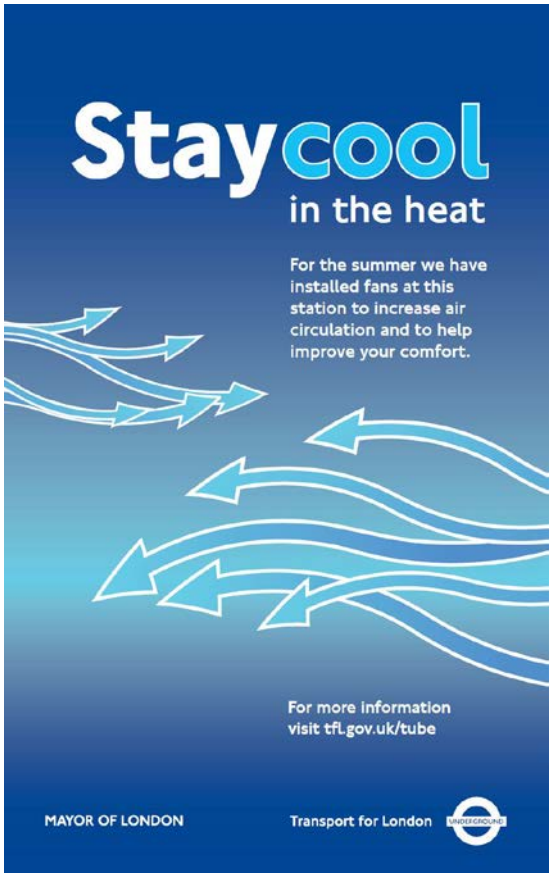
***People and services* (as well as assets)**

Managing Customer Expectations:

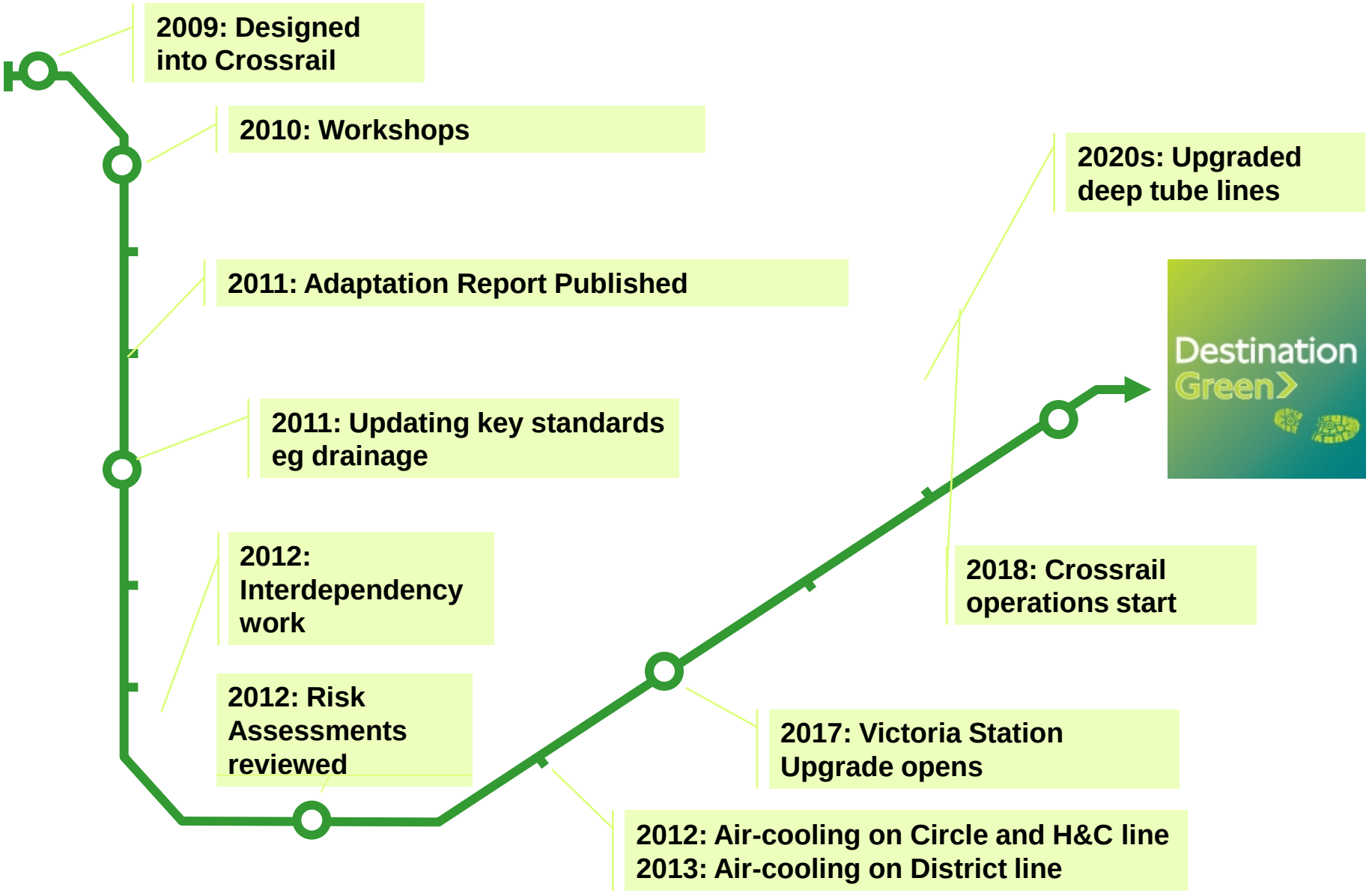
- Planned and real time information

Stakeholders:

- Liaising with key employers
- Organisations with interdependencies



What next?


2009: Designed into Crossrail
2010: Workshops
2011: Adaptation Report Published
2011: Updating key standards eg drainage
2012: Interdependency work
2012: Risk Assessments reviewed
2012: Air-cooling on Circle and H&C line
2013: Air-cooling on District line
2017: Victoria Station Upgrade opens
2018: Crossrail operations start
2020s: Upgraded deep tube lines
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