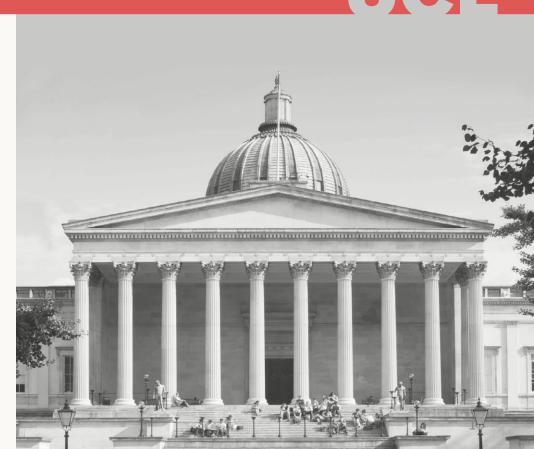
≜UCL

Infrastructure interdependency at Operation level

Samane Faramehr Taku Fujiyama University College London



Introduction



Interdependency of Infrastructure

- Many studies on existing and obvious interdependencies (e.g. electricity power supplies to other infrastructure (rail))
- Limited knowledge on
 - How one system is affected by another through unexpected means
 - How users embrace challenges and change behaviours, which leads to transformation of society
- Research needs
 - Numerical tools to empower practitioners

This presentation



 Evaluation of dependency between urban water supply and railway: The scenario of track flooding caused by water main burst

Samane Faramehr

 Interdependencies between power supply industry and Railways

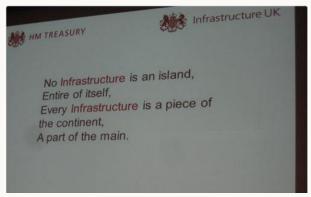
Taku Fujiyama

EVALUATION OF DEPENDENCY BETWEEN URBAN WATER SUPPLY AND RAILWAY:
THE SCENARIO OF TRACK FLOODING CAUSED BY WATER MAIN BURST

Background



- Infrastructure systems and interdependency
- Normal state of operation vs disrupted state
- Risk management strategies
- Scenario of track flooding (high consequence)





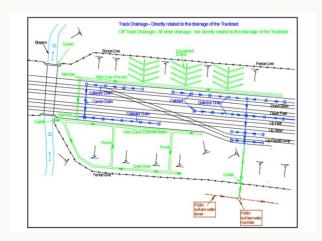




Scenario and the case study



- Past incident: Thameslink track flooding (Jan 2015)
- Thameslink: between Farringdon and Kentish Town
- Railway track through cuts and tunnel
- Immature drainage asset inventory (Network Rail)
- Railway gradient (Network Rail)
- Adjacent trunk water mains (Thames Water GIS data)



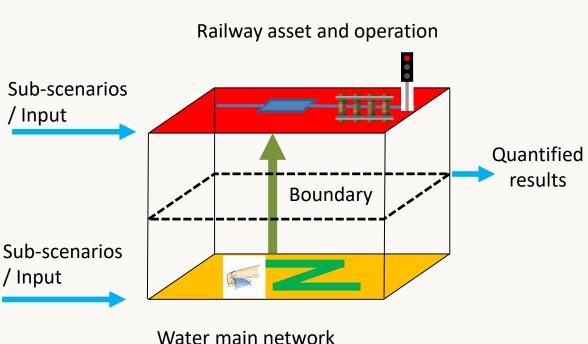




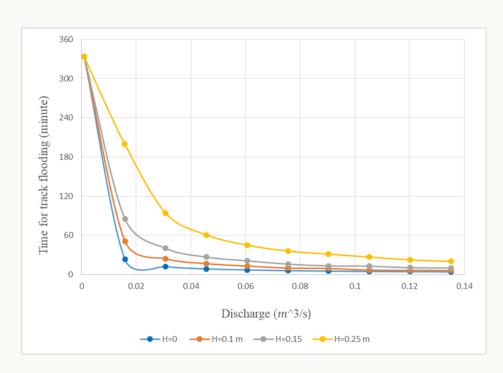
Methodology



- Sub-scenario development
- Numerical simulation
- Hydraulic calculation
- Input (parameters)
- Ballast and local drainage
- Railway flooding criteria

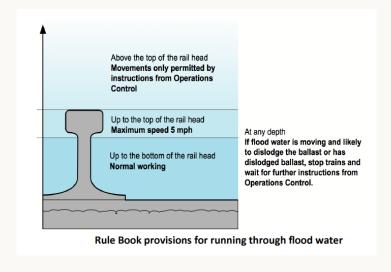






Flood caused by trunk main burst

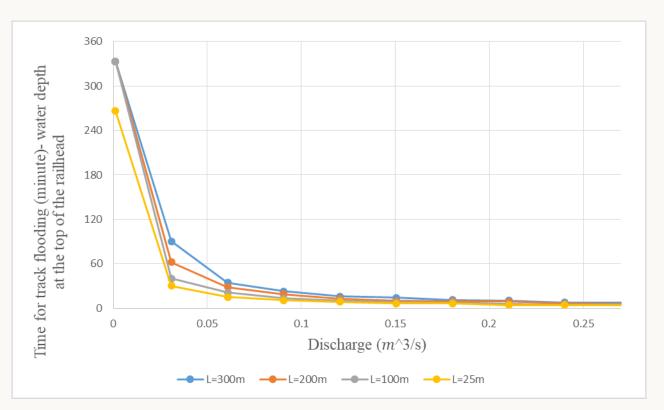
Rail Height= 0.159 m
Flat bottom standard rail (UIC54)



Criteria of track flooding

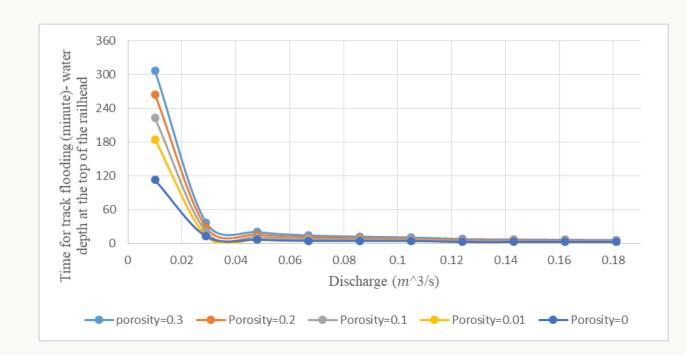


 Distance between the burst and the lowest point



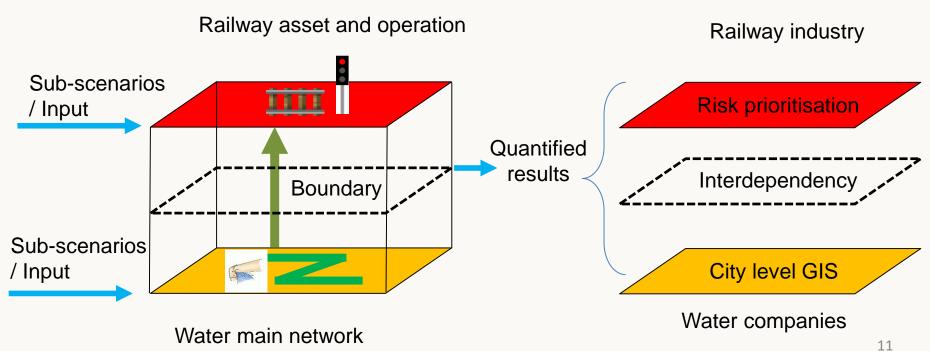


 Age of track ballast (new vs fouled ballast)



Application

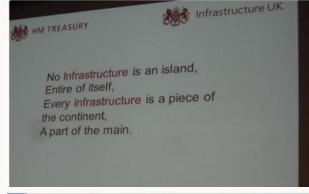




Background

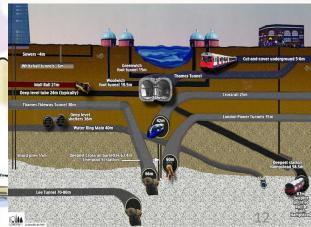


- Infrastructure systems and interdependency
- Risk management strategies
- Scenario of track flooding





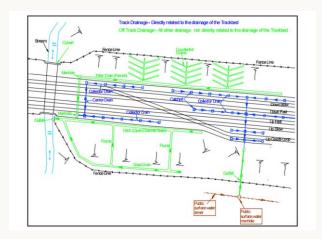




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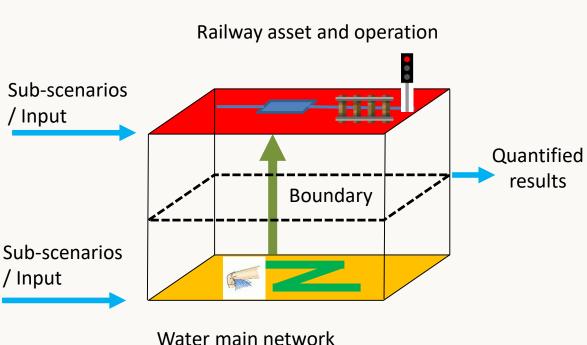




Methodology

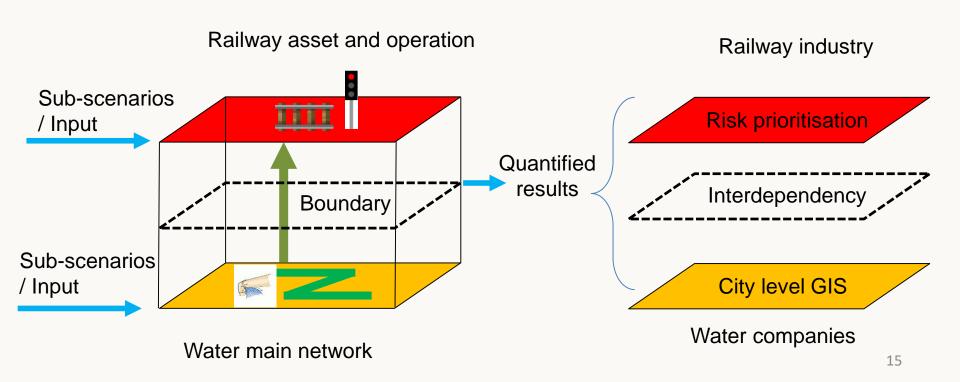


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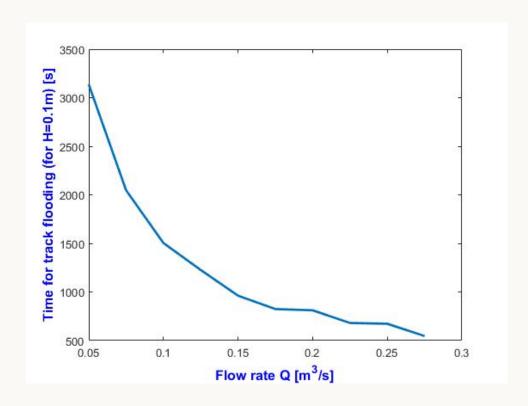


Application

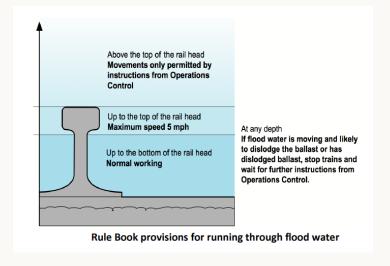








Rail Height= 0.159 m
Flat bottom standard rail (UIC54)

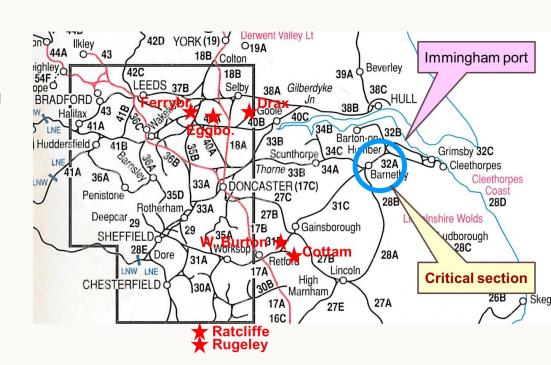


INTERDEPENDENCIES BETWEEN POWER SUPPLY INDUSTRY AND RAILWAYS

Background



- Coal/biomass power stations concentrated in North Lincolnshire with Immingham being the major import port
- Critical rail section around Immingham
- Quantification of risk is required



Critical rail infrastructure in Critical Section



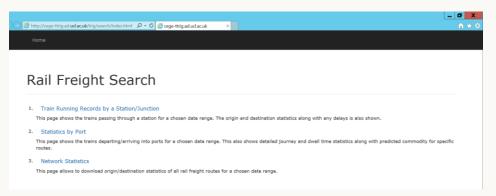


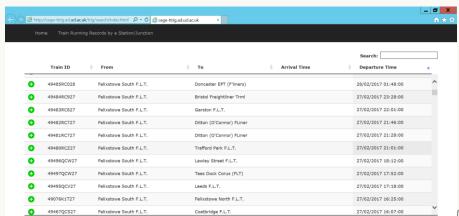


This Project



- Develop a Data system to capture and store of Network Rail's Data feeds (and power station outputs)
- Data includes
 - Origin (time, day)
 - Destination (time, day)
 - Tonnage
- Data Analysis to understand coal/biomass flow to power stations





Results: Biomass flow

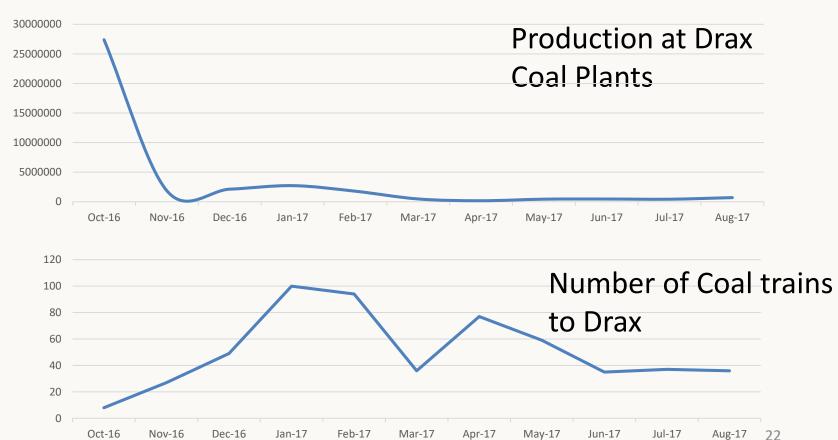






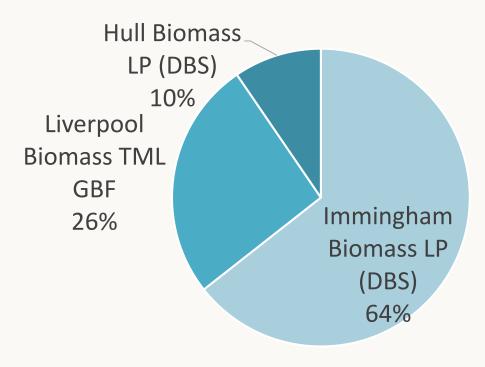
Results: Coal flow





Where does biomass to Drax come from?

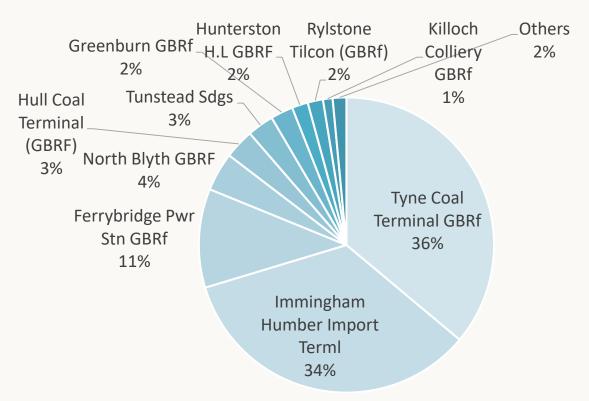




Data: Aug 2017

Where does coal to Drax come from?





Data: Aug 2017

Conclusion



- UCL attempts to create numerical tools/discussions on infrastructure interdependencies
- Scenario development is key. Comprehensive evidence- or data-based development of scenario development
- Scenarios that consider (or focus on) transformation