

Work Package 2.5 - Integrated cooling, heating and storage

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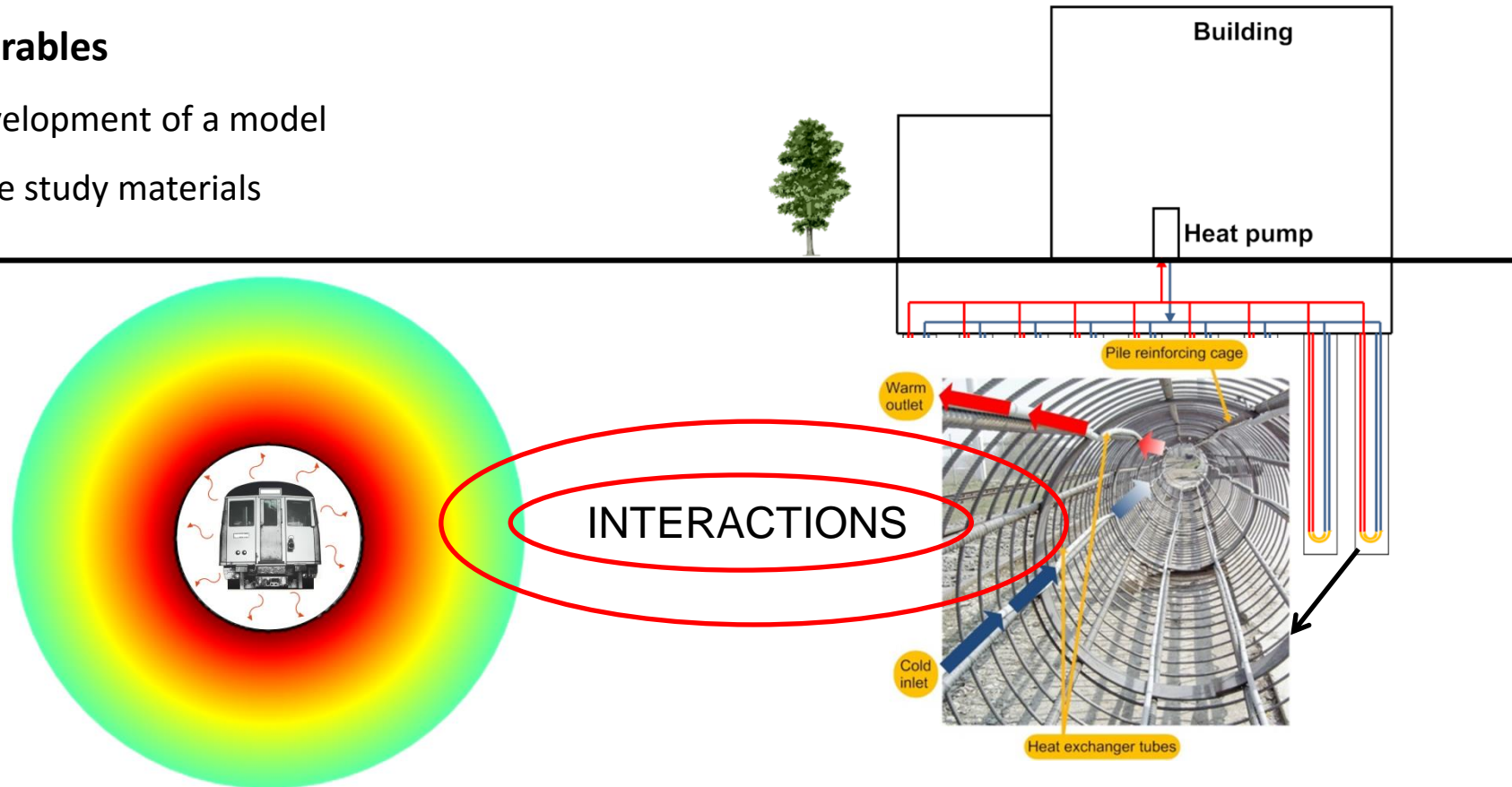
08/01/2015

Background

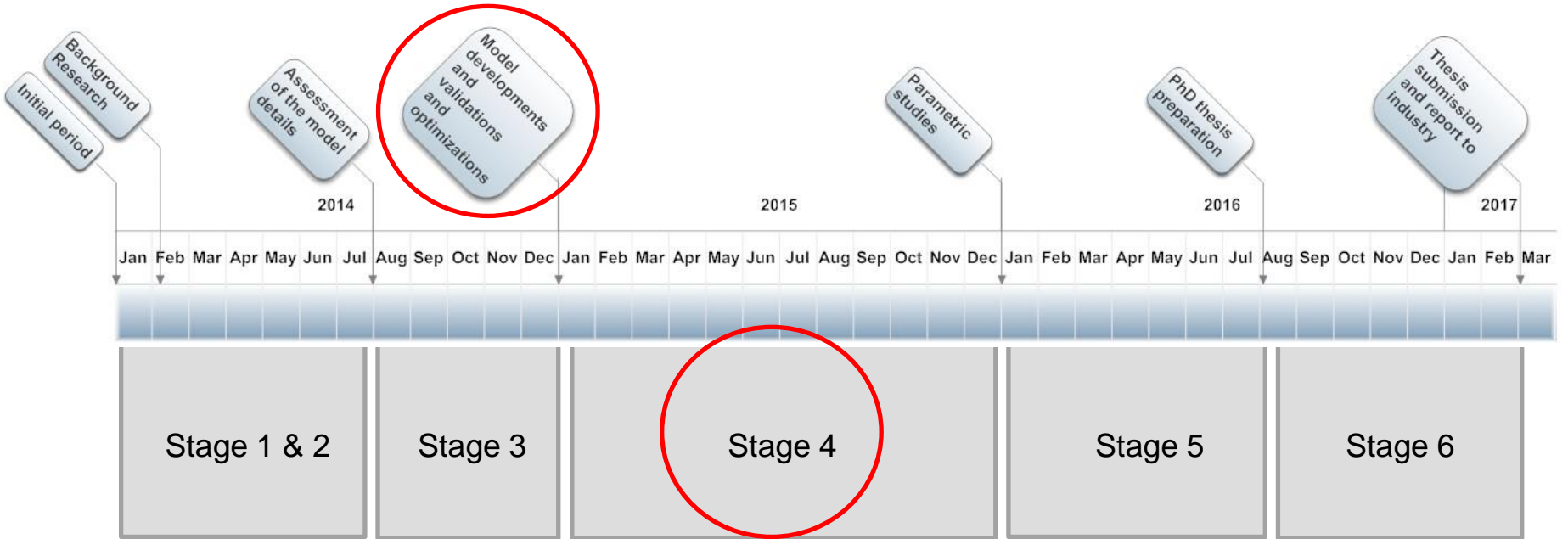
- To investigate the interactions of underground railway tunnels and ground heat exchangers
- To investigate the potential indirect use of waste heat from the tunnels to heat buildings above ground

Deliverables

- Development of a model
- Case study materials



Project time line with the key milestones and achievements



A review article has been published in ATE

2D Finite Element model

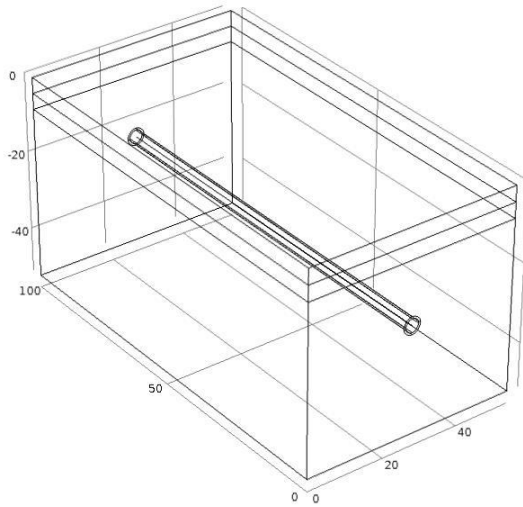
- Highly simplified
- Establish key parameters for more comprehensive research
- Details are published in the proceedings of the 24th IIR Congress on Refrigeration.

3D Finite Element model

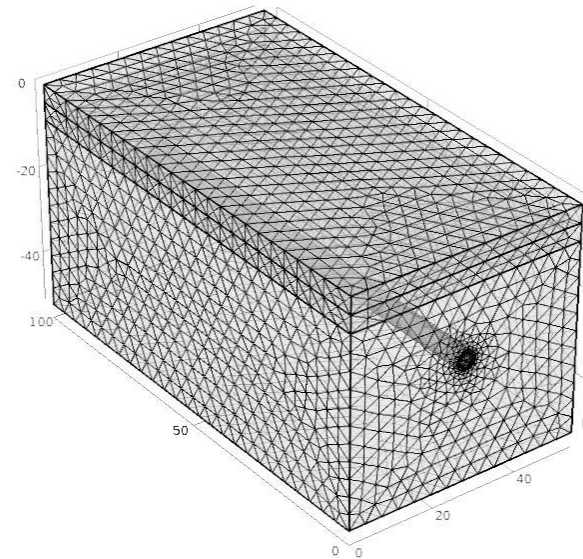
- Characterise UR and GSHP operation and translate that into a performance of crucial boundaries

3D model development – Initial work

- Development of a 3D geometry of central London's geology and an UR tunnel.
- Development of an optimised mesh configuration.
- Apply physics based on the conclusions of the 2D preliminary model.
- Characterise the operation of the railway.



3D geometry of an UR and the surrounding soil



The optimised 3D mesh

3D Underground Railway Model - A

Time dependent heat flux is applicable that is definable from the UR operation

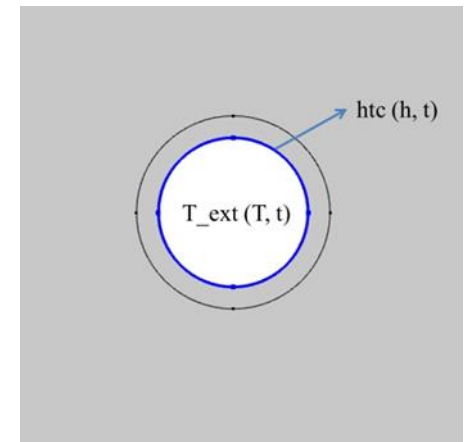
- Development Procedure: LU site visits for measurements

Air velocities within the tunnels were measured and collected from a disused LU platform



Simplified layout of the platform, passing trains and the measurement points

The data allowed to define a time dependent heat flux boundary condition on the inner surface of the tunnel wall.

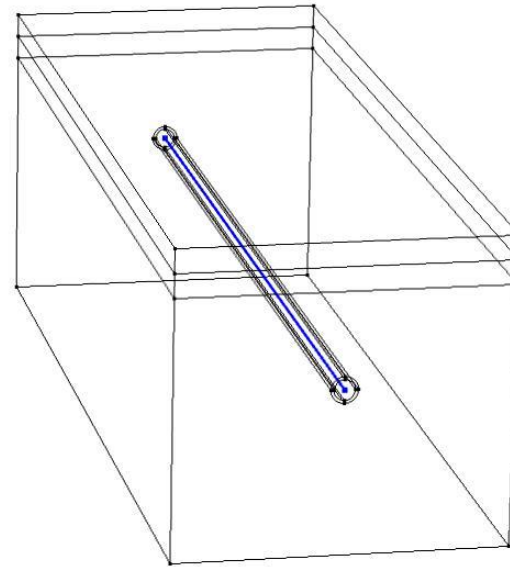


3D Underground Railway Model - B

- Incorporate a time scheduled heat load release from the operation of the trains

Method:

Represent the train as a line heat source



Immediate Next step

- Finalise both UR models
- Summary report on the UR models
- Start to develop a 3D GSHP model
- Combine the UR and GSHP model

WP 2.5 Deliverables

- Taking part in the EPSRC photo competition – December 2015
- Draft Report on the 3D UR models – January 2016
- Submit an abstract to a conference – Early 2016



Questions