



# Analysing Systems Interdependencies Using a Digital Twin

Benefits to asset managers, infrastructure owners and operators, commissioning managers, data-scientists working in major infrastructure projects or operations, and/or digital twin engineering.

“Working with Tideway, we brought research on theoretical work on modelling techniques and model integration into dialogue with leading practice to develop new ways of analysing systems interdependencies in the digital twin”

-Professor Jennifer Whyte, Centre for Systems Engineering and Innovation, Imperial College London

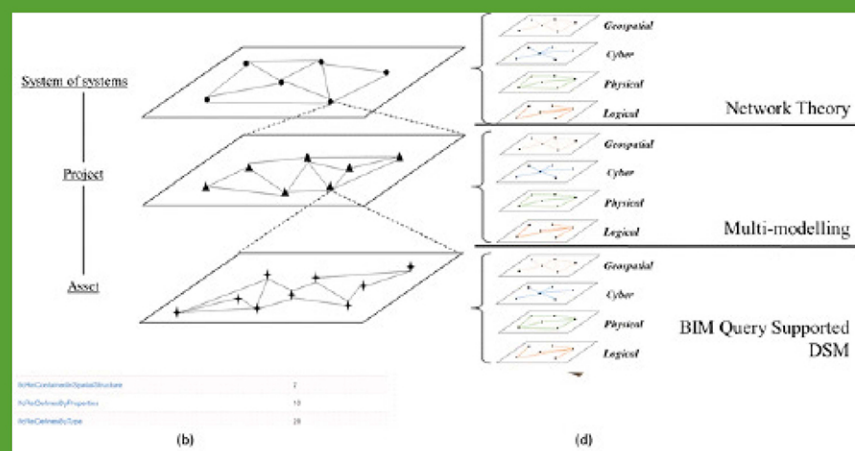
## Summary

Examines the potential to combine analytical methods (e.g. BIM query, network analyses and multi-modelling), demonstrating use of a digital twin to generate new insight into systems relationships and interdependencies.

Aim: To understand how articulate the extent to which a digital twin can be used to generate new insight into systems relationships and interdependencies.

### Objectives:

1. Identify and rank the importance of critical interdependencies emerging in Tideway, both in the infrastructure system and in the enabling production system;
2. Develop new approaches to identifying critical interdependencies in time for decision makers on the project to make decisions by linking digital data; and
3. Articulate, across different scales, the utility of and practical barriers to the use of different analytical approaches in relation to practical problems and use cases faced in delivery.

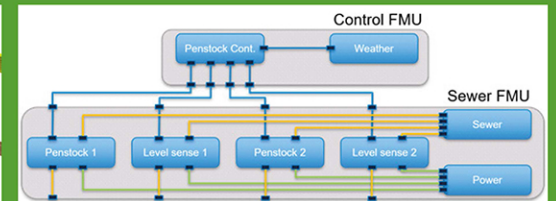
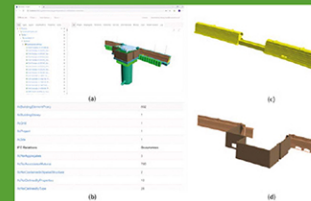


## Long-term Vision

The long-term ambition is to build the tools that decision-makers need to understand infrastructure system interdependencies within and across project boundaries, where these analyses provide information to decision-makers in time to make decisions on the project.

## Key Findings

1. Critical interdependencies: qualitative understanding of interdependence both delivery and operations.
2. Application of modelling approaches in BIM query supported Design Structure Matrices, multi-modelling and network analysis to infrastructure projects.
3. Use cases for different analysis approaches: decision trees to articulate, across different scales, the utility of and barriers to the use of different analysis approaches.



## Impact and Value

- Informs work on the digital twin including the Digital Twin hub set up by the Digital Framework Task Group (DFTG).
- Provides decision trees for practitioners to understand scenarios in which network analyses, multi-modelling and BIM query may be useful.
- Provides steps towards a framework through which digital approaches can be implemented and potentially integrated, and a model for how industry and researchers can work together on this.
- Identifies new research directions for the use of linked data and sensitivity analyses as well as the potential to use modelling techniques at different scales in observatories.

## Next Steps/ Further Work

We plan to examine combinations of these modelling approaches across scales and also the combination of multi-modelling and linked data approaches.

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