Modelling and the digital thread in infrastructure

Dr. Graham Bleakley, Systems Engineering Technical Director, Costain UK Ltd.
graham.bleakley@costain.com

Who are Costain?

Our heritage

More than
155 year
Track record

3,100
Employees across a broad mix of disciplines

Top 50
Employers for Women 2021

4 hubs
and many projects UK wide including our state-of-the-art technology hub

£1,070.5m
Adjusted Group revenue in 2020

Top 20
UK Management Consultant

Who are Costain ?

More than a Road, Railway or Water Delivery Contractor

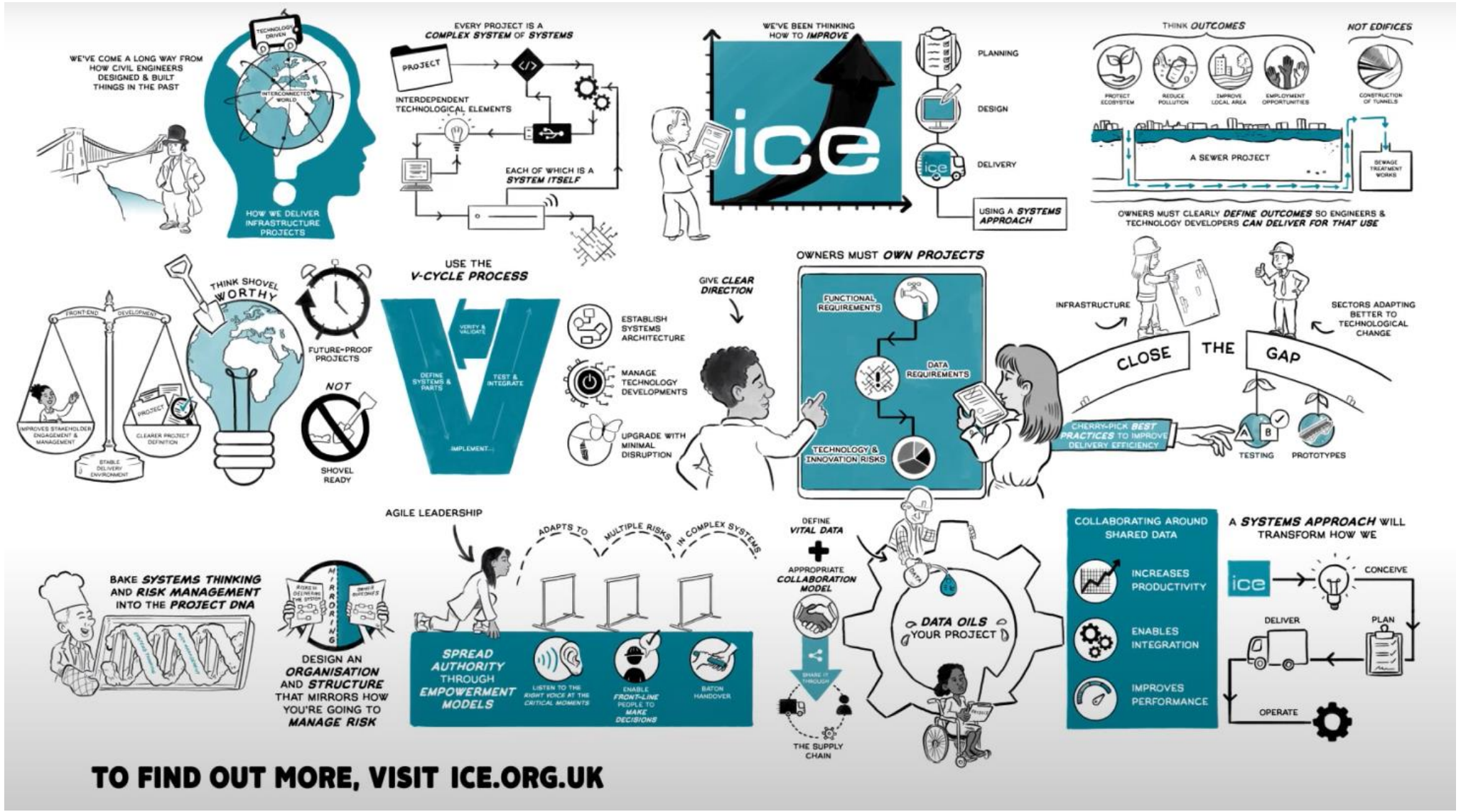
Integrated, digitally optimised services

We deliver integrated, digitally optimised smart infrastructure solutions to meet national needs across the UK's energy, water, transportation and defence markets.

Why Costain?
Who we work with

Infrastructure owners and operators	Local authorities	Central government
Water and energy utilities	Regeneration agencies	Technology developers
Small medium enterprises	Universities and research institutes	Other consultants

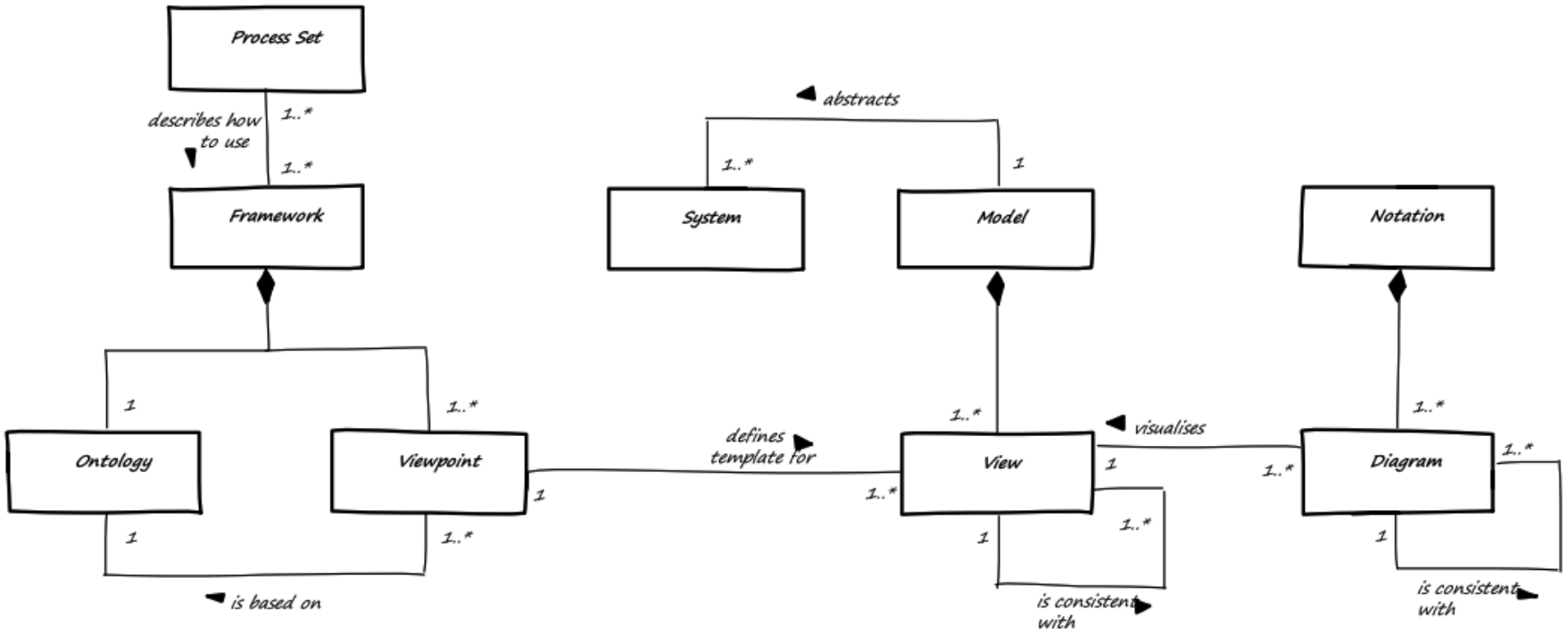
Systems Approach to Infrastructure Delivery



Jon Holt's MBSE in Slide

COSTAIN

MBSE in a Slide



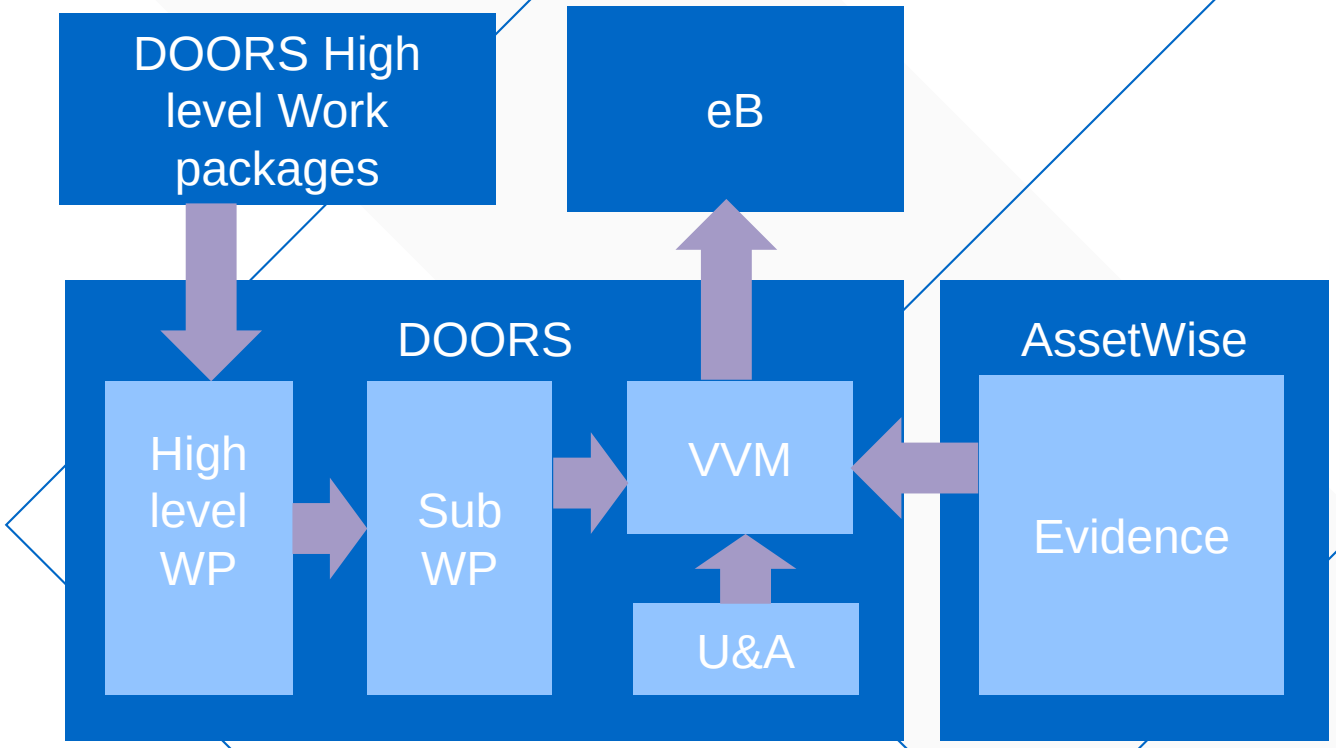
SCARECROW CONSULTANTS

It is MBSE but not as you know it

- **It is not SysML but it is Building Information Modeling (BIM)**
  - Level 0 - CAD Low Collaboration
  - Level 1 - 2D/3D Cad Partial Collaboration
  - Level 2 - 4D/5D BIM (Programme timing and cost analysis), full collaboration
    - Simulation
  - Level 4 – 6D BIM, all “as built” building information (holy grail)
- **It Is Geographical Information Systems (GIS)**
  - Digital mapping of areas
  - Linked to digital data sources
- **It is Data Models**
  - Ontologies
  - Frameworks
  - Asset Information modes
  - “Integrated” tool chains
- **It is Systems Engineering**
  - Requirements mapped to Compliance
  - Work breakdown structures
  - Dependency analysis
  - Optioneering- Design for Net Zero in design and project delivery
  - Governance processes

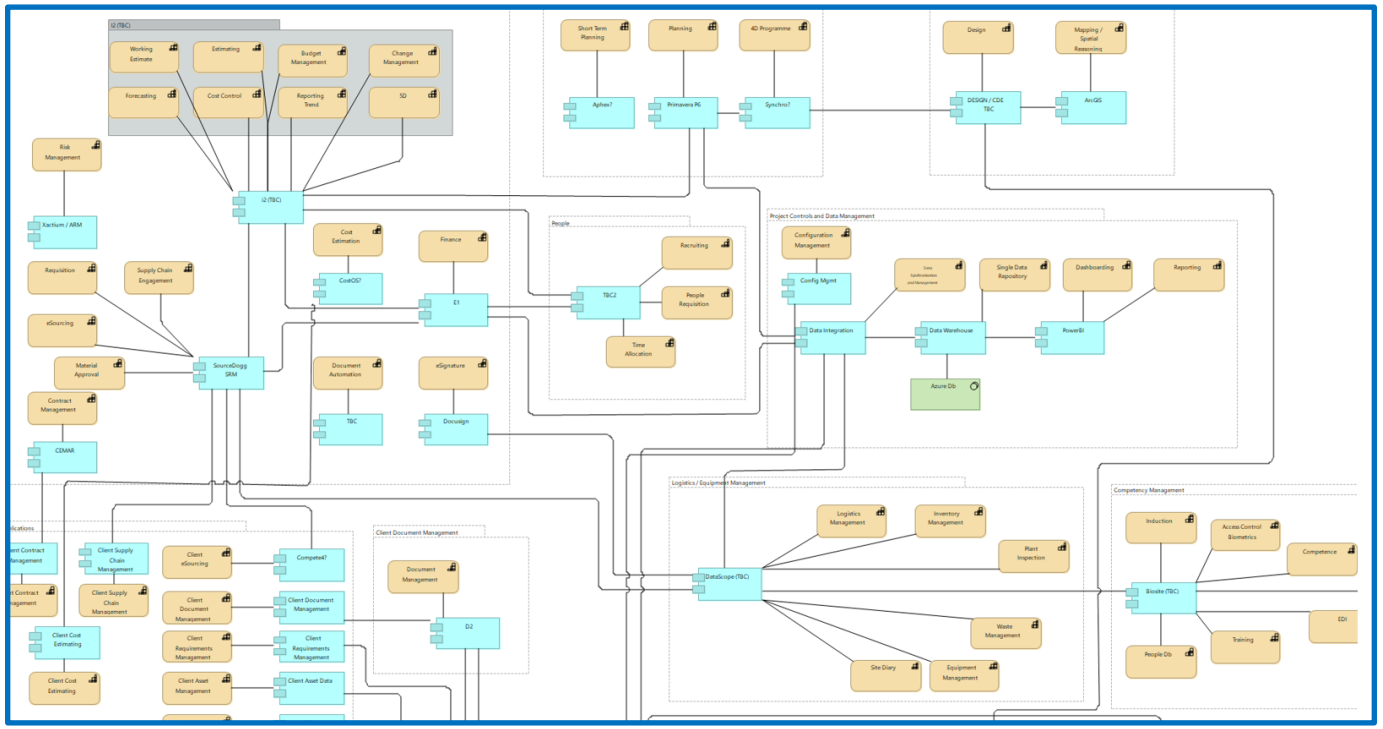
Data Models and Ontologies

- **Only prevalent on large projects**
  - Cross-Rail
  - HS2
  - SPA
- **Not delivering one large project but hundreds of smaller ones**
- **Work break down structure**
  - Decomposition of Assets
  - Decomposed into Work Packages
  - Programme dependencies between work packages
  - Work packages have deliverables associated with them
    - Drawings
    - Models in some cases
    - Compliance documents etc.
- **Overarching documents that capture**
  - Verification and Validation Matrices at different times of delivery
  - Interfaces
  - Delivery plans for compliance



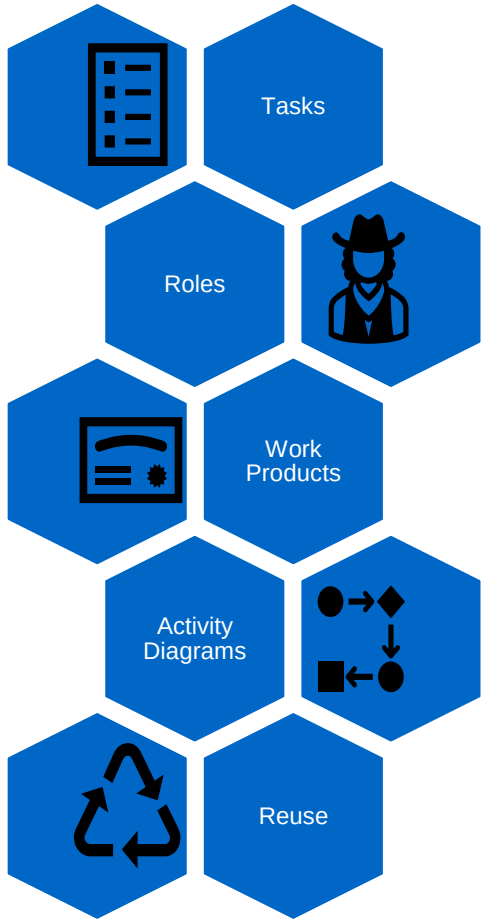
Tooling Infrastructure

- **Federated Information from many sources**
  - BIM (Projectwise, Revit)
  - SAP
  - GIS (ArcGIS)
  - Primavera (P6)
  - Requirements Management (DOORS, JIRA)
- **Lack of standardised connectivity between tools**
  - ETL tools create mappings between data
  - CSV export and Power BI for analytics
  - Proprietary point to point integrations
- **Need to engineer the supporting systems as much as the thing being developed**
  - Civil and infrastructure engineers are not Enterprise Architects, Systems or SW Engineers



Process Governance

- **Processes very document centric**
  - Processes developed in Visio per document
  - Held together by corporate knowledge of project members
  - Moving to a model based approach to define process
- **Based upon Systems and Software Process Engineering Metamodel**
  - Breaks down process into logical sets of tasks
  - Assigns inputs, outputs and roles to tasks
  - Applies methods and tools to implement tasks
  - Separates What from How



All Tasks Identified

All Roles associated with Tasks

All Work Products associated with Tasks as inputs and outputs

Tasks linked to each other to create process

Reuse of parts of the model

Optioneering

- **Value Analysis**
  - Systems Engineering terms design for X
- **Infrastructure delivery going beyond £**
- **Improved outcomes**
  - Social Value
  - Reduced Carbon
  - Reduced Cost
- **Hampered by reluctance to change and policy**
  - Looking to find ways to change policy

5D+ integrated carbon & cost calculation model

BIM model

INTEGRATED COST & CARBON MODEL

Cost estimation

Carbon inventory

Summary
MBSE by Stealth

- **We use the language of infrastructure**
  - Implement MBSE principles and practices without them being aware of it
- **They want to be able to measure progress**
  - They cannot do it without having the structures required to support MBSE being in place
- **They want to improve efficiency**
  - Minor improvements in the ways tools work and integrate give massive savings due to the size of the project
  - Needs an MBSE approach heavily tied to understanding process
- **Improve processes**
  - MBSE Quality Management

Thank you

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