Standardise, Automate, Generate!

Ian Besford
Director

Matt Pearce
Principal Engineer
Class objectives

1. Understand the reasons behind digital transformation

2. Learn how to evaluate different software tools for suitability

3. Learn how to identify opportunities for improvement in your own business

4. Learn about the need to manage change as well as technical skills
About the speaker

Ian Besford

Divisional Director at Mott MacDonalld
Leads the building engineering team in the east of the UK
Structural Engineer with 20 years experience
Digital lead for our European built environment business
Member of the Institution of Structural Engineers BIM panel
About the speaker

Matt Pearce
Principal Engineer at Mott MacDonald
Started with Mott MacDonald in 2007
Worked in UK, Hong Kong, Macau, China and Singapore
Key Projects: Waterloo, Twickenham Stadium, Jakarta Velodrome, Wynn Palace, Macau
 London 2012 Olympics Shooting Venue
Digital design leader for Building Structures
Why?  How?  What?
WHY?

Did we need to change our organization? What is our purpose?
Why do we need to change?

It’s a volatile world!

How do we make sure we remain relevant?

Previous transitions have happened organically e.g drawing board to CAD

This new digital age is predicated on changes to behaviours and ways of thinking

Clients are continually demanding more for less – more design inputs, better outcomes but generally no increase in fees.

Increased expectations around:

- Model deliverables
- Asset data
- Complex structures
- Architects pushing the boundaries
Structural engineering in Mott MacDonald
HOW?

How do we change as one across 500 global structural engineers?
Challenges with this...

- Right tool for the job, used in the right way consistently!
- Quality of deliverables generally good but different people wildly different times to do it
- Wild west – over 1500 different software tools audited across the business!
Challenges with this…

- Siloed thinking – lots of pockets of good stuff but don’t always share or know about them.
- Lack of standard PCs – built up over years, no common base spec – investment large required.
- Checking and how we standardise it.
How do we…

DO MORE FOR LESS?

DELIVER MORE CONSISTENCY?

WORK MORE CLOSELY?

TRANSFORM THE WAY WE DO THINGS?
WHAT?

...did we do to address the challenge?
What is the Problem

50+ Software Apps
100+ Software Apps
Gov’t approved software
Gov’t approved software
30+ Software Apps
Specialty

Complex. High Risk. One off.

Scale

**Three Stages of Transformation**

**STANDARDISE**

Look to gain efficiency from common approaches, common processes and common tools

Common ways of working..

**AUTOMATE**

Where can we use technology to automate what we do?

Standardised processes are easier to automate.

How can we use the power of computing to automate repetitive or error prone tasks?

**GENERATE**

How can we improve the delivery of the ‘fancy’ stuff? How can we push the boundaries by using new tools?

New technology, new processes and new tools.
Standardise
Standardise – Project Governance
# Standardise – Project Delivery

<table>
<thead>
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<th>Task ID</th>
<th>Task Name</th>
<th>Duration</th>
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<th>Finish</th>
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Standardise – Design Processes
# Standardise - Software

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## Summary Results

<p>| Analysis Elements Suitability     | No | No | No | No | No | Yes | Yes | No | No | No | No | No | No | No | No | No | No |
| Analysis Types Suitability       | No | No | Yes | No | No | Yes | Yes | No | No | No | No | No | No | No | No | No | No |
| Design Suitability               | Yes | Yes | Yes | No | No | Yes | Yes | No | No | No | Yes | Yes | No | No | No | No | Yes |
| BIM Interoperability Suitability | No | No | Yes | No | No | Yes | Yes | No | No | Yes | No | No | Yes | Yes | No | No | No |
| Overall Suitability               | No | No | No | No | No | Yes | Yes | No | No | No | Yes | Yes | No | No | No | No | No |</p>
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<td>BIM Coordinator</td>
<td>C.Cccccc.ccc</td>
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NOT FOR CONSTRUCTION

Model Issue Sheet Coordination Task Log

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**NOT FOR CONSTRUCTION**

**Model Issue Sheet Coordination Task Log**

<table>
<thead>
<tr>
<th>Task</th>
<th>Details</th>
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<tbody>
<tr>
<td>Task 1</td>
<td>Weekly Maintenance</td>
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<tr>
<td>Task 2</td>
<td>Model Issue</td>
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Automate
Implementation Framework

IDENTIFY
What standard processes can be automated?

ASSESS
What is the saving?
What is the cost?
How scalable is it?
Is it marketable?
What resources / expertise is needed?

INCUBATE
Develop the solution.
Test the solution.
Review and evaluate solution.

PUBLISH
Develop tool into final format.
Publish to group.
Automate - Identify

Browse Ideas

structural

Long Span Roof Design
Structural design of a cable roof, including form-finding, initial conditions
1/29/2018 4:52 PM

Wave wall stability checker
Structural check on wave stability based on data provided in wave generation
1/21/2018 5:04 PM

Cable Roof
Structural design of a cable roof, including form-finding, initial conditions
1/20/2018 7:06 PM

Andrew Zhao — September 12 at 10:16 AM

#idea - Project Animus - Operability Review - Delivering decisive operability reviews by using virtual reality to more effectively communicate with asset operators and maintainers during the design process. This idea has already been incubated through Project Animus.

Anne Carroll, Richard Brice, Timothy Fawcett, and 2 others like this

Andrew Zhao — October 1 at 10:27 AM

Check out Dan Buxton’s presentation for H&S week next Thursday. He will highlight the H&S benefits of this approach.

Anne Carroll — October 2 at 11:01 AM

Fantastic Anne, will do.

Write a reply
Automate - Incubate

ScriptHub

- Submit code
- Submit idea
- My pending code submissions
- My approved items
- All approved items

As a Code Chief, you can view the following additional options.

- Manage code submissions
- Manage Code Chiefs

Find code items which have been assigned to you for review.
View existing code chiefs, and add new Code Chiefs to the roster.
## Automate - Incubate

<table>
<thead>
<tr>
<th>Search by title, description, sector, or practice</th>
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<tbody>
<tr>
<td><strong>ExportCategoryParameters (Dynamo - Pearce, Matthew D)</strong></td>
</tr>
<tr>
<td>Exports all parameters for all Revit elements to Excel</td>
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<tr>
<td><strong>FindAndReplaceNumberParameters (Dynamo - Pearce, Matthew D)</strong></td>
</tr>
<tr>
<td>Finds and replaces parameter values (numbers) for the selected parameter for all elements in a selected category</td>
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<tr>
<td><strong>FindAndReplaceTextParameters (Dynamo - Pearce, Matthew D)</strong></td>
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<tr>
<td>Finds and replaces parameter values (text) for the selected parameter for all elements in a selected category</td>
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<td><strong>RenameFamilies (Dynamo - Pearce, Matthew D)</strong></td>
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<td>Finds and replaces family names</td>
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<tr>
<td><strong>CreateStructuralGaPlanViews (Dynamo - Pearce, Matthew D)</strong></td>
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<tr>
<td>Creates all the Structural GA plan views based on dependant views. This script should be run once on each project at stage 3 as part of step 1 for creating the drawings.</td>
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<tr>
<td><strong>PlaceViewsOnSheets (Dynamo - Pearce, Matthew D)</strong></td>
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<tr>
<td>Creates a series of drawing sheets in Revit and places all the dependant tiled views on their respective drawing sheet, whilst correctly filling in the tile/block parameters.</td>
</tr>
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</table>
Automate – Solutions – Revit MM Toolbar
Generate
Generate – Surfer Pile Designer

1) Robot file exported from Revit model. Automated VB routine exports maximum SLS loads to Excel to determine spring stiffness and inputs it into Robot. Model re-run and support co-ordinates and reactions exported to Excel.

2) Piles drawn into Revit with default size and depth. X & Y co-ordinates exported to Excel using BIMcoder plug-in.

3) VB routine matches co-ordinates from Revit and Robot to assign design load to each pile. VB routine matches piles with subsurface profile.

4a) Borehole data (ideally in AGIS format) plotted in Civil3D using HoleBASE S.I.

4b) Boreholes exported to Surfer to create subsurface profile.

4c) Subsurface profiles imported into Civil3D.

4d) Subsurface profile created for each pile.

5) Automated pile design. Pile design spreadsheet created and pile depth iterated until design requirements are met. Cost analysis is completed within VB script.

6) Pile loads, sizes and summary table imported into Revit using BIMcoder plug-in.

Surfer Pile Designer

Location
Singapore

860
Piles

9
Different design scenarios

2
Weeks from receiving information to design documentation
Generate – Truss Optimisation

**Method 1:** Dynamo & Robot

**Method 2:** Rhino, Grasshopper & Karamba

**STEP 1**
Generate Truss Geometry from Revit model

**STEP 2**
Run Truss Optimisation
Two methods investigated – Dynamo and Grasshopper

**STEP 3**
Export Optimised Truss Geometry into Revit model
Generate – Truss Optimisation
Generate – Truss Optimisation
Generate – Optimise Geometry
Numerical Modelling
Neural Networks

To simulate 2 months

Numerical Model: 16 days  Surrogate: 4.5 seconds

(300 thousand times faster)
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<th>June</th>
<th>July</th>
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<td>Upscale</td>
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SO WHAT?
How do we measure impact?
How do we measure impact?

294 Ideas submitted
38 Processes published
19 Modules released
7 Modules in development
£1.70M Value added
51 Connected thoughts
Integration

Good:
Creation of new ‘digital’ roles

Better:
Integration of digital talent across business

Best:
Upskilling digital capability of all staff across business
So what has changed?

- Innovation
- Engaged staff
- Great service
- Happy clients
Close out tasks.

1. Please take the class survey in the app

2. Check out the socials and meetups in the Expo and Quads

3. Come and schedule a meet up with us if you want to learn more.
Thank you.