CAMBRIDGE FUTURE CITIES CONFERENCE 2016
ENGINEERING SMARTER FOR CITY FUTURES
ADAM LOCKE
“A combination of factors can be credited with forcing open the construction skills gap, but put simply, there aren't enough staff to cover the demand.”
WHY SMARTER?

More efficient data collection & analytics
Better by informed design
Optimised delivery
Better operational & asset management interventions

Asset availability
Long term asset performance
Customer delight and loyalty
CONSTRUCTION 2025

- Lack of integration
- Low levels of innovation
- High construction costs
- Lack of collaboration
- 33% Lower Costs
- 50% Fast Delivery
- 50% Lower Emissions
- 50% Improvement in Exports

Insanity: Doing the same thing over and over again and expecting different results.

Albert Einstein
AN ENGINEERING ENTERPRISE
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Certainty

Early engagement helping to find the right solution for our clients

Design – Manufacture – Construct

Time

Cost

Quality

Sustainability

Health and safety

Excellence in Engineering

Digital Engineering

Offsite Manufacturing

DiME and Manufacturing

Direct Delivery
AN ENGINEERING ENTERPRISE
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WORKING SMARTER TODAY DIGITALLY

- Digital platforms
  - Supporting early design
  - Client communication
  - Digital engineering
  - Integrated cost models
  - Planning of logistics
  - Assuring certainty
WORKING SMARTER TODAY DIGITALLY

- Digital platforms
  - Augmented reality
  - Virtual reality – digital twin
  - Quality and commissioning
  - Reduction of operational cost and carbon
WORKING SMARTER TODAY DIGITALLY

- Meeting new standards
  - Reduction of operational cost and carbon

Source: http://transitionbath.org/
WORKING SMARTER TODAY DIGITALLY

- Smart Home Control
  - Adaptable, configurable digitally connected homes
  - Energy, cost and carbon savings
  - Business models to reduce up front hardware costs
  - Data that informs value driven future design performance
WORKING SMARTER TODAY DIGITALLY

- Digital platforms
  - Program and sequence
  - Bill of quantities
WORKING SMARTER TODAY DIGITALLY

- Digital platforms
  - Early cost estimates
  - System integration
WORKING SMARTER TODAY DIGITALLY

- Digital platforms
  - Team communication
  - Construction sequence
  - Visual method statements
WORKING SMARTER TODAY DIGITALLY

- Digital platforms
  - Immersive visualisations
  - Design coordination
  - Collaboration
THE CRICK

- Challenging logistics overcome by DfMA approach
- As small as 50mm turning clearance in LB2
- Just 50 men on site – 150 working offsite in factory
LOOKING AHEAD
ADVANCED MANUFACTURING FACILITY
ADVANCED MANUFACTURING FACILITY

- Advanced Manufacturing Supply Chain Initiative “AMSCI”
- £22m grant for consortium

Supply Chain Partners:
- BIS
- Department for Business Innovation & Skills
- Finance Birmingham
- Laing O’Rourke
- Vertical Integration

Design Partners:
- BIS
- explore
- expanded
- Crown House
- Select

Manufacturing / Research Partners:
- ARMSTRONG
- Airedale
- CRANE
- APL Applied Thermal Innovation
- THORN Lighting People
- Hamworthy
- BECKHOFF
- GRUNDFOS
- SIG
- Apex Parts
- SAINT-GOBAIN

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LOOKING AHEAD

- Augmented Reality
  - Confirming component quantities
  - As built quality assurance
  - In process quality verification
LOOKING AHEAD

- Holographic Building Projection
LOOKING AHEAD

- Productivity through collaborative robots
  - Adding mechanical strength
  - Remote access
LOOKING AHEAD

- Intelligent Lifting and Logistics
  - Remote monitoring
  - Optimisation systems
  - Big data processing
LOOKING AHEAD

- Drone technologies
  - Site survey and 3D scanning
  - Delivery
  - Assembly
LOOKING AHEAD

Enhancing Productivity

- From assembly to maintenance
- 24-7
- In high risk areas
LOOKING AHEAD

- 3D concrete printing
  - Complex components
  - Entire buildings
LOOKING AHEAD

- Flexible manufacturing
  - Architectural prototypes
  - Automated production
INTELLIGENT SYSTEMS – PROJECT, ASSET, TO CITY SCALE

- Asset renewal coordination
- Energy and demand management
- Traffic Flows Journey Management
- Customer experience
- Visual Method Statements
- Visualisation
- Mobile IT (systems)
- Quality Assurance
- Component Tracking
- Geotechnical Monitoring
- Plant Performance Telemetry
- Asset Energy Monitoring
- Active Security
- Asset Condition Monitoring
- Visual Monitoring
- Intelligent Systems DE/Data Integration/IT
- Asset Energy Monitoring
- Geotechnical Monitoring
- Component Tracking
- Quality Assurance
- Mobile IT (systems)
- Visualisation
- Visual Method Statements
- Active Security
- Asset Condition Monitoring
- Geotechnical Monitoring
- Component Tracking
- Quality Assurance
- Mobile IT (systems)
- Visualisation
- Visual Method Statements
- Active Security
HOW DOES YOUR BRIDGE FEEL?

FIBRE OPTIC BRIDGE MONITORING

LOR / Staffordshire Alliance Benefits

- Gave us certainty and product assurance data
- Confirmation that Prestressing Accords with EC2
- Aligns with LOR DfMA Strategy as a Client offering

Wider Industry Benefits

- Provide Evidence for any future reassessment for new loading (load history)
- Tailoring Inspections - strategically target worst structures
- Health Passport for Structures – Remote Asset Management
Product development in wireless sensors using open protocols, such as Enocean, and intelligent building networks using Power over Ethernet (PoE) protocols enable greater understanding, better optimisation and improved functionality of the internal environment.

- **Flexibility**
  Re-configure spaces easily.

- **Smart Grid Aware**
  Demand response or peak time pricing event turns non-critical lights off.

- **Personal control of light**
  Via smartphones to suit users’ tasks and preferences, even in open plan offices.

- **Energy Efficiency**
  Empty conference room – lights turned off, HVAC reduced, plug load off.

- **Safety and Security**
  Report occupancy during emergency and light path of egress; alerts for unexpected presence.

- **Space Utilisation**
  Utilisation data shows when rooms are available. Data logging can help better understand how effective the space is being used.

- **Wayfinding**
  Sensors can act as an indoor positioning grid enabling users to find their way through the building or empty meeting rooms via an app.

- **Maintenance**
  Alert sent out when light fixture out. Sensors can also collect information, such as occupancy data, to help facilities managers increase energy efficiency.

- **Occupancy Health and Comfort**
  Ventilation system responds to changes in occupancy and temperature to maintain comfort levels.
Can using sensor networks improve the commissioning process and narrow the gap between as-designed and as-operated energy consumption from HVAC systems?

- Sensors used to report back performance data to assist the commissioning of systems during the on-site construction and handover periods.
- The same sensors will enable performance data to be fed back to facilities managers during occupancy to ensure systems stay within tolerance.

This approach will:
- Reduce energy consumption and maintenance costs
- Provide the correct indoor environment for occupants
- Improve the understanding of how the building performs over time
Is it possible to use real-time building energy evaluation techniques to manage the uncertainty of occupancy behaviour to enable better in-use energy performance?

The discrepancy between predicted and actual energy use in buildings shows that energy is wasted.

Studies show that this is mostly through poor control and occupant behaviour.

Understanding occupant behaviour and correlating this against actual energy use helps to identify where energy use is highly affected by occupant behaviour.

In the future, prediction of a buildings occupancy based on the recorded data will be available through sensor networks and analysis models.

This will help drive more optimised designs and control methodologies.
We are investigating the relationship between occupancy, behaviour and energy use within a building, so that the BMS can be used more effectively and efficiently to control the building environment and energy usage.

Each apartment has a ‘PLC’ which is a windows based controller to collect data from wireless sensors and sent it to the internet via the IP network.

The sensors are monitoring:
- Temperature
- Humidity
- Occupancy
- CO2 levels

The plantroom has a dedicated controller to control and monitor the plant.

The data is sent securely to the IP network where it can be viewed remotely on a graphical head end interface.
THANK YOU

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