Tackling productivity through Industrialised Construction

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What do we mean by 'value'?



X

Why aren't we more like manufacturing?

Standardisation





1886

1913





Cost density





Concrete ~£120 / m³

Apple iPhone ~£12,000,000 / m³







Source: UK Government department

Industrialised

construction



Client risk Supply chain overhead Site overhead (supply chain) Client fees Constructor design fees Site overheads (management) Site overheads (management) Constructor overheads Escort costs Constructor overheads Escort costs Constructor profit Design development contingency

Product

- Minimise effort required to turn raw material into the finished asset by handling and / or moving material:
 - The fewest number of times;
 - Through the least amount of processes;
 - With up skilled and / or highly productive people;
 - Using the least number of people overall;
- Locate activity where it is best suited, rather than mandating 'on site' or 'off site';
- Deliver materials + elements to site at the right time, in the right sequence, with the correct information
- Use automation where appropriate









BILLY







'Platforms identify features of assets that could be shared and then harmonise those features.'

- This approach provides the opportunity to create common 'kits of parts'.
- Harmonised cross-sector demand enables their manufacture in high volume, with configuration allowing delivery of multiple asset types across sectors (e.g., schools, apartments, healthcare facilities).

Bryden Wood

Transforming Infrastructure Performance: Roadmap to 2030, IPA, 2021



Key elements

Harmonised, standardised requirements

- Stakeholder perspectives;
- Analysis of spaces:
 - Space types + performance characteristics;
 - Adjacencies + flows;
 - Technical specifications;
 - Dimensional grids.
- Grouping spaces to form a brief



Platform productivity enablers

- Application of lean principles to reduce waste in all its forms and eliminate non-value adding activity (plus lower carbon – 39% carbon reduction in The Forge)
- Creating simple, repeatable tasks using highly accurate components lowers the barrier to entry, facilitating new entrants. It's not enough to boost the productivity of the existing workforce - CITB CSN report states another 251,000 extra workers are needed by 2028*.
- Superstructure as a 'carrier frame' in traditional construction each trade is fixing the tolerance issues created by the preceding trade. An accurate superstructure allows following trades to work with unparalleled speed.
- Creating a cycle of continuous improvement based on evidence (University of Cambridge study introduced flow lines, takt time and the importance of consistency over speed).



Click to play video



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Sample uses



Residential (e.g. mid rise apartments)

Education (e.g. teaching block)

Commercial (e.g. open plan office)

Healthcare

(e.g. hospital)

Click to play video

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SINGLE SYSTEM



Breakdown of costs for a traditional steel frame Source: Steel Construction Institute



- Columns standard square hollow sections - most efficient distribution of material compared to I-beams. No 'fabrication'; a single hole is punched or laser cut in each column.
- Beams standard rolled profile (metal coils passed through a highly efficient, automated process with virtually no waste or no double handling) as a permanent shutter.

- - Interfaces are laser cut, self-locating to control tolerances and colourcoded to ensure correct application. These 'intelligent' components are small, manually handleable and accurately mass-produced.

Remove waste - slab





The Forge, London

- 139,000m² office for Landsec, the UK's largest developer
- Productivity study conducted by Dr Danny Murguia, Laing O'Rourke Centre for Construction Engineering and Technology at the University of Cambridge
- "Bryden Wood's superstructure platform delivered an architecturally ambitious and highly location-specific building, alongside the safety, quality, and productivity benefits that a manufactured solution offers."



Neil Pennell Head of Design Innovation and Property Solutions, Landsec



LAING O'ROURKE CENTRE for CONSTRUCTION ENGINEERING and TECHNOLOGY



Remove variability

- **Consistency** is more important than **speed** (at least in the first instance).
- Maintaining the average rates every day (i.e. not going faster than was achieved, but simply being consistent) would have dramatically reduced programme.
- Consistently installing just the average number of components every day would have reduced:
 - Steel installation by 25%.
 - ComFlor installation by 55%.
 - Shuttering installation by 26%





Façade

- Fastest install rate 6 minutes / panel
- This is ~10 x faster than industry average
- "Developing the façade around the structural platform allowed us to really optimise the use of materials and create the most efficient units for handling in the factory and on-site. It also facilitated incredibly fast installation on traditional projects up to 40% of installation time is spent on wasteful, unproductive activity. The platform allowed crews to work safely without the need for fall arrest systems conditions under which they could install finished panels much faster than we've ever seen before."



Wojciech Brozyna Managing Director, Aluprof





MEP installation







Weekly module install times

- Install times are shown in the graph on the right
- The dramatic reduction coincides with the introduction of the adapted forklifts in weeks 5 – 6
- Install times were reduced by 66% -90%
- NG Bailey estimate the prefabricated nature of the MEP has resulted in a reduction of 30,000 hours of site labour
- "The superstructure allowed us to do our best work, maintaining unparalleled levels of speed and productivity from assembly right the way through delivery and installation. The platform created a 'factory on-site' which allowed us to develop, test and perfect new ways of working."



NG Bailey Offsite Manufacture, NG Bailey



Actual vs. 75% rates





Further information





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