

LEAN in: how to help your team do more with less in commercial archaeology

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LEAN is a tool traditionally associated with production lines and business management. Nevertheless, it has applications across a large number of archaeological activities. Encouraging and supporting people to develop LEAN skillsets has been a key part of delivering efficiencies in archaeology on Costain's recent sites including the enabling works in HS2 Area South. By undertaking process mapping to understand how and why we deliver our specific activities, we, as archaeologists, are able to identify 'wastes' and open up a more pinpointed dialogue with construction partners around programme, productivity, and outcomes.

So, what is LEAN?

LEAN was developed in the manufacturing industry, specifically the Japanese car manufacturing industry (and even more specifically by Toyota). It was identified that production lines could be made more efficient by streamlining specific activities and that this could generate lots of potential benefits.

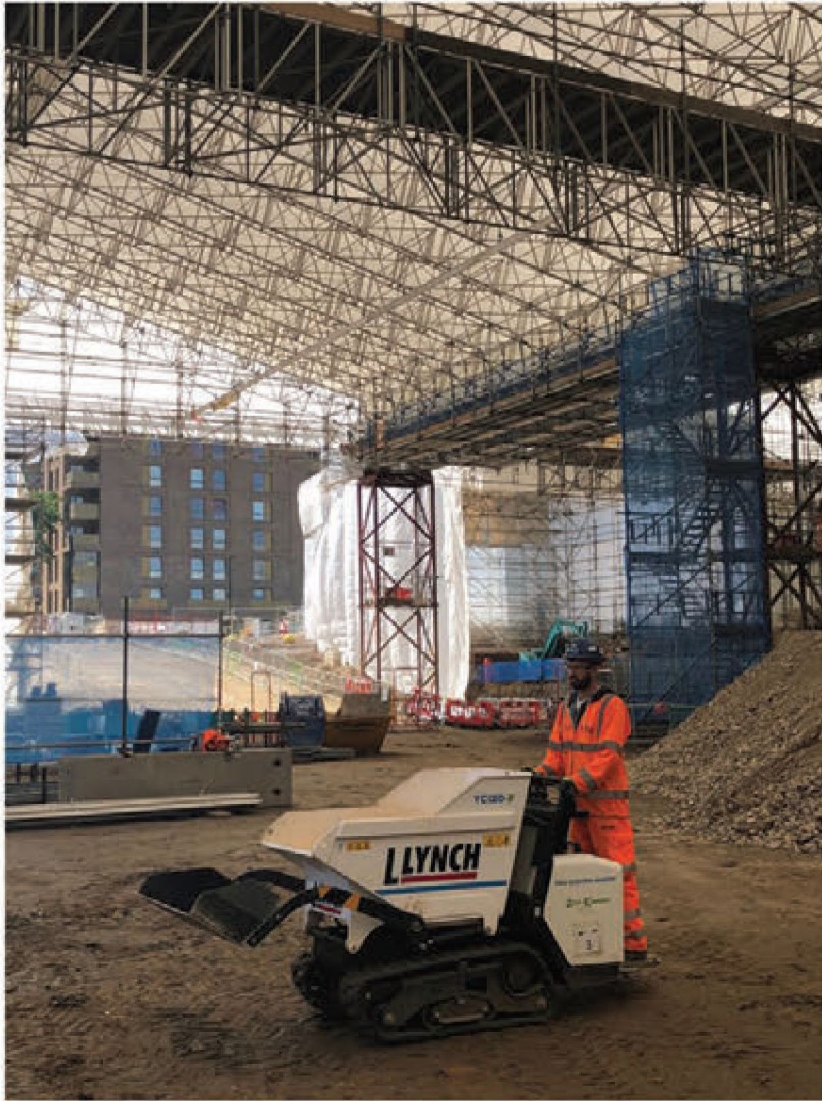
LEAN is essentially a process that allows you to identify and eliminate waste. In this instance waste does not refer to rubbish (although eliminating unwanted, hazardous or costly by-products may be a desirable output). There are eight wastes identified in LEAN practice:

- The Waste of Transport
- The Waste of Inventory
- The Waste of Motion
- The Waste of Waiting
- The Waste of Overproduction
- The Waste of Over-processing
- The Waste of Defects
- The Waste of Talent

Each task, no matter how simple, has multiple steps but we often fail to consider an activity in this way and so do not understand where the waste starts to creep in.



LEAN drying room with ergonomically designed shelving. Credit: Caroline Raynor, Costain Skanska JV, © HS2 Ltd



Small electric plant (1-tonne ride-on dumper) used to streamline materials management. Credit: Caroline Raynor, Costain Skanska JV; © HS2 Ltd



Encapsulation structure over the big dig at St James's Gardens in Euston designed by Costain Skanska JV. Credit: Caroline Raynor, Costain Skanska JV; © HS2 Ltd

Archaeology is not a production line and no two archaeological sites are the same. But archaeology as a discipline is process driven, and activities such as finds processing or excavating a feature or burial are governed by rigid methodologies.

Understanding activities and what they entail is known as 'process mapping'. This is a simple way of breaking down activities in a step-by-step manner, by creating a flow chart that shows each activity that leads to the completion of a task. Each task, no matter how simple, has multiple steps but we often fail to consider an activity in this way and so do not understand where the waste starts to creep in.

The most common wastes in archaeology are the waste of motion (walking across site seeking tools and equipment, finds registers, incorrectly placed welfare facilities); the waste of transport (moving samples and finds from site to office without checking labelling, volumes, etc); the waste of waiting (delays on site caused by weather, lack of plant, etc. leading to inefficient use of time on site when secondary activities could have been planned); and the waste of talent (not understanding or registering the key skills present amongst an often transient or temporary workforce).

At the HS2 enabling works, Costain Skanska JV used LEAN techniques and applied them to archaeological processes to increase safety, efficiency, and productivity. The first step was to process map all key activities where waste was likely to occur. High-level analysis indicated that waste of motion, transport and waiting occurred most frequently.

Activity	Waste
Managing tools and equipment	Motion, Transport,
Accessing tools and equipment	Motion, Waiting
Management of spoil and muck shift	Transport, Motion, Waiting
Finds processing	Transport, motion, Waiting
Recording including populating registers and context sheets	Motion, Waiting

Measures were put in place to help reduce or remove wastes and the improvements were measured using a LEAN control board where 'time on task' and m³ of material removed was recorded each day as a measure of productivity. Productivity initiatives included the use of small all electric plant (1.9 tonne mini diggers and 1 tonne tracked barrows), digital recording, and the deploying of one site operative per five archaeologists to help with spoil management and muck shift.



Ergonomic/LEAN lab designed by Costain Skanska JV to support osteological works. Credit: Caroline Raynor, Costain Skanska JV; © HS2 Ltd

All team members from Project Officers to Field Archaeologists were invited to provide targeted feedback on measures to help shape improvements.

Similarly, finds management activities were also process mapped to identify opportunities for efficiency and a bespoke lab with a factory production line approach was built on site. This facility considered specific tasks, optimal production (*tokt* time) and ergonomics based on a 43 per cent female demographic on site. Additional benefits were also identified where on-site processing provided earlier insight into the assemblage and helped to inform excavation and community engagement strategy over a 40-week period in line with HS2's Historic Environment Research Delivery Strategy (GWSI-HERDS).

The archaeological team were asked to nominate 'LEAN champions' who could provide feedback in a wider forum with other supply chain members. The nominated persons were also invited to help identify other opportunities and develop a wider appreciation of LEAN, through working with the project LEAN Practitioner and the Business Improvement manager. These activities could be registered as CPD by participants and are the first steps to using LEAN on other sites and projects as a natural response to identifying inefficiencies or wastes.

Process mapping, team work and a series of targeted efficiency measures combined to deliver a positive culture of collaboration between the engineers, archaeologists and site operatives as well as delivering measurable efficiencies where outputs at peak work flow exceed

original expectations by a factor of five. The application of LEAN has been embedded within the wider team and forms part of the legacy of HS2's archaeology and heritage works.

With thanks to HS2 Ltd, Costain Skanska, MOLA-Headland Infrastructure, TCS exhumations, Bowercross Construction Ltd, and Penmark Consulting for supporting LEAN archaeology.

See The Archaeologist 109 for an example of how LEAN techniques were used at St James' burial ground, Euston.

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