

Implementing Lean in construction:

*Overview of CIRIA's guides and
a brief introduction to Lean.*



SKANSKA



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Implementing Lean in construction: Overview of CIRIA's guides. A brief introduction to Lean

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Foreword

The construction industry, its clients and its supply chain are under pressure to deliver 'more for less'. This is especially so within the UK Government, where Lean practice is fast becoming a pre-requisite of its supply chains. There are good news stories of effective use of technology and collaborative delivery, but in general, a totally joined-up approach to delivery is not the norm. A collaborative delivery environment that supports transparency, accurate reporting of quantities and benchmarking should be the expected norm. Many will recognise this as a 'Lean' approach.

I was therefore delighted to accept CIRIA's invitation to chair the Project Steering Group (PSG) for its project: *Implementing Lean in construction*. The group brought together public and private sector clients, contractors, consultants and researchers, together with several Lean practitioners. The project brought together clients and contractors involved in implementing Lean and consultants experienced in supporting such organisations. This collective experience has, we hope, resulted in a suite of documents that will provide practical advice and a wealth of examples to organisations who have been considering a Lean approach.

The guides will help clients, contractors and others in three ways. Firstly, by developing an awareness of Lean and building an appreciation of their own maturity and aspirations. Secondly, by helping to raise confidence in developing a Lean culture and applying Lean tools. Finally, by highlighting the synergies between Lean and wider government/industry priorities such as BIM and sustainability.

I hope that these guides will ignite a new or renewed interest in Lean which, if introduced into any organisational environment, will help deliver projects better, faster and more cost-effectively.



Terry Stocks

**Ministry of Justice, Deputy Head MOJ Estate
Directorate and Head of Project Delivery.**

Downloading these reports and submitting your feedback
These reports are available from: www.ciria.org/service/lean
Each guide contains an invitation for you to feedback, which
the Steering Group will review autumn 2013

1 Background

Lean is a term that relates to a proven way of doing business, entirely focused on maximising customer value through the relentless elimination of all forms of process waste and ensuring that value-adding activities are completed in the most efficient and time-effective manner. Lean has been successfully applied in all sectors of business, service and project delivery, resulting in improved performance in quality, time, cost and bottom line profit.

Many construction organisations and their clients are practicing or exploring Lean as a way of delivering this value. However, while there are instances of its successful application on projects, programmes and frameworks, there is still a lack of awareness and even some misunderstanding.

2 Why these guides were written

Conscious of the potential of lean, but equally conscious of a degree of lack of awareness, CIRIA developed a project in 2010 to help raise awareness of Lean. The PSG assembled to guide the work concluded that the document should provide an insight as to how the change to a Lean culture could be achieved. It was also decided to write the guide as a narrative following a Lean champion on his journey in exploring and implementing lean. The guide *Build Lean: Transforming construction using Lean Thinking* (C696) was published in 2011.

The PSG also envisaged that following the publication of *Build Lean*, a series of further documents should be produced. This set of documents should cover a number of specific areas covered in *Build Lean*, but at a level of greater detail not appropriate in the original guide.

The questions that still needed answering were:

- 1 How are the Lean and BIM agendas linked?
- 2 How are the Lean and sustainability agendas linked?
- 3 Which are the principal Lean tools in a construction context?
- 4 How can the benefits of applying Lean be measured across an organisation?
- 5 How can clients promote and enable Lean?
- 6 What is the best way to go about appointing a Lean consultant?

These questions were developed into specifications for six guides that were produced during 2012.

While there has been an increase in interest in Lean in recent years, further development of support through groups such as CLIP and the Lean Construction Institute, events and features in the press and guides such as *Build Lean*, Lean is some way from becoming mainstream. By making these reports freely available, we hope that we will encourage you to explore the topic and, hopefully, apply the principles.

3 Overview of the six guides

USING THE GUIDES

The suite of documents will be of interest to a range of organisations and individuals with different requirements, perspectives and varying degrees of awareness and experience of Lean. There is no prescribed order to reading them and, indeed, some may neither wish or need to read all six. We have provided an outline of each document here.

Enabling Lean

- ▶ Lean clients guide
- ▶ Appointing and working with Lean consultants.

As with many business improvements or change initiatives, there are many factors that influence their successful implementation. The client's guide considers what clients should do, and equally what they should avoid, when considering the application of Lean to their projects and programmes. One of the first for many organisations in exploring, trialling or fully implementing Lean is to employ the services of a specialist Lean consultant. This guide takes you through this process of appointing and working with Lean consultants in relation to your specific aims – whether running trial projects or building capacity and expertise across your organisation and suppliers.

Applying Lean

- ▶ Lean tools
- ▶ Lean benefits realisation management.

Lean is not simply a collection of tools. Lean is a total organisational and operational approach to business that is customer focused and people centric. It is, nevertheless, important to understand the approaches that are used in Lean. Some find Lean terminology off-putting. Others recognise the principles as reflecting their current practices, while not making the connection with Lean. The tools guide introduces some of the tools you are most likely to come across. Part of the process of Lean implementation is being able to capture and quantify the benefits. As mentioned above, Lean benefits are not restricted to financial ones. This guide considers how Lean improvement initiatives can be tracked from the level of project activities and how they relate to organisational KPIs.

Lean synergies

- ▶ Lean and the sustainability agenda
- ▶ Lean construction and BIM.

The sustainability agenda has now been a vital element of organisations' practice for several years. BIM is increasingly becoming so. These two guides consider how Lean thinking supports these agendas. The guides focus on the synergies and opportunities recognising that you may be approaching these from a sustainability or BIM perspective.

Lean construction and BIM (C725)

Why you should read this guide	Contents
<p>In this guide, academic and professional knowledge regarding the joint application of Lean and BIM has been compiled for the first time. The information is based on up-to-date experiences and knowledge regarding the topic, gained by pioneering organisations in different countries.</p> <p>The guide contains a clear description on the links between Lean and BIM, and how these can be marshalled to provide a range of incremental benefits in an incremental manner. It provides specific advice for different parties of a construction project and for different project stages, as well as references to the wider literature. The guide provides essential reading to anyone interested in practical and effective improvement of construction.</p>	<ol style="list-style-type: none"> 1 Introduction 2 What does a Lean and BIM project look like? 3 Enablers, methods and tools 4 What steps need to be taken to adopt Lean and BIM? 5 Key considerations for clients and contractors 6 Conclusion

Lean and the sustainability agenda (C726)

Why you should read this guide	Contents
<p>The built environment offers many challenges and opportunities in terms of sustainability whatever your role might be. No matter what your previous knowledge is with regard to Lean this guide will show you how a Lean approach can support the areas of sustainability that you will encounter, making your role simpler and more effective.</p> <p>Appendix A1 contains a series of workbooks, which gives you the opportunity to reflect and review on points made in this guide. There are references to these workbooks throughout the guide.</p>	<ol style="list-style-type: none"> 1 Setting the scene 2 Building the whole view 3 Practical application 4 Case studies 5 Moving forward

Lean benefits realisation management (C727)

Why you should read this guide	Contents
<p>Currently, there is no universally accepted way of describing and classifying benefits from Lean within the construction sector. The measurement, reporting and communication of benefits is a key factor in the success of Lean. It follows that we need to have a clear way of describing benefits to stakeholders within an organisation and ideally within the industry to help us:</p> <ul style="list-style-type: none"> ▶ communicate and manage stakeholder expectations ▶ analyse outcomes across projects, schemes and organisations ▶ avoid double counting ▶ monitor longer term transformation progress. <p>This guide draws on many sources as the subject matter has been addressed by academics, authors, practitioners and consultancies over the past 30 years. There has been a convergence of themes into what can now be considered 'best practice' for a 'standard' benefit realisation management approach but there is very little written about Lean benefits realisation management. This guide draws from existing thinking and, together with experience of delivering Lean benefits in the industry, attempts to build a clear and concise approach that is appropriate for Lean in a construction context.</p>	<ol style="list-style-type: none"> 1 Introduction 2 Fundamentals, principles and considerations – what is important for effective benefits realisation? 3 Benefits measurement 4 Application of best practice Lean benefit realisation management in the construction environment 5 Typical challenge and top tips 6 Sustaining the benefit of Lean 7 Conclusion 8 Examples and case studies

A Lean guide for client organisations (C728)

Why you should read this guide	Contents
<p>Within the built environment, building and infrastructure clients like you are the key link between the end users and those that formulate the design and carry out the construction on site. Most involved in our industry now seem to accept that waste in construction processes and communications remains annoyingly persistent despite the best efforts of many over the last two decades.</p> <p>Regrettably, our public buildings and infrastructure still costs more than they should. As clients it is surely our responsibility to demand better, and then to contribute to improving matters.</p> <p>'Lean' is a simple, intuitive way to remove waste of all kinds from everything we do. When we work collaboratively for improvement we can together change our industry. However, this will only happen if you, the client, demand that it should. Reading this guide is a first step on that road to better, more cost effective, quicker, safer, more sustainable and more enjoyable ways of constructing our built environment.</p> <p>This guide has been authored and reviewed by individuals who have worked with some of the UK's leading client organisations in terms of delivering Lean solutions within their supply chains. Accordingly, this guide uniquely explains the principles behind 'Lean' and describes how to put them into practice from a client's perspective.</p>	<ol style="list-style-type: none"> 1 Lean principles for the building and infrastructure client 2 Lean practice for the building and infrastructure client – a roadmap 3 Six steps to implementation – the detail

Selecting and working with a Lean consultant (C729)

Why you should read this guide	Contents
<p>You have already explored the principles of 'Lean' and how they may be applied to construction. You may want to assess the size of the opportunity for your organisation or need help with implementing a Lean based improvement programme. You may have achieved a degree of progress within your own organisation and now wish to build on it or extend it into your supply chains and client projects. To do this you may be considering how to develop your own team or bring in expertise to work with you and your suppliers.</p> <p>Reading this guide will help you assess what your organisation needs, identify potential consultants, procure their services effectively, have a productive relationship with them and develop your organisation's internal capabilities for the longer term. Implementing Lean is a continuous improvement programme, which is likely to need significant consultant support to get it established efficiently and effectively.</p> <p>This guide has been authored and reviewed by individuals who have considerable experience of applying Lean principles to construction in the UK, both as clients and suppliers of Lean consulting services.</p>	<ol style="list-style-type: none"> 1 Developing the brief 2 Market research 3 Procurement process and supplier selection 4 Building and maintaining the supplier relationship 5 Becoming a Lean enterprise 6 Conclusion

Lean tools and techniques – an introduction (C730)

Why you should read this guide	Contents
<p>Do you want to improve business organisation, performance, competitiveness and profitability? Would you like to raise project delivery performance in terms of quality, programme and cost? If you answered yes to any or all of these points, then you should read this guide.</p> <p>This guide outlines the use of Lean tools and approaches that have been adapted, developed and applied successfully in the construction industry throughout the UK and across the world. Several key tools are presented. Each tool is described, pointers on where, when and how to apply are given and the benefits that typically result are listed. Simple case examples are included to outline where each tool has been successfully applied.</p> <p>To maximise the gains possible on a construction project, Lean should be applied by all parties to all stages, aspects and activities of the end-to-end project cycle. However, this guide has been written to focus on the construction phase of a project. It intends to give the reader initial guidance on a series of Lean tools and techniques that can help you deliver tangible benefits to your business and in the way you deliver construction works and projects. Lean and the related tools really do deliver and we hope this guide motivates you to really 'go Lean'.</p>	<ol style="list-style-type: none">1 Introduction2 Delivering against agreed vision, objectives and strategy for Lean project delivery (Hoshin Kanri)3 Lean collaborative planning and project management4 Structured problem solving5 5S workplace organisation6 Visual management7 Process improvement8 Operations improvement9 Other tools and techniques associated with a Lean approach to construction

Just do it!

You may feel in your current role that you have little or no influence or authority to apply Lean to make an improvement. The important thing is to do something. Ideally your approach will be part of a concerted effort and improvement strategy for your business and/or a project. Failing that, by applying an appropriate tool to activities that are within your field of control, you will be amazed at the benefits you and your team can realise.

4 Lean – a brief overview

LEAN – THE BENEFITS

‘Lean’ in its simplest form means eliminating waste from everything we do. When applied to construction, Lean provides a way to deliver high performance in every category of measure, including quality, cost, delivery, profitability and sustainability. It has been proven across the UK and the globe that when companies consistently apply a Lean approach across all aspects of their work activities, they achieve excellent results. Savings of 20 per cent of costs, sometimes considerably more, have been reported. But Lean is not just about cost savings, and can yield a range of other benefits including:

- 1 Reducing operating costs through the minimisation of non-value adding activities.
- 2 Winning a higher proportion of bids through a better understanding of what represents value to the client and focusing on it.
- 3 Being able to deliver the project more quickly with a more consistent work flow.
- 4 At a lower cost having reduced the amount of waste.
- 5 With less labour on site.
- 6 A lower degree of risk and a safer environment.
- 7 Producing the right quality product.
- 8 Establishing a culture that rigorously works to continuously improve the performance of the business.

A key element of Lean is continuous improvement, so becoming Lean is an aspiration and ongoing process – not an end result. Those organisations that have successfully implemented Lean refer to it as a journey and aim to continuously enhance all aspects of their business, organisation and how they deliver their product or service, including all levels of their supply chain. Many texts have been written about becoming a Lean organisation (a short-list of key references to be selected by the PSG)

Lean construction relates to a proven and effective approach for project productivity, reducing waste, improving quality and developing people – and at the same time creating a culture of continuous improvement.

When used to improve the delivery performance of a construction project, Lean should ideally be applied right from the start of a project to help define efficient processes and practices, not only for the construction process but for pre-construction processes as well. Lean tools can also be applied to improve the delivery of specific aspects of a project and help in the recovery of a project that is already underway and requires improvement in performance. Whichever point in a project Lean is applied, there is now evidence to show that value for money can be optimised as Lean will help improve ‘right first time’ quality and enhance cost and time performance.

LEAN – THE PRINCIPLES

It is beyond the scope of a document of this length to provide anything other than the briefest overview of Lean. Anyone who has explored Lean, even at the most basic levels, would have identified three aspects, which are the five principles of Lean, the seven (or eight) types of wastes and principal approaches used in implementing Lean.

The five principles of Lean are value, value stream, flow, pull, and perfection.

The first principle – understanding the value to the client – will be familiar to most in the construction sector. The final one ‘perfection’ may be more familiar as ‘continuous improvement’ or ‘knowledge capture and learning’. The intermediate principles of value stream, flow and pull draw on approaches to help optimise the way all the stages in construction – from developing a brief to operating the facility – are undertaken. These are explained further in Table 1.

Table 1 *The five principles of Lean*

Value	This must be defined by the customer. In construction, value-adding activities can be broadly defined as those that transform materials and information into something that the customer would be prepared to pay for. Non-value activities are those that do not. A further category includes activities that don't add value and that cannot be avoided at the present. Checks carried out for legal compliance are an example of the latter.
Value stream	The flow from raw materials to completed project. The value stream can be mapped between activities that add value to expose waste. Value streams exist both on site and across company boundaries from all raw materials being used on the project whether they arrive on site as a raw material (aggregate) or as a finished product (a lift).
Flow	In manufacturing the product flows through work stations or companies, which each adds value. In construction projects it can still represent the flow in or between companies until materials and products arrive on site for assembly. Construction's uniqueness is partly that it is then the workforce who tends to flow over the project rather than the other way round. The construction programme itself can flow in this sense.
Pull	All components and information are made and supplied at the necessary time to deliver the product or service to the customer at exactly the time the customer wants it. Perhaps this has always been the goal in construction rather than in manufacturing where mass production was pushed onto the customer. In construction one of pull's biggest enemies is excessive unexposed risk contingency.
Perfection	For both manufacturing and construction this represents an 'ideal state' that will never be achieved in the field. Striving for it by continuously improving through collaboratively identifying and removing waste provides the desired results.

A key aspect of the intermediate principles is to study the various processes or activities. A further feature is to employ a collaborative approach, engaging with as full a range of stakeholders as possible (from client, user and supply chain) to:

- ▶ really understand what adds value
- ▶ study the processes by which information, materials, labour and other resources are being applied to the project
- ▶ identify ways in which the activities can be optimised, with a particular focus on ‘waste’.

Waste from a Lean perspective

Waste has a broader interpretation in Lean than the physical wastes that are the focus of construction site activity. In fact waste is any activity (or inactivity) that does not add value to the product or service.

Value and waste

Value-adding (VA): this is the work that changes the shape or nature of the product (or service) in a way that contributes to the final form that the customer is willing to pay for.

Essential non-value adding activities (ENVAs, or support activities): these are the tasks that must be completed to enable the value-adding activity to be completed, but do not add value. For example, inspection does not add actual value but is necessary up to the point where a process can be improved so that inspection can be eliminated.

Waste: this is any other activity or event associated with carrying out a particular work activity. Waste can be viewed from two perspectives:

Waste in the work itself (eg excessive walking, looking for tools and materials, poor quality).

Introduced or 'enforced' waste (eg waiting for information, materials not supplied), which has prevented work activity from being carried out.

This broader definition of waste is variously described as having seven or eight types. There is some variability in precise terms, although many are listed using the mnemonic 'TIMWOODS'.

The eight classes of wastes (from Terry and Smith, 2011).

T Transportation	<ul style="list-style-type: none"> ◆ moving work-in-process from place to place etc ◆ delivering equipment, incomplete orders ◆ moving to and from storage.
I Inventory	<ul style="list-style-type: none"> ◆ excess raw material, WIP or finished goods causing longer lead times, obsolescence, damaged goods, transportation/ storage costs and delays etc ◆ large site stores of materials ◆ poor stock management ◆ too much material compromising workspace.
M Motion	<ul style="list-style-type: none"> ◆ unnecessary movement of people and equipment that does not add value, including walking between different work places etc ◆ walking between workplace and welfare facilities, manual paperwork processing ◆ movement of materials and drawing information.
W Waiting	<ul style="list-style-type: none"> ◆ workers unable to do value-creating work, and capacity bottlenecks ◆ waiting time between processes or for capacity to take the next step ◆ documents awaiting updating or processing ◆ equipment downtime.
O Over-production	<ul style="list-style-type: none"> ◆ producing items earlier than needed or beyond specification ◆ producing more than is needed ◆ larger than necessary excavations, orders placed for same materials with different suppliers ◆ generating waste through overstaffing, storage and transportation costs ◆ can be physical or information that is produced.
O Over-processing	<ul style="list-style-type: none"> ◆ taking unnecessary steps ◆ multiple plant movements ◆ inefficient processing, especially due to poor design or work planning causing something unnecessary ◆ providing higher quality products than necessary, and produced to standards beyond specifications (BS) ◆ work done to 'fill the gaps' rather than appear to be waiting, eg 'waiting for instructions'.
D Defects	<ul style="list-style-type: none"> ◆ production of defective work or corrections, snags, not meeting specifications first time etc ◆ inspections to reduce/remove defects ◆ wrong information on drawings ◆ production of replacements – rework.
S Skills misuse	<ul style="list-style-type: none"> ◆ losing time and ideas, skills improvements and learning opportunities etc ◆ learning from one site not being used well on another ◆ people working one or two levels down from their true capability ◆ mismanaged health and safety.

What is Lean?

Lean is a total organisational and operational approach to business that is customer focused and people centric. Often thought to be no more than a suite of tools, Lean is widely misunderstood, including within the construction sector. Actually Lean is as much about the way you think and the way you feel about your thoughts”.

“You will not get to be a sustainable Lean company unless you have a system that includes all managers, all operatives and a skilled support team of Lean leaders working as an integral part of your business. Construction companies fragment their businesses by not seeing the **continuous nature of their projects and supply chains as a whole system that is interactive and interdependent at all levels.**”

CIRIA (2012) *Lean and BIM - synergies and opportunities*
CIRIA Briefing, ref: 08/02/2012. Go to: www.ciria.org/service/lean

The series of guides described in this document support and supplement CIRIA’s Lean guide published in 2011 (C696)
BUILD LEAN: transforming construction using Lean Thinking

Build Lean. Transforming construction using Lean Thinking

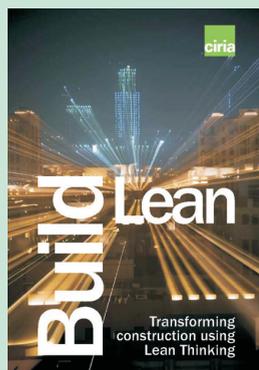
A Terry and S Smith

We meet Steve, a senior leader in a construction business as he receives news of yet another failed tender bid. Licking his wounds, and pondering what he can do differently next time, he comes across a comparative review of two projects recently completed by his company. The two schemes were similar. However the second project, significantly outperformed the first.

The review reported that the team had achieved this performance through adopting what they described as a Lean Thinking approach. It was worth a look.

What did he have to lose?

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