

## TOOL C.6

### PLANNING AND MANAGING CONSTRUCTION TO OPTIMISE PROGRAMME AND MINIMISE WASTE

The formal use of Value Management and Value Engineering gives structure and discipline to the work of the Cluster Leaders and Designers during the development of the Project Brief and the Scheme Design. These techniques are used by the Prime Contractor to ensure that all the parties involved in the project are able to contribute their skills and experience to optimise functionality (VM) and produce a design which delivers minimal through-life-cost (VE).

Formal structure and discipline are still required to eliminate the waste of labour and materials that all too often add cost to a project during the construction phase (paid for either by the client in an unnecessarily high price or by the members of the construction team in reduced margins). They are also required in order to optimise the time taken to complete construction – again with the purpose of minimising the price paid by the client and protecting pre-determined margins for the construction team members. This tool describes the way in which appropriate processes can be applied to achieve those objectives.

Their application involves all the Cluster Leaders and the Design team – lead and facilitated by the Prime Contractor’s Project Manager and Planner. The process of applying these techniques begins during Detail Design and continues throughout Construction. We now look at the application of these techniques – principally Value Engineering (VE) and Continuous Improvement (CI) – and the tools (notably Process Mapping) which underpin them in **Planning** to optimise the schedule for the construction phase and then in **Managing** construction activities to eliminate waste once on site.

#### 1. PLANNING FOR CONSTRUCTION.

This activity starts with the beginning of the Detail Design phase. Cluster Leader meetings will continue as in the Concept design phase and continue to use Value Engineering to further reduce through life costs. Now, however, Value Engineering can also be used in conjunction with the Interface Register (see Tool I) to minimise the labour costs which will be incurred in connecting the physical deliverables of one Cluster with another.

This process results in the development of construction information developed by the Cluster Leaders themselves – co-ordinated and facilitated in the process by the Prime Contractor. The objective is for everyone in the team to be satisfied that, once construction begins, there will be no surprises and that the construction process can be completed with no modification or rectification of components and with minimal labour time. The rigorous application of Value Engineering, informed by the discipline of the Interface Register and use of Process Mapping to understand how existing ways of doing things could be improved, will achieve that objective.

But there is a further requirement. If components are to fit together first time - which means that no modification or rectification will be needed – then they have to be made to the correct dimensions in the first place. Apertures can be pre-formed in blockwork or beams so that pipework and ducting, for example, can be made (ideally off-site) and slotted into place with no need to waste materials and labour in cutting or knocking holes in beams or walls to accommodate them. For all this to happen, the Cluster Leaders must have fully and accurately dimensioned drawings with a suitably referenced grid. Each Cluster Leader will, of course, prepare drawings for their own purposes but it is essential to remember that their drawings will impinge on the activities of all the other Cluster Leaders. All drawings therefore need to be prepared to a common datum and the dimensional integrity of the building as a whole must be maintained throughout the entire design process. All Cluster Leaders' drawings must be dimensionally interchangeable. This issue is best carried out - or at the least co-ordinated - by the project's consultant designers.

Clearly, the activities described above will have a significant effect on the construction schedule. Therefore, it is logical to extend the work of the Cluster Leaders in optimising the construction process to simultaneously include the development of the production schedule.

The development of the production schedule is the responsibility of the Prime Contractor whose Planners would - in a traditional project - develop the schedule based on past experience and in isolation from the people contracted to construct the project. Their views may be canvassed but they would not participate directly in the planning and scheduling process.

While the responsibility for producing and maintaining the production schedule remains with the Prime Contractor, in this process it is developed by drawing on the practical expertise of the Cluster Leaders whose input will ensure that the production process can be optimised and the time for completion thus minimised.

The role of the Prime Contractor's Planner is therefore to work with the Cluster Leaders - in the way that the Project Manager has done throughout the project - by delegating responsibility to them to say how they want to manage their part of the construction process for greatest efficiency. Their outputs must then be co-ordinated to ensure that the requirements of each Cluster Leader for, for example, access at different stages of construction can best be co-ordinated and that every opportunity for each Cluster Leader to help the others is identified and built into the schedule.

The Planner's role is one of facilitation and monitoring. The Planner should also encourage the use of Process Mapping as a tool by which each Cluster Leader can question traditional approaches to construction tasks - particularly in the way that one trade interfaces with another. Given that this tool may be unfamiliar to members of the supply chain, the Prime Contractor may need to take the lead in demonstrating its use and benefits.

An example of the power of Process Mapping was demonstrated on one of the pilot projects. To ensure an effective and efficient Detail Design phase, a workshop was held for the designers, the Cluster Leaders and the Prime Contractor's own team to

draw up and to map the overall process which should be followed during detail design. The workshop was facilitated by an outsider to ensure that people did not just fall back on custom and practice but really thought things through from first principles. This allowed for issues associated with each step of the process to be identified and for the necessary actions for each member of the team to be determined. This mapping and issue identification exercise clearly demonstrated the shortcomings of the traditional bar chart approach that would have been used in identifying the real purpose behind each action and the effect it would have on all the other members of the team.

There are two notable benefits to this form of collaborative planning. First, since all the parties to the project have developed the plan, they automatically feel a far greater level than normal to ensure its realisation. Secondly, since all the available construction expertise has been mobilised, far greater attention is paid to detail which helps to ensure that the unexpected is eliminated as far as possible. The result is that, once construction commences, people can spend their time on finding even better ways of doing things day-by-day rather than trying to manage crises.

## **2. MANAGING CONSTRUCTION.**

So, with the construction team freed from crisis management and day-to-day resolution of issues which should - and in this process will - have been foreseen, they can spend their time in working on further ways to take out even more waste and inefficiency as construction proceeds. The mechanism for this is Continuous Improvement, and although it now becomes the principal vehicle for cost reduction during the remainder of the project, its application begins before construction actually starts, as the table below shows.

EVENT	DETAILS	OUTCOMES	WHEN IN PROCESS
A. Meeting with senior management of Cluster Leaders and Members	<ul style="list-style-type: none"> <li>• ½ day workshop</li> <li>• convened, run and facilitated by Prime Contractor with external support if needed</li> </ul>	<ul style="list-style-type: none"> <li>• confirmed interest in CI</li> <li>• deepened understanding of CI process and the place of the Business Excellence model</li> <li>• Commitment obtained</li> <li>• key issues for improvement identified - short and longer term</li> </ul>	Immediately following sign-off of Spatial Layout
B. Meeting with Cluster Leaders'/Members' site operations staff	<ul style="list-style-type: none"> <li>• 1 day workshop run and facilitated by Prime Contractor with external support if needed</li> </ul>	<ul style="list-style-type: none"> <li>• areas for improvement identified in detail</li> <li>• process for improvement methodology and responsibility agreed</li> <li>• actions allocated to teams which include necessary capabilities. Teams clear that they are <b>Problem Solving Teams</b></li> </ul>	During Concept Design (right after the above meeting)
C. Problem Solving Team meetings	<ul style="list-style-type: none"> <li>• regular meetings</li> <li>• run by appropriate team leader with Prime Contractor in attendance to monitor and support</li> </ul>	<ul style="list-style-type: none"> <li>• CI Problem Solving tools and techniques learned and applied</li> <li>• action plans devised and implemented (long and short term)</li> <li>• progress and benefits of CI action plans monitored, reviewed and implemented with benefits codified for future application elsewhere</li> </ul>	Start during Concept phase and continue throughout project
D. Repeat from Event B			

The activities described above - which take place concurrently with the work described in Section 1 of this tool again illustrate the changed role of the Prime Contractor. There is a shift from control to facilitation, so that the expertise of all parties is mobilised, and co-ordination, so that the work of all parties can proceed in the most mutually beneficial way.

The organisation of the project is different to the extent that site meetings are collaborative, with the Prime Contractor delegating decisions to Cluster Leaders and supporting them by doing those things that they ask for in order to do their own jobs as quickly and effectively as possible. The elimination of waste in materials and time (and hence labour cost) informs all decision making. Attention to quality is automatically enhanced, since any rework means a waste of materials and labour which in this process will not be paid for by the client. On the contrary, it will come straight out of the profitability of the project for the Cluster Leader or Member responsible for the poor quality in the first place. This process expects everything to be done right first time and every time.

Problem Solving Teams (see Section B in the preceding Table) use the tools of Continuous Improvement to identify the underlying causes of waste and inefficiency both prior to and during the construction process. Those causes reside in inadequate planning - already addressed in Part 1 of this tool - and in site processes which are inefficient.

As far as planning and scheduling are concerned, a great deal of work is undertaken before construction starts, as has been discussed. But there is still a need to review and refine the schedule in the light of actual progress on site. The problem that is likely to be encountered on site in a project of this nature is dealing with faster progress than originally planned, unlike traditional sites where the problem is more likely to be how to catch up.

But the Prime Contractor and his team will not want the benefits of early excellent progress on the project to be lost due to materials not being available because their delivery is now needed earlier. This aspect of planning and scheduling is an ideal topic for a Problem Solving Team. Such a team can include the site foremen from each Cluster and they are the people who, on the one hand, are best able to identify potential material shortages due to greater-than-anticipated progress and, on the other hand, have the greatest incentive to help the Prime Contractor to find a solution since they will not want their tradesmen to be idle.

The more usual application of Continuous Improvement disciplines is in identifying, for example, the causes of materials wastage (perhaps through damage caused by multiple handling on site or because components are delivered long before they are required) and of time (perhaps through trades having incomplete or late access to their work-site). The role of the Prime Contractor is to mobilise the appropriate members of the relevant Clusters and facilitate their involvement in the use of the problem solving tools which enable Continuous Improvement to deliver the benefits of which it is capable.

So, throughout the planning and management of site activities to minimise construction time and eliminate waste of labour and materials, the role of the Prime Contractor is to mobilise the expertise of the Cluster Leaders and their teams and allow them, through facilitation and co-ordination, to achieve those objectives.

### *VIGNETTE 1*

At one of the Pilot projects, the designers and Cluster Leaders were invited to a meeting by the Prime Contractor to discuss what lessons could be learned from the design process so that it could be done even better on future projects. (It has to be said that the process had gone very well but, as always, there are opportunities for improvement. The team was not content to rest on its laurels). The Project Manager said how important a series of simple sketches that the architect had prepared to show the construction details of critical inter-faces (and hence inter-Cluster activity) had been in facilitating easy assembly.

The building services Cluster leader then added how gratifying it had been to find that the architect had maintained such an accurate dimensional grid throughout the project. As a result, all the ducts and pipework (constructed on site) had fitted perfectly first time. He knew, he said, that this was the object of the process but since, in all his years in the industry he had never seen all his components fit first time, he hadn't really believed that it would actually work this time. Now that he had seen it work in practice, he had the confidence to pre-fabricate all his pipe and ductwork at the factory in future - with attendant reduction in cost.

Someone expressed surprise that architects don't always dimension drawings properly and in sufficient detail for all suppliers to make their components fit first time. The structural consultant responded by saying that this process is much more like an engineering process than a building process.

So perhaps there is still some way to go in the industry in understanding - as other industries do - that failure to control dimensions, or worse, not even recognise their critical importance, adds unnecessary cost and reduces opportunities for off-site pre-construction and assembly.

## *VIGNETTE 2.*

The topic for the Problem Solving Team was the elimination of waste of materials on site. One area for review was wastage due to damage resulting from materials having to be moved from one place to another unnecessarily. One conclusion was that materials should be put in the right place to begin with (there were others, of course, such as scheduling materials to arrive when needed and not before).

So, the question was how this could be achieved. The obvious (in hindsight) answer was to give the gateman each day a list of deliveries for that day and the location on site for the driver to off-load. If he was to be expected to take this responsibility (which he accepted quite happily), why not invite him to take part in the daily foremen's site progress meetings (also an outcome of a Problem Solving Team) so that he could contribute to the whole question of materials storage and become properly involved?

Despite the view of some that this would all be beyond the capability of a mere gateman, it has worked excellently.

As in many other industries, on this particular project the team has found that people possess far more ability than they are customarily given credit for and, when asked, relish the chance to contribute to the successful outcome of whatever activity they are involved in - and make their own jobs more interesting and fulfilling at the same time.

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Be is an independent body formed from a merger of the Reading Construction Forum and the Design Build Foundation in 2002. Its 100 member organisations come from the demand and supply chains of the 'industry formerly known as construction', ranging from public sector and private sector clients and developers to contractors, designers, consultants, specialists and suppliers. It leads research and implementation activities in support of a vision of delivering integrated built environment solutions through collaborative working.

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The Collaborative Working Centre of Be is a not-for-profit organisation set up from members of the team that facilitated *Building Down Barriers* to provide consultancy, training and other continuous improvement services to support the development and implementation of collaborative working.

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