

## TOOL D.2.

### ASSESSING BUSINESS AND ENGINEERING PROCESSES

#### 1. STAKEHOLDERS AND THEIR KEY EVALUATION PURPOSES

- 1) Prime Contractors and their Cluster Leaders need to understand how effective their project processes are, to improve them during the current project and make delivery predictable, and to learn for future projects
- 2) The Client wants to be re-assured that the Prime Contractor is managing processes effectively
- 3) Industry in general wants to learn about best practice.

#### 2. KEY INDICATORS RELEVANT TO THESE EVALUATION PURPOSES

- A) **Comprehensive cost management:** costs and prices are optimised in parallel with design development, based on bottom-up understanding of labour, plant and materials content and the use of some form of continuous improvement to reduce waste in construction processes
- B) **Effective management of design activities:** including early identification of interfaces, production of information required schedules, and monitoring of progress against a programme.
- C) **Effective management of construction activities:** including utilisation of labour, plant and materials.
- D) **Application of industry norms in QA, H&S, CDM**

#### 3. EVALUATION MECHANISMS, ROLES & RESPONSIBILITIES FOR KEY INDICATORS

In what follows, we outline who will need to collect what evidence, and for what kind of use, in order to evaluate performance according to the above criteria.

##### *1.1. Assessing the approach to cost management*

The Client wants reassurance that the price that they finally agree to pay is based on the lowest possible cost of constructing the design that has been accepted. That reassurance must be based on the ability of the Prime Contractor to demonstrate that they have taken all the steps necessary to minimise the cost of construction. Thus, the Prime Contractor must be able to demonstrate that the following activities have taken place.

**Scheme Design** The design for construction - the greatest driver of cost - has been optimised. Less than optimal design of the actual structure, and in particular, over-engineering, will lead to unnecessary cost in materials, associated cost of labour, and, possibly, use of plant. The evidence that the client needs to demonstrate that the design process has been managed effectively by the Prime Contractor to drive out unnecessary cost includes:

- Minutes of design meetings from which it is clear that consultants and Cluster Leaders have collaborated to bring out their joint experience to bear in making design decisions. These decisions should be made on the basis of costed analyses of the different options that were considered, so that the client has a record available which clearly explains why design decisions were taken and what cost benefits were achieved.
- Minutes of Value Engineering meetings from which it is clear that objective decisions were taken on the specification of materials and equipment, bearing in mind the balance of capital and through life costs, and that the people with the most appropriate skills and experience from within the team were present. A Value Engineering register, which captures the costs of the options considered, would enable the client to see how much VE activities had saved him.
- Evidence that the interface issues between the various Clusters were identified and managed to ensure that buildability was optimised to ensure that there would be no need for re-work and its associated costs once construction starts. Some form of Interface Register that identifies potential problems and confirms their resolution will be necessary for such a demonstration.

### **Detailed Design and Prebuild**

Once it is demonstrated that the fundamental cost of construction has been minimised through effective design, it will be necessary for the Prime Contractor to demonstrate to the client that they have secured the lowest prices for labour and materials from Cluster Leaders for actually constructing the building. Cluster Leaders will have built up their prices for delivering their individual work packages through a combination of:

- their own costs together with agreed gross margins
- their suppliers' (Cluster Members) prices, which will be a combination of labour, materials, plant, prelims and risk.

What is now required is for the Prime Contractor to demonstrate to the client that they have interrogated and agreed these Cluster Leaders' prices by following the process set out in Tool CX in this handbook or some similar and equally rigorous process. The evidence that the client should require to demonstrate that this has been done will include:

- Records of discussions in which the labour element of Cluster Members' bids has been developed. This should be based on best estimates of what will be required for this specific project, taking into account the efficiencies on site which are anticipated as a result of the design process, rather than using historic generic data which is derived from past inefficient ways of working.
- The active use of a formal Risk Register, from the earliest stages of concept design, to demonstrate that risk has been managed out and that, where it justifiably exists, has been properly allocated.
- Records of actions taken to minimise site prelims and the optimal use of plant.

Given that he has this documentation, the Prime Contractor can demonstrate that he has minimised the costs of completing the project in

terms of the contribution to the overall cost by the Cluster Leaders. Even though that will be a large proportion of overall costs, there is still the element for which the Prime Contractor himself is responsible through the activities that he directly controls. These will include, for example, work packages which he decides to manage himself and overall site prelims. In all such cases, he must be prepared to justify his decisions with evidence similar to that described in the foregoing section. In addition, he should also be able to produce for the client evidence (generally through minutes of meetings) of Continuous Improvement activities aimed at reducing costs and eliminating waste once work has started on site. Examples of such cost saving activities might include arrangements for materials storage intended to minimise waste through damage or theft, and sharing resources amongst the trades on site to avoid unnecessary duplication of effort and cost.

**Construction** Managing the underpinning cost structure and associated prices is inevitably also dependent on the management of the construction programme itself. A programme that fails to eliminate situations in which, for example, the work of one trade being disrupted by the need for access to the same space by another trade will lead to delays and unnecessary cost. Similarly, if the construction process is not designed with due regard for the efficient deployment and use of the plant which will be required, cost and delay will also result. The client has every right to expect that the Prime Contractor will manage the project programme, and the schedule of events which drives it, as efficiently as possible. The Prime Contractor must have the evidence available to demonstrate to the client that in developing the programme he has ensured that all potential problems have been identified and ways found to eliminate them.

Such evidence might come from:

- Minutes of meetings, with the Prime Contractor acting as facilitator, to identify the requirements for each Cluster Leader to be able to carry out his work on site with the least disruption and in the shortest time
- Programmes developed by the Prime Contractor which can be demonstrated to have taken into account the Cluster Leaders' requirements for efficient working
- Schedules that demonstrate that activities have been included to facilitate site operations - e.g. the creation of suitably firm and level surfaces to be able access equipment to assemble the steel frame to be used efficiently and safely regardless of weather conditions before the roof is complete.

The client should also have access to evidence that, once construction starts, there are processes involving all the Cluster Leaders on site to enable the alteration of the schedule in the very short term. The purpose of these processes is to take advantage of opportunities that may arise if the original programme is overtaken or to manage problems that may occur through unforeseeable delays to part of the project. This can be achieved for example through weekly short-term planning meetings, where progress

and “look-ahead” plans are reviewed.

## ***1.2. Assessing management of design activities***

The Client will want to know that the Prime Contractor has a firm grip on the sequencing and management of design activities. In Tool CX, we saw how the key to design management at each level of design development is the early identification and resolution of key interdependencies or interfaces, so that design activities can then proceed in parallel. The Client will want to see evidence that the Prime Contractor is managing design in this way, as well as clear evidence that activities are proceeding according to the design programme that has been put in place. The following specific kinds of evidence of effective design processes will be relevant.

<b>Project Brief</b>	Records of value management workshops that show the involvement of users and key suppliers in expanding understanding of the functional and other requirements to be fulfilled by the design
<b>Design Strategy</b>	Records showing early identification of design interdependencies e.g. between services strategy, frame solution, and approach to foundations, and workshops where relevant designers – both consultants and Cluster-based – debate alternative solutions with the Prime Contractor and the Client, using value engineering or a similar rigorous methodology for identifying a preferred solution
<b>Scheme Design</b>	<p>Records of an initial workshop showing identification of key works interfaces between Cluster design packages, and establishment of a system for tracking early resolution of them, such as an Interface Register which clearly allocates responsibility for each interface.</p> <p>Production of an Information Required Schedule and a design programme based on it for the Scheme Design Stage</p> <p>Evidence of an effective system (preferably but not necessarily electronic) for circulation of design drawings, commenting on them, and taking action by “owners” of drawings.</p> <p>Records of design reviews showing regular monitoring of progress of each Cluster design package against the programme, regular reviews of the interface issues (e.g. through the Interface Register), and continually updated estimates of how much work there is still to complete on each package</p> <p>Production of fully-dimensioned general arrangements drawings for the total design</p>
<b>Detailed Design and Prebuild</b>	Records of an initial planning workshop involving all Cluster designers and design consultants, leading to early production of an Information Required Schedule and a programme for producing production drawings by Clusters

Records of regular design reviews showing regular monitoring of progress of each Cluster design package against the programme, regular reviews of issues (e.g. through the Interface Register), and continually up-dated estimates of how much work there is still to complete on each package

### ***1.3. Assessing management of construction activities***

Section 3.1 has already indicated the kind of evidence required to show that a Prime Contractor has systems in place to minimise Prelims, and ensure production and continuous review of a well co-ordinated construction programme. Beyond this, both the Prime Contractor's supply team and the Client need to know that plant, material and labour are in fact being effectively utilised, and that work is being completed to programme or better. The following kinds of performance measures will be meaningful.

**Construction**      Weekly records of tasks completed, or % completed, compared to programme, for each Cluster

Periodic (for example monthly or bimonthly) updates of the overall integrated target programme, including revision of the completion date, taking account of the implications of certain activities being completed ahead of schedule and others being subject to delays.

Use of some form of activity-based monitoring of site activities, to produce weekly records of % time utilisation of labour and plant for each Cluster on site, the amount of time (if any!) spent on rework and the amount of material wasted or damaged. These figures can be compared to targets or benchmarks agreed between the Prime Contractor and each Cluster, and provide the basis for site-based continuous improvement teams to understand why a given level of performance has been achieved, and how it can be improved in the short and long-term.

#### *Illustration:*

The Aldershot Pilot Project used the Building Research Establishment's CALIBRE system. Independent observers monitored utilisation of all plant and labour intensively throughout each day, for the entire construction period. Each Cluster produced estimates of each main task in terms of man-hours of work, and the BRE CALIBRE team produced weekly reports comparing man-hours actually worked on each task with the estimate. The reports also indicated the percentage of labour time for each Cluster that was spent on value added activities, compared to targets agreed with each Cluster, and also compared the overall weekly site labour utilisation percentage with an industry benchmark of 54%. Levels of value-adding work were consistently in the region of 60-65% for most Clusters. CALIBRE reports also indicated the causes of unplanned non-value adding labour time, such as double handling of materials, and the nature of any rework. Rework levels were consistently of the order of 1% time, compared to a project target of 10% and industry much higher industry norms.

#### ***1.4. Application of industry norms in QA, and Health and Safety, including CDM***

BDB projects should conform with industry norms in terms of Prime Contractors and their suppliers producing project plans that have fully developed quality assurance systems, and which conform with CDM regulations in terms of health and safety for construction, use and maintenance of all facilities. The nature of quality assurance systems and requirements of CDM regulations are not covered in this handbook, because they are not specific to the BDB approach. However, the key features that reinforce the overall BDB approach are:

- Quality assurance systems which involve documentation of each stage of the overall project process before it is conducted, with clear specification of roles and responsibilities, in particular of who is responsible for setting quality standards, and who is responsible for checking them, or carrying out engineering tests, at what point. In general, with the BDB approach, Cluster Leaders are responsible for controlling standards of workmanship before indicating that a task is completed to the Prime Contractor. There is no “clerk or works” role in BDB quality control, which means that the Prime Contractor and Client will undertake only occasional checks on standards of work, for example inspecting examples of installed finishes in order to agree standards that subsequent work will be completed to. The Prime Contractor and Client will expect quality of workmanship to be controlled largely through the use of some form of “snagging database”, by which all project team members can input views on potential defects and shortcomings as soon as they become visible, so that rapid, low-cost remedial work can be undertaken.

*Illustration:*

- CDM regulations require that designs are audited before being finalised to reveal whether they pose any hazards for personnel involved in construction, operation and maintenance of the building. This audit can take place as an additional check during the Scheme and Detailed Design development stages. CDM audit can also take place after construction has been completed, to identify any areas where safety issues have in fact arisen, so that learning can be fed into future design audits

*Illustration:*

On the Aldershot site, the Finishes Cluster leader reported that problems with engaging labour in an area with a shortage of bricklayers had been compounded by the large amount of blockwork involving very heavy blocks, which had been selected to meet stringent requirements for sound separation between two areas. Workers had found getting the blocks to elevated working positions demanding and stressful, as well as tiring to lift into position, and some minor strains had resulted. On the whole, workers chose to work somewhere else after a few weeks. These issues have been noted, and will be taken note of in future CDM design assessments.

In addition, as with any construction project, one run according to the BDB approach will need to keep records of reportable accidents. The cause of each one will need to be investigated, and their overall incidence can be compared with industry targets at the end of a project. Since, at the time of writing, both BDB projects are approaching completion of site activities and neither has experienced a reportable accident, a viable target for any future BDB-type project is zero reportable accidents.

#### 4. OTHER INDICATORS

In addition to the key indicators and forms of evidence described above, Clients, Prime Contractors and their Suppliers may wish to consider the following as ways of assessing the performance of design and construction processes.

- E) **People results:** levels of job satisfaction and motivation expressed by design and construction personnel, in response to periodic surveys asking them to rate their experience of this project compared to recent past projects, and identify what in the work is increasing or decreasing their satisfaction and motivation.
- F) **Environmental results:** reductions in levels of material waste, including through recycling recovered materials from initial groundworks, compared to project targets and industry standards; contributions to local environmental targets through planting of trees; contributions to local clean air targets by use of low emission heating and cooling systems, including combined heat and power installations, and use of natural ventilation
- G) **Profitability of the Prime Contractor and supply chain members:** measured in terms of out-turn margins for the project, compared to project targets and industry benchmarks
- H) **Development of intellectual capital:** assessment of what the project has demonstrated in terms of the collective capability of the Prime Contractor and their supply chain to deliver business results, compared to where they would like to be in order to performance compatible with long term strategic goals. This provides a basis for the supply team to identify what they have learned to do better during the current project, and what the next step should be in terms of improving.

## 5. SUMMARY OF EVALUATION ACTIVITY

Project Phases	Assessing Products	Assessing Business and Engineering Processes
Initiation	Client defines what is to be achieved in terms of a,b,c & d <i>(See Tools E and F)</i>	
Selection	PC is invited to demonstrate past achievements in terms of a, b, c, & d, and to set targets for this project	PC demonstrates achievement of improvement in A, B & C in past projects
Scheme Design	Assess achievements in a, b & c	Assess achievements in A, B,C,D
Detailed Design	Assess achievements in a, b & c	Assess achievements in A, B,C,D
Handover	Assess achievements in a, b & c	Assess achievements in B,C,D
Post Handover	Assess achievements in a,b,c & d	

### **Collaborating for the Built Environment (Be) – [www.beonline.co.uk](http://www.beonline.co.uk)**

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.

Contact Don Ward (Chief Executive):

(E) [don.ward@beonline.co.uk](mailto:don.ward@beonline.co.uk) (W) [www.beonline.co.uk](http://www.beonline.co.uk)

PO Box 2874, London Road, Reading RG1 5UQ. (T) 0870 922 0034

### **Collaborative Working Centre – [www.collaborativeworking.co.uk](http://www.collaborativeworking.co.uk)**

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.

Contact Neil Jarrett or Vassos Chrysostomou (Directors):

(E) [neil.jarrett@collaborativeworking.co.uk](mailto:neil.jarrett@collaborativeworking.co.uk) or [vassos@collaborativeworking.co.uk](mailto:vassos@collaborativeworking.co.uk)

c/o PO Box 2874, London Road, Reading RG1 5UQ. (T) 0870 922 0034