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BENEFITS DERIVED FROM USE OF DSM AS PART OF THE ADEPT APPROACH TO MANAGING ENGINEERING PROJECTS

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1. INTRODUCTION

Papers have been presented on the ADePT planning and management approach at DSM Conferences going back to 2000. The approach is now in widespread use in industrial applications, ranging from a US$4M building fit-out project to a £4Bn urban redevelopment project, and a number of practices have been established to ensure design planning and control is undertaken in the most effective way possible.

The impacts of the approach's use have recently been assessed, highlighting a number of areas where benefit is derived and showing a significant return on the investment required to implement the technique.

2. BACKGROUND

The ADePT methodology has traditionally been thought of as a planning approach used to plan the design phase of construction projects. The development of a design programme integrated across the design disciplines, incorporating iteration, and linked to procurement and construction sets a framework for project delivery. However, we have seen that the number of unpredictable variables in a design and construction project means that it is usually impossible to rigidly follow the programme and that the actual design process can deviate from the programme wildly. Therefore, the ADePT methodology now incorporates an approach to controlling the design process to ensure that deviation is minimised.

The ADePT methodology comprises four stages. In the first stage, the scope of the design process and dependencies between activities are defined. In the second, the sequence of the process is determined based on the dependencies between activities and the iteration within the process. The third stage entails the representation of the design process in the form of a programme, enabling the integration of the design process with procurement and construction. Finally, the fourth stage is where the design process is monitored and the flow of work is controlled.

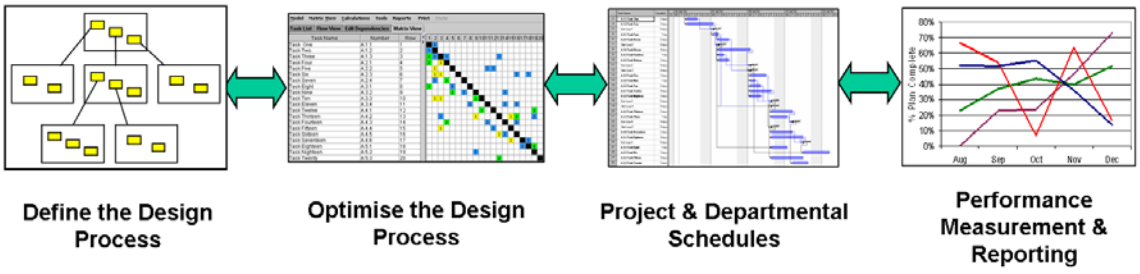

Figure 1 – The Analytical Design Planning Technique

4. PRACTICAL IMPLEMENTATION OF ADEPT

4.1 Dealing with Iteration in the Design Process

ADePT identifies iteration within the design process. This in turn must be represented on a programme. Usually this is achieved by grouping activities together in the programme and running them concurrently over a period of time which is deemed necessary to develop a co-ordinated design solution, thus representing the concurrent, cross-disciplinary working that is needed to develop the co-ordinated outputs from the interdependent activities.

The more significant challenge (and opportunity) lies in defining tactics to manage the design team as they work concurrently on an interdependent design problem. There is no single solution as the number or activities and deliverables, number of team members involved, and time required to develop the design will dictate the approaches used. What is important is that each of these issues is thought about in turn and that an appropriate approach is put in place. Recording the approach in the form of a procedure or method statement focuses the design team on these iterative co-ordination problems and provides a guide for undertaking the work during each period of concurrent working.

4.2 Integrating Design with Procurement & Construction

When integrating a design programme with a construction / procurement programme, information and document release dates must be tied into dates when those same deliverables are required for tender or construction. Of course this requires a mapping between the design process and the Work Packages which typically give the construction programme its structure. Rarely does all the required design information meet with the target construction dates, particularly around the early elements of construction. In these cases, design must be expedited through the introduction of assumptions and fixity. The assumptions / fixes and their effects can be observed in the matrix stage in ADePT to ensure that only the necessary ones are made.

Where required design information does not meet with target tender dates, it is not always necessary to introduce assumptions to ensure that 100% of design information is available. Rather, tender information can be released incomplete and assumptions can be made in the pricing which can then be firmed up later. Analysis such as that allow the procurement team to clearly see: (i) the remaining time required to achieve 100% complete design information; (ii) the completeness of information on the target tender date; and (iii) an indication of cost certainty based on that level of completeness.

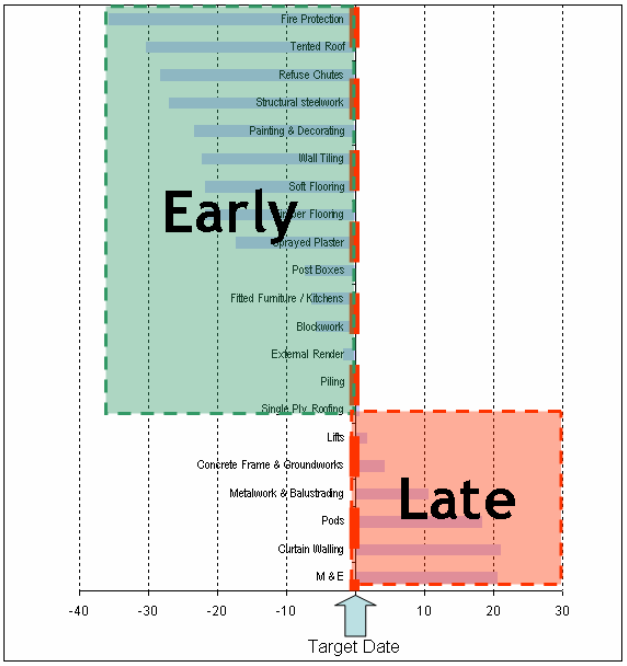

Figure 2 – Design information delivery dates compared to targets for procurement

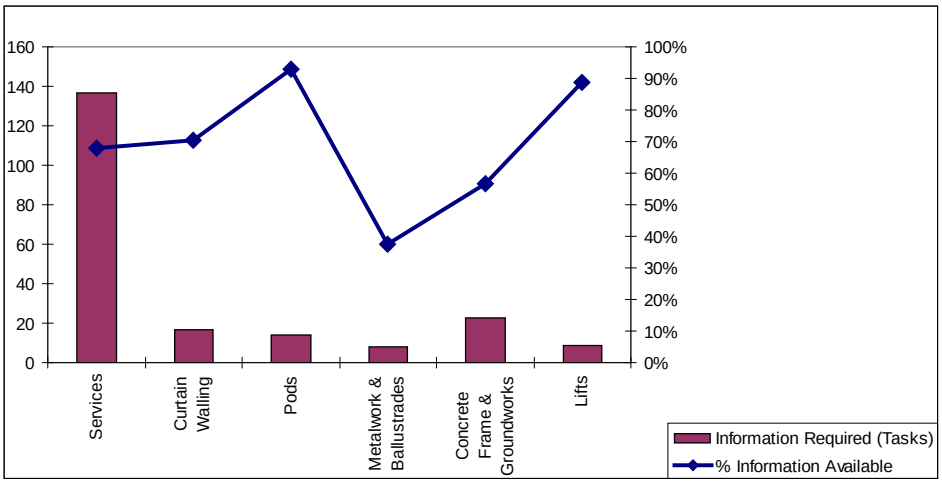

Figure 3 – Assessment of information completeness at target dates

Of course it is important to understand which information is missing and the impact of this upon achieving adequate cost certainty. However, when this level of understanding is required, supplementary analysis can be introduced to augment the indication given in (iii) above.

4.3 Managing Constraints & Measuring Progress

As described earlier, when managing a design project it is important to understand where the process is deviating from the programme as a result of constraints so that action can be taken.

As an output from the implementation of ADePT, reports on forthcoming activities are produced intermittently for each design team member, typically fortnightly. These cover the designers' 'work plans' (activities to be undertaken in the next period) and 'look-ahead schedules' (activities due immediately following the next period). The reports, which are in the form of to-do lists, are much easier for the design team to digest than a detailed programme which may have been changed in fairly subtle ways.

Designers are asked to identify any forthcoming activities which they are constrained from completing due to lack of resources, incomplete information, and so on, along with the 'root-cause' of the problem. Where these constraints exist, activities are not promoted from the look-ahead schedule to the work plan. This means that in any period the designers are only asked to undertake activities which are free of constraints and which, therefore, they are able to complete without delay. In the meantime, any constraints are removed so that those activities can be completed in the next work plan period.

At the end of each work plan period (which is, of course, the point where constraint-free activities in the look-ahead schedule are promoted to the next period's work plan), the design team report the progress made and the status of any constraints. Progress is reported as '% complete'. Overall progress is generally measured in two ways: (i) the proportion of activities due for completion which are completed ('percentage planned complete'); and (ii) the proportion of activities due to be progressed which have been ('work in progress'). The first of these measures is the most important since it is only upon the completion of a design activity when all of its outputs can be said to be fully co-ordinated and complete. The measure focuses the team upon fully completing activities since a report that all activities are 90% complete scores a PPC of zero. So, the scenario where an activity's progress develops over time by 0, 50, 80, 85, 90, 95% can be replaced by 0, 50, 100%.

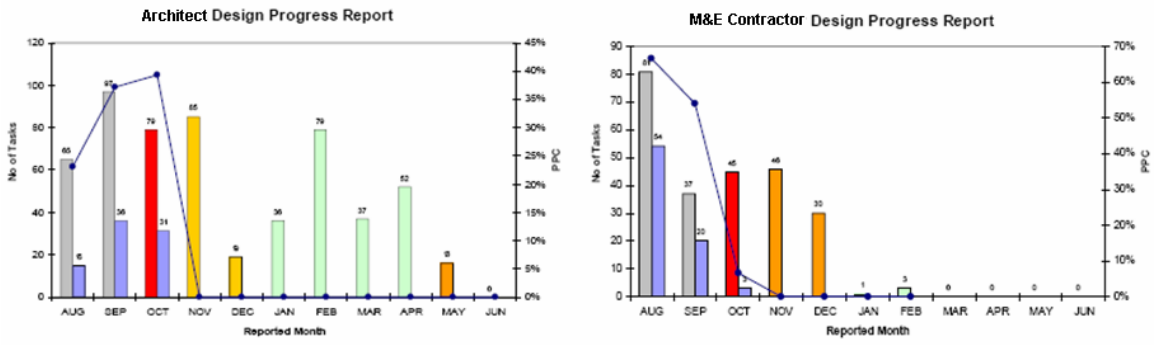

Figure 4 – Design performance reports

Having reported progress and on any constraints affecting activities due in the next work plan period, the design programme can be updated. This then creates the new work plan and look-ahead schedule which is issued to the team and the process starts over.

5. IMPACTS

There has been a long-held view among advocates of ADePT that it delivers benefits to project teams. Back in 1999 assessments were made within Laing (now Laing O'Rourke), Arup, and AMEC about the savings offered by the use of ADePT. These varied from 10 to 22.5% of the total design fee and 0.75 to 1.65% of a project's total cost. The judgements made were high-level, based on the experience of the individuals involved and made at a time when there was insufficient evidence from projects to support the views. Since 2000 anecdotal evidence of the impacts of ADePT has been gathered. However, this has also been based upon subjective views which may have been biased by other factors affecting project team performance.

Robust underlying evidence of the overall impacts of ADePT's implementation has recently been gathered by an independent consultant, Capita Symonds[5]. Two projects have been examined in detail and senior project representatives have been interviewed in a structured manner. Despite the fact that the two projects were of a different size and nature (being a c£35M retail development and a c£380M healthcare project) and undertaken by entirely different teams, this process has identified largely common areas of impact:

- ADePT identifies and removes "turbulence" from the project process;
- It provides greater certainty of design co-ordination;
- It offers an ability to better prioritise design work;
- It integrates sub-contractor design with consultant design in an effective way;
- Management of design change is more effective than is typically the case;
- Collaboration between design team members is improved;
- Workflow control focuses the team on task completion;
- It fosters a 'self-policing' design team; and
- The relationship between delivery of outputs and design fee is made clearer.

Three particularly stark examples of these impacts which were identified by Capita Symonds are:

- Design co-ordination - 32 week saving on achieving co-ordinated design in one complex work package;
- Change management - at least 5 man-weeks saved in avoiding the knock-on effect of a change; and
- Design outputs - c£75K saving where design fees were linked to achievement of design outputs.

It is clear from these examples that there are significant benefits to be derived from the implementation of ADePT. Of course, these benefits are not derived without any sacrifice on the part of the project team. The team must be prepared to invest in the adoption of a new approach. This

means time contributing to the design planning process and a charge for consultancy support and the tools to deploy the ADePT technique.

Clearly, even with an investment cost, the return from the implementation of ADePT is significant. Even in just the three examples above there is a return of around 80% over a 9 month detailed design process. Taking the conclusions drawn in 1999 within Laing, Arup and AMEC, the return would be in the order of 5 – 10 times in a £30M project with a 9 month design process.

6. CONCLUSIONS

Despite increased awareness of the importance of an integrated design process, and some tangible steps toward achieving this goal by the industry, projects generally continue to be delivered late and over budget.

The analytical design planning technique (ADePT) offers an approach to planning and controlling design processes in a manner which is more effective than is typical in current practice. The practical implementation of the technique involves a structured, facilitated approach but this provides opportunities to establish the optimal sequence of the process and to understand the interface between design and construction. The workflow element of ADePT enables the design process to be monitored and controlled effectively.

Overall the technique provides a range of benefits, and these have been shown to be significant. Anecdotal evidence of the benefits has now been backed up by robust and independent analysis.

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