DePlan: a tool for integrated design management

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Abstract

The iterative and information-intensive nature of the design process makes it hard to plan and schedule work using tools for conventional project management. The success of design projects depends on the quality of the available information. This paper proposes DePlan as a method for integrated design management during the detail design phase. DePlan integrates two techniques, namely, Analytical Design Planning Technique (ADePT) and planning according to Last Planner™, each involving a software tool. ADePT implements the dependency structure matrix (DSM) analysis method to identify iterative processes and the planning strategy for managing them. Planning according to Last Planner™ follows a production management philosophy that includes reliably scheduling and controlling design activities. Combined as DePlan, these techniques help planners generate quality plans, that is, plans that express what is ready for execution by sequencing activities in the right order, by identifying informational and resource requirements ahead of design execution, and by scheduling only activities that have met these requirements. This collaborative research has successfully developed the DePlan approach and associated computer software, and has tested them.

1. Introduction

In recent times, there has been a growing understanding of the importance of effective design management to ensure that a coordinated building design is developed within budget and to ensure the smooth running of the project. Architectural/engineering/construction (AEC) clients are seeking major reductions in the cost of buildings which can be achieved only by closer integration between the design and con-

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struction functions in the product cycle as has occurred in other engineering sectors (such as the automobile and manufacturing industries). A key aspect is the capability to plan and manage the design effectively, taking into account the iterative nature of the process and the changing needs of the project stakeholders.

Current practice in the planning, management, and control of design is focused on the design deliverables (e.g., 30%, 60%, 90%, or 95% complete drawings) that are listed at the start of each stage of the design process. The tendency is then to plan the design process backwards from the date when these deliverables are due to be released to the client or contractor. A master programme is produced and distributed to the design team, who then plans their work within the framework of the master programme.

The current approach assumes that design information is made available and communicated between the project participants as required, either informally or formally via drawings and design reviews. The objective is to get the right information to the right person at the right time, but experience shows that this is not often the case. One key point is that design should be planned, managed, and controlled around the flow of information, rather than deliverables, if a coordinated and effective solution is to be found. This is a fundamental insight that is increasingly being recognized by the construction industry. The other key point is that design activity, unlike construction, is highly interrelated, and finding a suitable sequence that minimizes wasteful rework is difficult. Planners responsible for design are also hampered by the limitation of current project management software, all of which is based on the critical path method and consequently cannot deal with interrelated tasks (like design) but only with sequential activities.

The application of Analytical Design Planning Technique (ADePT) in building projects has resulted in improved planning effectiveness by allowing design managers to focus on the flow of information between design tasks [1–4]. By focusing on information flow rather than deliverables, an optimal design sequence can be achieved. Furthermore, ADePT allows the planner to determine a design strategy that best fits the problem involving, for example, concurrent working, targeted solution workshops, and timely design reviews.

Effective planning of the design process is the first step in improving design management. However, if not carefully controlled, design teams may be tempted to revert back to more traditional methods of management, leading to significant inefficiencies due to poor information flow and the inappropriate allocation of resources. Last Planner™ technique is a production management philosophy that focuses on the application of lean principles to the organization and management of the project operation [5–7]. This technique is designed to reduce the amount of uncertainty that exists within the project process by managing the inherent variability that lies within it. Originally devised for construction but suitable for other types of project-based production processes, the technique has been adapted here to the design process. Last Planner™ helps the project team to systematically create lookaheads and weekly work plans before the start of design to track the status of completed work.

This paper introduces DePlan [8], an integrated approach in managing the design process that combines the strategic nature of ADePT with the operational approach of Last Planner™ (Fig. 1). DePlan encompasses design planning, scheduling, and control:

- planning—determining the required activities to meet the design criteria, the relationship between the activities, and an optimal sequencing.
- scheduling—assessing the status on the activities' readiness to be performed, assigning resources, and determining the start time, duration, and completion time for each of the activities.
- control—assessing the status of activities after completion of work and calculating resource use in terms of time and cost.

Unlike traditional interpretations, scheduling and control also encompass the make-ready process [5,6], i.e., determining what needs to be achieved and focusing on those needs to make activities ready to be performed.

The paper describes the implementation of DePlan through a combination of software tools. Analytical Design Planner (ADP) was already being developed to support ADePT. WorkPlan [9], which implemented weekly work planning for construction according to Last Planner™, was modified and