2006-1600: MULTI-LAYERED, MULTIMEDIA SCHEDULE REPORTING

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MMSR: Multi-Layered, Multimedia Schedule Reporting

Abstract

Scheduling is the art and science of forecasting future performance based on historical information. It aims at charting a roadmap for the project to follow during its different phases of development to secure timely completion. In most construction projects, an owner-approved schedule becomes one of the contract documents, and a way of communication between the main project team members (Owner, Architect/Engineer, and General Contractor). Changes are one of the few certainties a construction schedule will have to go through. These changes might be due to an initial lack of information, false assumptions, unexpected events, or acts of God (Also known as *Force Majeure*). Regular and timely updating of the initially approved construction schedule becomes a necessity to reflect the impact of the different changes on the project timeline.
This paper presents a new communication tool based on the framework of the Work Breakdown Structure (WBS), and supplemented by multimedia files representing the planned Vs. actual project performance in the form of digital pictures, still and animated CAD drawings/models, and live video footage in addition to the computer-generated schedule. This communication tool presents a multi-layered view of the schedule, and allows for embedding additional files reflecting reasons for and amounts of delay, allowing for a better claim analysis, resulting in reduction in project disputes.

The development of the layers followed a simple rule of thumb; 1-5-5-5-.., breaking down each level to 5 subsequent levels, until the required level of detail (Activity or work package level) is reached. Upon project completion, the completed model serves as an as-built chronology of project execution, which can serve as an as-built documentation of the project.

Historical Background

Several attempts were implemented to design a scheduling technique allowing for the planning, monitoring, and control of the schedule during different phases of project development, particularly the construction or execution phase. Such efforts Included:

1 – Checklists: Where the project was broken down into activities and a list of these anticipated project activities was produced, without any chronological order, and without any type of relationships reflecting interdependency. This technique has been used successfully for several centuries as both a planning and a control technique. As each of the activities was performed, a check mark was put next to it to denote its completion. The ease and simplicity of such a technique are quite obvious; yet its drawbacks are also easily recognizable. The main deficiencies of the checklist were its failure to reflect the impact of the delay in performing a current activity on other activities, and the absence of any logic or time dimension in the representation of activities.

2 - Bar Charts: Also known as Gant charts, which tried to avoid one of the major drawbacks of the checklist, by graphically representing the list of activities plotted

against time on the horizontal axis, and drawn to scale to show the relative duration of each activity. Although this was a major development in project schedule presentation due to its ease of displaying the different activities, and for the first time graphically showing the overall expected duration of the project, it still failed to represent the interrelationship between activities. It is worth mentioning that the Gant chart remains until today, not withstanding its known deficiencies, the preferred tool for communicating project schedule information.
3 – Time scaled logic diagrams: As an attempt to overcome the major drawback of the Gant chart, lines depicting activity relationships were added. However simple this solution was perceived to be, it proved to be ineffective due to the complexity of the schedule and the crossing of the lines which rendered the display unusable [1].
4 - Network techniques: The network model presented, through both Arrow Diagramming Method (ADM) and Precedence Diagramming Method (PDM), a new approach toward arranging, calculating, and presenting schedule information. Activities were represented graphically by either a line (or arrow) or a node, and relationships were clearly delineated on the graph. This development was a major development in both the planning and control of schedules. Though still used until today with varying degrees of success, this category of scheduling techniques, generally based on the Critical Path Method (CPM), is not user friendly for the non-experts [2], and can form a challenge as a tool of communication with field personnel.
5 – Other techniques: This last category includes other scheduling techniques ranging from stochastic models and simulation techniques [3], to linear scheduling methods including the Line of Balance Technique [4] (LOB) used for linear and repetitive projects [5]. The major disadvantage of the techniques included in this category is the presentation medium which, like network techniques, is not meant to be for the non-experts [6].

The multi layered, multimedia model

As mentioned earlier, the mode of communicating schedule outputs and results between different project parties was one of the main problems; Checklists were too simplistic and lacked details, Bar Charts did not reflect the interaction between activities, Time-Scaled Logic Diagrams were impossible to navigate through, and CPM networks are too complicated for the non-experts.
The model presented through this paper was based on one of the basic tools used in schedule development, the Work Breakdown Structure, or WBS. The WBS is a graphing tool used very early in the project development process to breakdown a complicated project into smaller, more manageable entities, and breaking down the latter into even smaller work packages, until a satisfactory level of detail and complexity is reached. This final level of detail may be a work package or even an activity, usually defined by a verb and a noun, describing a finite, quantifiable, and measurable amount of work. The presentation of the WBS follows a simple rule of thumb, the 1-5-5-5-..5 rule. Each level is broken down into 5 subsequent levels, and this process continues until a satisfactory

level of detail is achieved. The breakdown hierarchy may vary slightly from that structure, but not too drastically.
To an uninitiated user, the idea of presenting the schedule information in a gradually unfolding structure allows for viewing the schedule from different angles, and stopping at a comfortable and understandable level of detail. It allows the different project team members to look at the project horizontally or vertically for the purposes of both planning and control. Figure 1 presents a basic WBS presentation for a multi-phased project. The project can be broken down by phase, location, trade, responsibility, or system. Examples include buildings, floors, subcontractors, etc. Each level was broken down into five subsequent, or subordinate, levels.

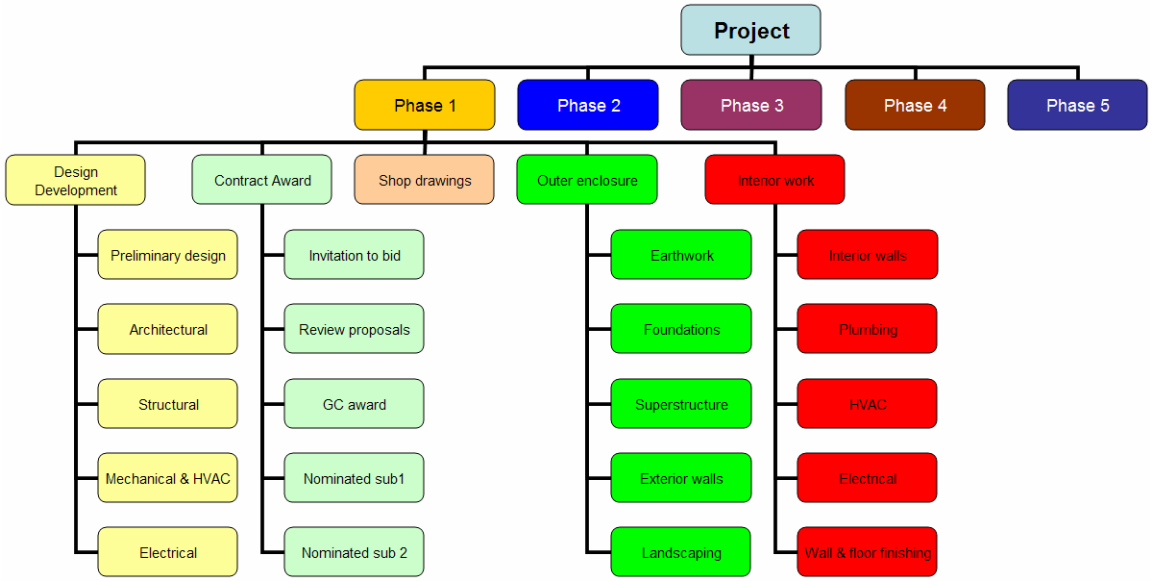

Figure 1 – Basic WBS presentation at the master level

Information Presentation

The multilayered approach presented through the WBS was complemented through the use of multimedia to present the schedule and progress information in different presentation displays. This allows the users, regardless of their level of sophistication, to view the project status through regular schedule updates. Multimedia including graphics, still digital pictures, panoramic vistas (360 degree pictures allowing for panning and zooming), and video clips accompanied by narration, together with other project documentation including CAD drawings, Schedule snapshots, and scanned documents allow for the creation of metafiles including mixed types of data for comprehensive information presentation.
The process started with the creation of the WBS, which can also serve as a template for future projects of the same type. The tools used to create the WBS could be as simple as Microsoft PowerPoint, or a more customizable multimedia authoring tool such as Toolbook (both tools were used for the presentation of this model allowing for different levels of computer literacy and programming ability). Both approaches allowed for hyperlinking, or the addition of several layers of information that could be accessed though button or mouse clicks. The content of the hyperlinks could be different types of

media, allowing for a proper presentation of the required level of detail. As mentioned earlier, the multi-layered, multimedia schedule reporting tool (MMSR) allows for its use as both a planning and control tool. With regular updates to the schedule, accompanied by progress reports reflecting the actual status of the project underway, both as planned and as built information is presented side-by-side for easy comparison. This allows the different project stakeholders to review existing progress, and allows for the early detection of potential problem areas, as well as the documentation of deviations from the initial plans together with justification and quantification of these variances. Figures 2 to 5 show the hierarchical structure of the WBS from the work package to the activity detail level and the hyperlinked metafiles. Figure 6 shows a sample screen from the application displaying a comparison between the as planned and the as built drawings reflecting changes in design and the corresponding change order.

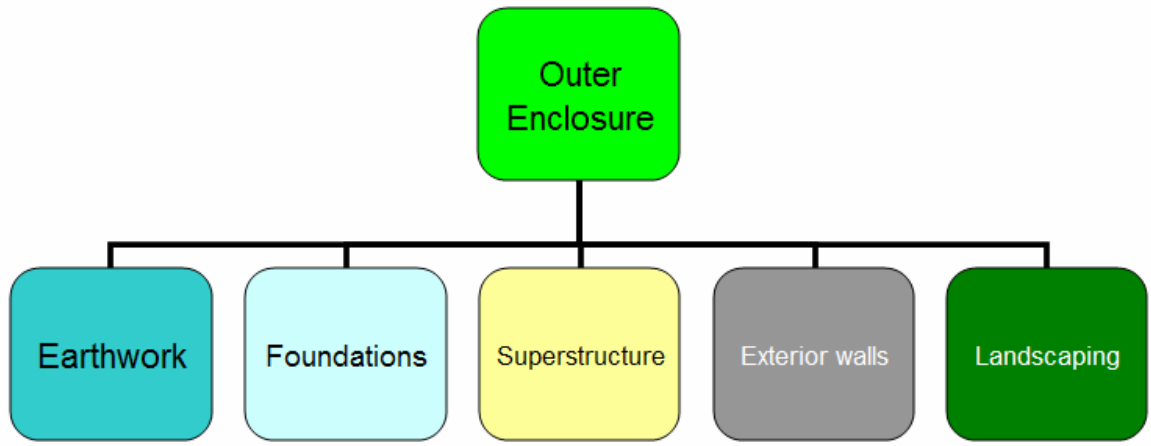

Figure 2 – Second level of breakdown at the system level

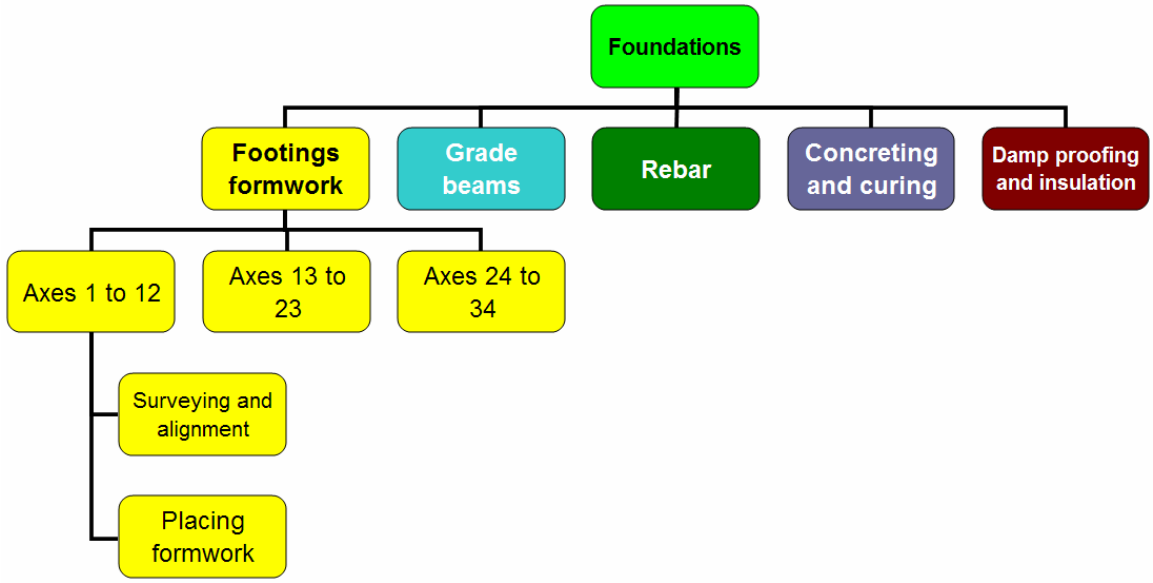

Figure 3 – Breakdown of the system into the work package and activity level

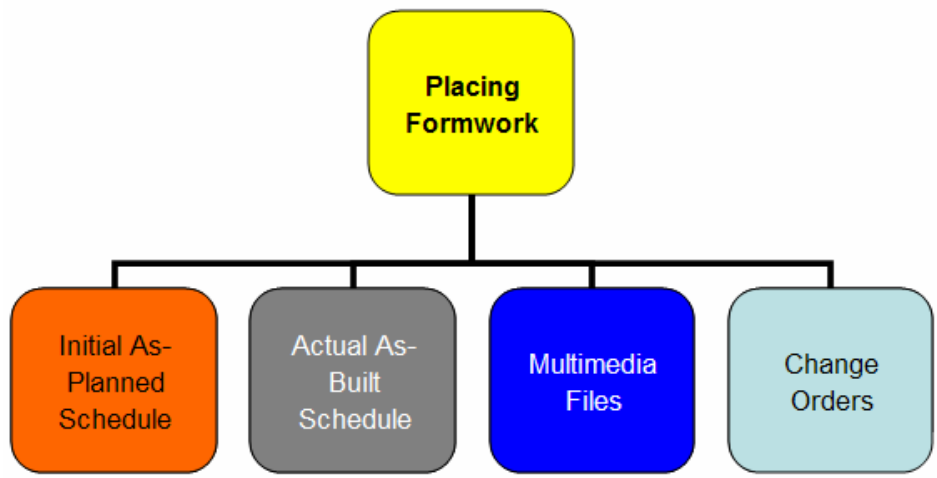

Figure 4 – Breakdown at the activity level

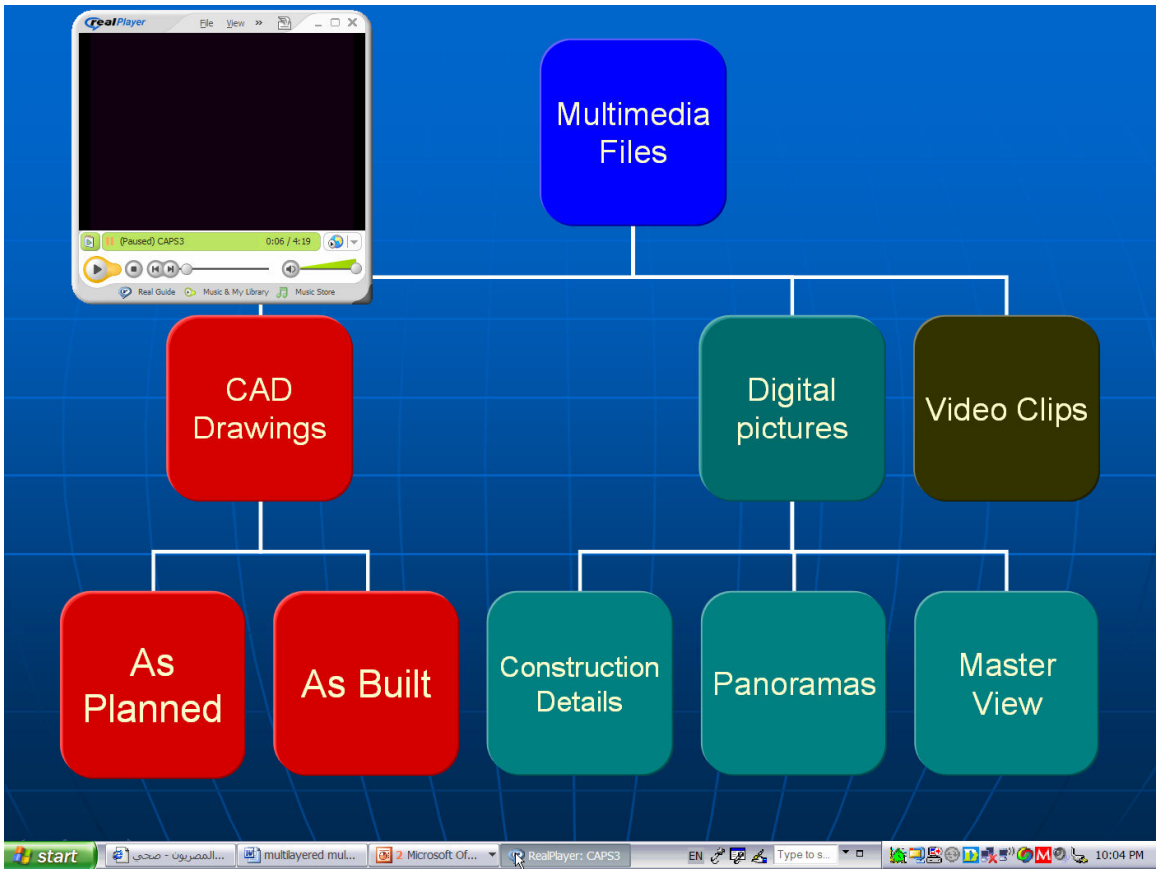

Figure 5 – Activity details and metafiles (Sample screen from the application)

Figure 6 – Comparison between as planned and as built drawings (Sample screen from the application)

Conclusion

Computer generated network schedules are an effective way to calculate the start and finish of the project activities and its milestones. They are not however a good medium for communicating project information to different stakeholders who might not be trained to read complex schedules. The Work Breakdown Structure (WBS) based on which a network might be developed can offer an alternative communication medium to disseminate schedule information. Multilayered WBS supported by multimedia in different forms can offer a comprehensive and immersive update on the project status. Sharing of the information in an understandable and timely manner helps reduce the possibility of changes and deviations escalating to contract disputes. The reporting system can be developed in Microsoft PowerPoint for easy authoring and maintenance, and the WBS can be saved as a template for repeated use in similar projects.

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