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RESEARCH ARTICLE

A STUDY ON PLANNING AND SUPERVISING OF A RESEARCH PROJECT: HYPER PLASTICIZER ADDED CONCRETE PRODUCTION

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ABSTRACT

In today's World, Disciplines that are dealing with Project Management, can plan projects by using planning software based on Critical Path Method with an advanced scheduling & tracking engine. Day by day increase in R&D Projects and their complexity creates a need of single management software in our country. By using Planning Software, commencement & completion dates, resources to be used and their costs can be easily defined and tracked. Thus, a considerable saving in time and resource usage can be provided. In this study, planning and monitoring of hyper plasticizer added concrete production and its development processes were carried out by using Critical Path Method.

INTRODUCTION

Human beings have been managing projects for centuries. Göbekli Tepe Monument, which was built mysteriously 13 thousand years ago (Banning, 2011), and it is the oldest monument feature of the world, was a project and had a project manager. However, it is a big question whether project management of people who lived at that time, knew the term and methods like critical path method. At that time, no matter how it was named, the aim of project management was the same: the art of completion of the project with the available construction materials, equipment and machinery and within the required time (Pemsel *et al.*, 2013). The same principles apply today. Depending on the increasing number of projects and their complexity ratios, planning and process management are also essential in Research and Development Projects. Determination of targets, implementation of R & D program, appointment of tasks, monitoring progress and realization of required revisions until the project is completed in a healthy manner has vital importance for success of the project concerned (Cooper *et al.*, 2006). The MS Project program is a critical road method based planning and management program that has the ability to successfully manage all these concepts (Schwab, 2011). Through this program, R & D project inputs and estimated outputs were linked through various functions, and the duration of the project was shortened comparing the classical methods and the costs were reduced thanks to the correct, on-site and effective resource usage. It is also less likely to encounter involuntary outcomes.

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With this project, which aims to facilitate the application of innovations brought by project management software technology to R & D management, we produced glass fibre reinforced concrete with hyper plasticizer. Planning and tracking of foreseen works were also executed with the aid of MS Project. Hyper plasticizers, a chemical additive, are the most important components in the production of cement based building materials (Barbudo *et al.*, 2013). In addition, the physical and chemical properties of cement-based building materials are significantly improved using such additives. It is generally used to improve properties such as reduction of water content and workability (Raouf *et al.*, 2014). There is a close relationship between cement-based materials production technology and internal structure and physical properties. Planning and production processes are followed effectively and efficiently, both in physical properties and in their strengths. This work using hyper plasticizers aims to shed light on the demonstration of the feasibility and merit of the program on a small number of R & D project managers working. The critical path method technique developed in 1950s. This method has been used for many years in many disciplines ranging from construction to space engineering, defence engineering, software development and product development (Yang & Kao, 2012). Today, Advanced Planning Technique which was developed by Armstrong-Wright have been commonly used (PM Book, 2012).

METHODOLOGY

Within the scope of this study, production of reinforced concrete reinforced with glass fibre reinforced concrete was carried out in line with the targeted values.

The standards that are used in the process are as follows: TS EN 196-3, TS EN 196-1, TS EN 12350-2, ASTM C143, TS EN 12350-6, TS 3261, ASTM C 173, TS EN 1170-1, TS EN 1170-2, TS EN 1170-3, TS EN 1170-4 and TS EN 1170-6. The planning and follow-up processes of R & D projects vary according to the volume of work to be done. Therefore, it is very important to manage the projects with the help of a database that can keep the time concept per the increasing complexity.

Ms Project software provides great convenience to users in this process with its advanced reporting options and customizable structure as per the project manager's request.

PLANNING OF THE PROJECT

Time Scheduling

Our tasks to produce superplasticizer reinforced concrete are simplified into a table. The table for our related project tasks is as follows (Table 1):

Table 1. Main Task of the Project and Expected Durations

Main Tasks	Expected Durations (day)
Determination of the project requirements	3
Requesting the materials to be used from the producers	1
Procurement of materials to be used	7
Concrete mix design works	7
Cost Analysis	3
Employment of project personnel	1
Training of elected staff	2
Commencement of the project	0
Determination of actual targets	1
Termination of the project and preparation of related reports	1

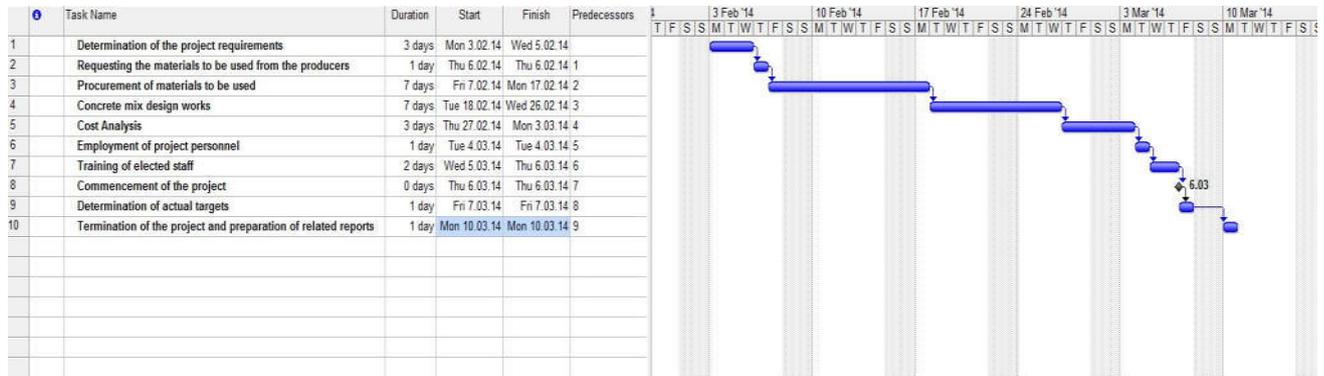


Fig. 1. Planning of the Project

Table 2. The workforce Table

Workforce Definition	Duty
Rafet Evrensel	Project Manager
Firat Günel	Concrete Casting Laboratory
Ahmet Okay	Cost Control and Analysis Personnel
Ahmet Acar	Purchasing Manager

Resource Name	Type	Material Label	Initials	Group	Max. Units	Std. Rate	Ovt. Rate	Cost/Use	Accrue At	Base Calendar	Code
Rafet Evrensel (PM)	Work		RE	Engineer	100%	30,00 ₺/hr	0,00 ₺/hr	0,00 ₺	Prorated	Standard	H101
Firat Günel (CCL)	Work		FG	Tech	100%	19,00 ₺/hr	0,00 ₺/hr	0,00 ₺	Prorated	Standard	H102
Ahmet Okan (CAP)	Work		AO	Subc	100%	23,00 ₺/hr	0,00 ₺/hr	0,00 ₺	Prorated	Standard	H201
Ahmet Yilmaz (PRM)	Work		AY	Engineer	100%	24,00 ₺/hr	0,00 ₺/hr	0,00 ₺	Prorated	Standard	H103

Fig. 2. Resource Planning

Table 3. Project Material List

Material Description	Amount
Sand	100 kg
CEM I 42,5 R Cement	100 kg
Hyper plasticizers- Type I	25 lt
Hyper plasticizers- Type II	25 lt
Mix Water	80 lt

Resource Name	Type	Material Label	Initials	Group	Max. Units	Std. Rate	Ovt. Rate	Cost/Use	Accrue At	Base Calendar	Code
Rafet Evrensel (PM)	Work		RE	Engineer	100%	30,00 ₺/hr	0,00 ₺/hr	0,00 ₺	Prorated	Standard	H101
Firat Günel (CCL)	Work		FG	Tech	100%	19,00 ₺/hr	0,00 ₺/hr	0,00 ₺	Prorated	Standard	H102
Ahmet Okan (CAP)	Work		AO	Subc	100%	23,00 ₺/hr	0,00 ₺/hr	0,00 ₺	Prorated	Standard	H201
Ahmet Yılmaz (PRM)	Work		AY	Engineer	100%	24,00 ₺/hr	0,00 ₺/hr	0,00 ₺	Prorated	Standard	H103
Sand	Material		S			200,00 ₺		0,00 ₺	Start		M101
CEM I 42,5 R Cement	Material		C			250,00 ₺		0,00 ₺	Start		M102
Hyper plasticizers- Type I	Material		H1			65,00 ₺		0,00 ₺	Start		M103-1
Hyper plasticizers- Type II	Material		H2			75,00 ₺		0,00 ₺	Start		M103-2
Mix Water	Material		MW			5,00 ₺		0,00 ₺	Start		M104

Fig. 3. Material Planning

Table 4: Project Equipment List

Equipment Description	Amount
Vicat's apparatus and ring	1+6
Cement mixer	1
Precision scale	1
Abraham funnel	1
Universal Compression and Tensile Test Machine	1
Archimedes Bucket	1

Resource Name	Type	Material Label	Initials	Group	Max. Units	Std. Rate	Ovt. Rate	Cost/Use	Accrue At	Base Calendar	Code
Rafet Evrensel (PM)	Work		RE	Engineer	100%	30,00 ₺/hr	0,00 ₺/hr	0,00 ₺	Prorated	Standard	H101
Firat Günel (CCL)	Work		FG	Tech	100%	19,00 ₺/hr	0,00 ₺/hr	0,00 ₺	Prorated	Standard	H102
Ahmet Okan (CAP)	Work		AO	Subc	100%	23,00 ₺/hr	0,00 ₺/hr	0,00 ₺	Prorated	Standard	H201
Ahmet Yılmaz (PRM)	Work		AY	Engineer	100%	24,00 ₺/hr	0,00 ₺/hr	0,00 ₺	Prorated	Standard	H103
Sand	Material		S			200,00 ₺		0,00 ₺	Start		M101
CEM I 42,5 R Cement	Material		C			250,00 ₺		0,00 ₺	Start		M102
Hyper plasticizers- Type I	Material		H1			65,00 ₺		0,00 ₺	Start		M103-1
Hyper plasticizers- Type II	Material		H2			75,00 ₺		0,00 ₺	Start		M103-2
Mix Water	Material		MW			5,00 ₺		0,00 ₺	Start		M104
Vicat's apparatus and ring	Material		VA			650,00 ₺		0,00 ₺	Start		E101
Cement mixer	Material		CMX			2.450,00 ₺		0,00 ₺	Start		E102
Precision scale	Material		PS			175,00 ₺		0,00 ₺	Start		E103
Abraham funnel	Material		AF			55,00 ₺		0,00 ₺	Start		E104
Universal Compression and Tensile Test Machine	Material		UCT			9.900,00 ₺		0,00 ₺	Start		E105
Archimedes Bucket	Material		AB			390,00 ₺		0,00 ₺	Start		E106

Fig. 4. Equipment Planning

The process may take place during the follow-up period of the process, or incomplete or overdue. Project durations can be specified in minutes as well as day units. As can be seen from the Table 1, the estimated time for starting the project is 0 days. For tasks that do not require time and resources, such as at the beginning of the project, the task duration is set to 0 days. And such tasks are called milestones. Milestones give us general information about the progress of the project. In other words, it is a reference point marking an important event in an R & D projects. Milestones can also be used in projects to represent external missions. Execution of the planning works can be found as shown in Figure 1.

Following the completion of the tasks related to the time planning in our R & D project, task relocation works were conducted. Task dependencies consist of the tasks associated with each other in our project. The methods used to associate are predicate task and successor task definitions. Following the task contexts, the task constraints settings we would use in our project were set. Our project management had chosen the earliest option from these constraints.

Resource Planning

In the previous section, we had planned the time for our R & D project. In the next step, we planned the resources we will use in our project.

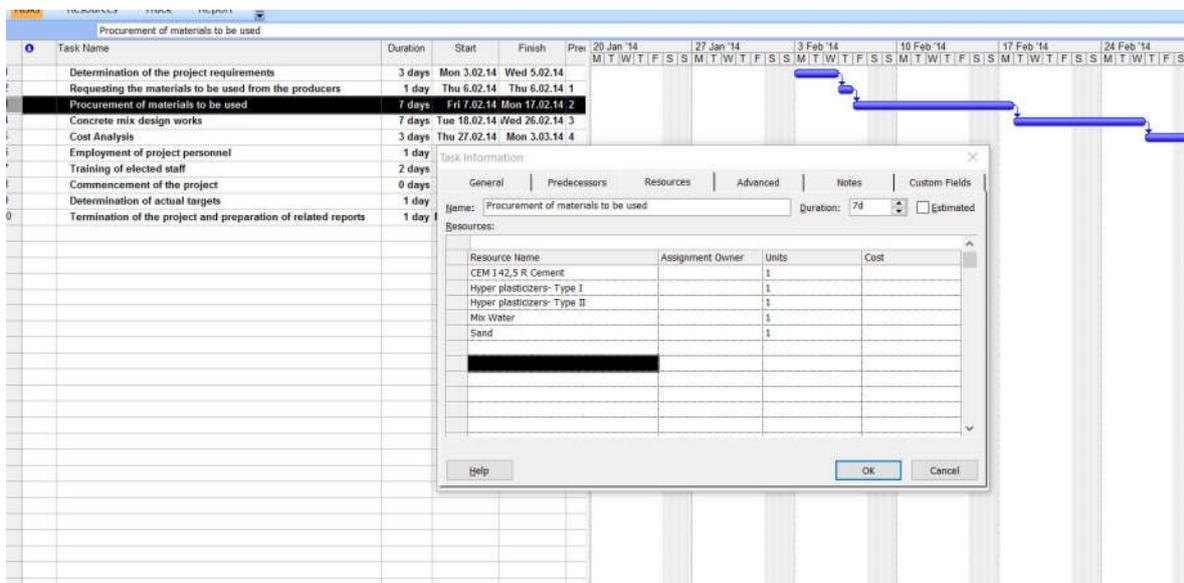


Fig. 5. Assignment of Resources-I

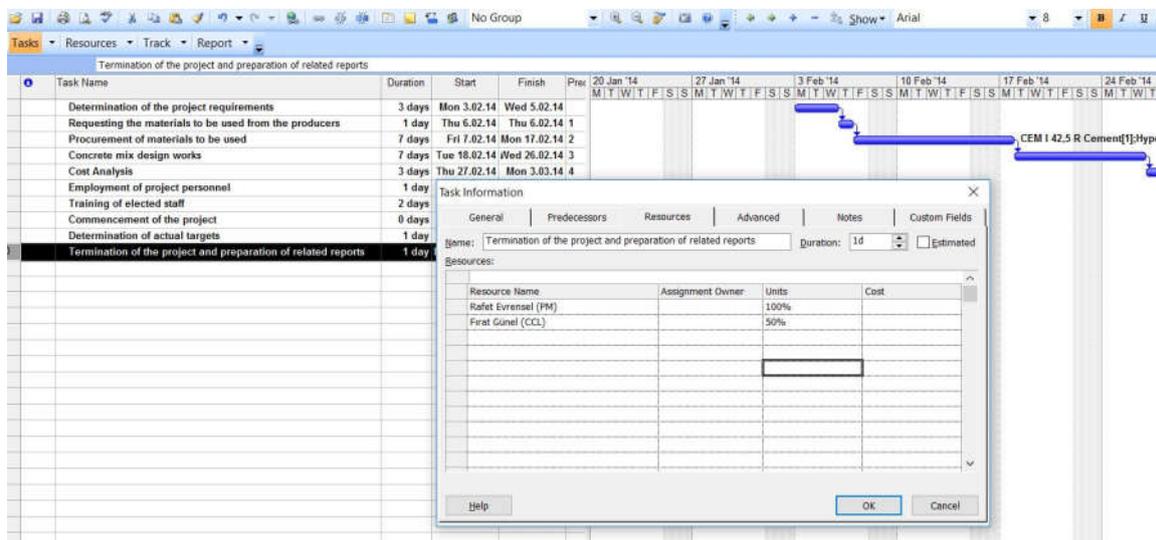


Fig. 6. Assignment of Resources-II

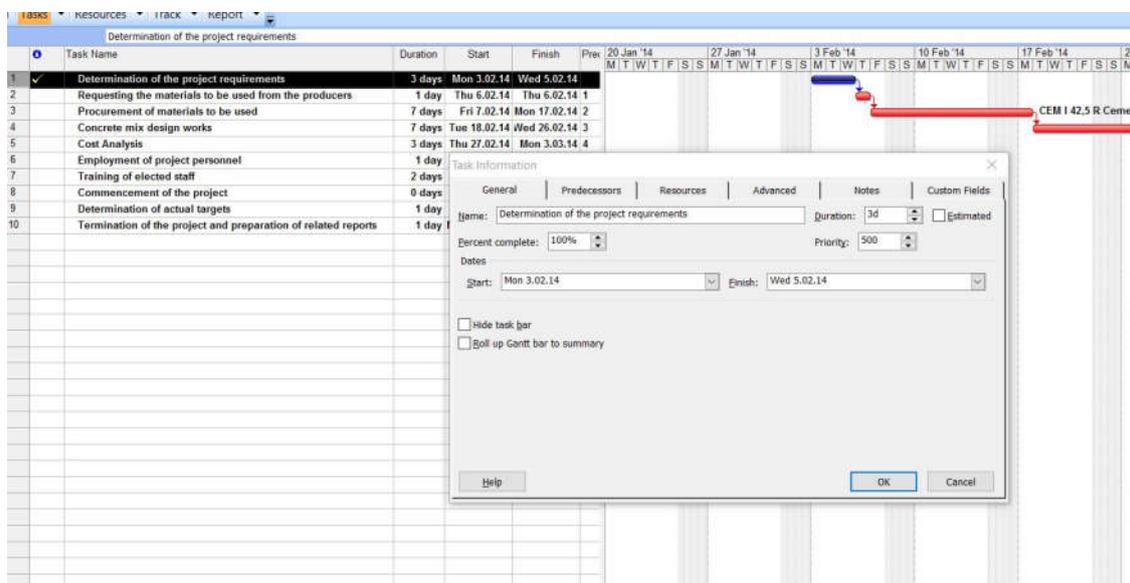


Fig. 7. Progress Monitoring

Resources are the workforce, materials and fund that we use to complete the main tasks and functions in our project. Depending on the increase or decrease of the resources while performing the main tasks in the project, the total duration of the project was calculated from this change depending on this change. The work table used are presented in Table 2. On the source page Initials are the initials of the names of the staff. In the group section, grouping of the sections that work in our project was performed (Figure 2). In this way, during process follow-up, we provided great facilities for reporting and arranging progress reports. Subsequent to the workforce planning, the planning of the materials to be used in the work started. The material list to be entered on the source page is as follows (Table 3):

The resources that are marked as material type do not affect the project timing as much as they are used in the project (Figure 3).

Unit prices of materials were also entered. For materials, the time of realization was marked as start. This is meant to indicate that the payment was made at the beginning of the work. The equipment list is as seen in Table 4. Equipment was also entered on the welding page. Again, the material was taken as a species and the effect on the timing was minimized. Prices are also entered as market average values (Figure 4). After all the operations related to resource definitions had been performed, the tasks and resources had been linked (Figure 5). The assignment of resources had been completed by assigning the necessary resources to the main tasks (Figure 6).

THE PROJECT MONITORING WORKS

The project started on 3 February 2014 with the task of determining the project needs. No problems were encountered in the process of determining needs. Progress with the completion of the first mission was recorded through the program (Figure 7). There was a delay of 2 days in the task of using the materials and accessing the user. The task that had to be completed on February 17, 2014 was hanging on February 19th. As in every project, there are deviations in time and cost in our project. Viewing and analysing the change between basic and actual values is one of the most important tasks of the process.

After viewing and evaluating the deviations as a schedule, the next analysis was started to assess the costs. Remaining work belonging to the working status of all the working resources in the project, the completed working percentage and all the working resources were displayed in the Resource General View report.

RESULTS AND DISCUSSION

In the world, disciplines dealing with Project Management commonly use planning programs that work with the logic of Critical Path Methods. The increase in number and complexity of R & D projects in our country necessitates the control of all projects through a single software. The planning software for R & D projects can be used to determine which resources will be used in the process of implementing the project, and their costs can be easily planned and controlled. This saves time and resources. In addition, the use of a software with a database that can schedule time in research and development projects, is essential for the effectiveness and efficient management of projects. When functionality is assessed within the framework of accurate and complete planning and effective and efficient process benchmarks, the use of Ms Project and similar programs in managing one or more projects for an R & D manager will provide great convenience and benefits. With the execution of this study, it has been shown a solution and an example for R&D management and managers.

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