高等院校土建学科双语教材（中英文对照）

◆工程管理专业◆

施工进度计划

CONSTRUCTION SCHEDULING

[德] 伯特·比勒费尔德 编著

杨璐 柳美玉 译

BASICS

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序

将进度计划和施工过程协调统一是一项非常复杂的任务，特别对于规模较大的工程，其中涉及大量不同的工作。由于不同工作部门之间、不同工种承包商之间以及二者相互之间的联系和影响日益增多，需要协调众多的工作者以及工作内容之间的相互关系。对于工程设计人员，制定施工进度计划是把握控制整个工程最重要的方法。施工进度计划向各个参与施工的公司明确了合同中各工种的时间期限，同时也是用来主动应对施工过程中可能遇到的偶然事件和各种干扰的重要工具。

由于大学毕业生和初级专业人员在工程经验方面比较缺乏，在着手进行第一个工程的时候经常不知道该如何管理整个设计工程和施工过程中的参与者。经常会面临以下一些问题：哪些工作是必须进行协调安排的？不同施工过程的施工顺序如何确定？这些施工过程将持续多长时间？本书面向的读者正是相关专业的学生和初级专业人员。该书通过循序渐进的方法并结合实际工程，对施工进度计划的制订、施工设计和施工过程在其中的表达方法以及如何在实际工程中使用施工进度计划进行了讲解。

编辑　伯特·比勒费尔德（Bert Bielefeld）

FOREWORD

Coordinating the planning and construction process is a complex task, which involves a great deal of responsibility, especially in larger building projects. Due both to the increasing interconnection between components and to the specialization of contractors, a large number of participants and their work must be organized. Scheduling is the most important means by which project planners control the entire process. It forms the basis of the contractual deadlines given to the participating construction companies, and is also a tool that is used actively to respond to unforeseen happenings and disruptions during the planning and construction process.

Due to their lack of experience, university graduates and entry-level professionals embarking on their initial projects are often unsure of how to manage the participants in the planning and construction process. Typical questions are: What work must be coordinated? What is the sequence of work steps? And how long do these steps last? *Basics Construction Scheduling* is directed at students and entry-level professionals at this early stage of the game. In a step-by-step, practical way, it shows how a schedule is created, how it represents the planning and construction process, and how it can be used as a tool in the real world.

Bert Bielefeld, Editor

INTRODUCTION

The translation of an initial idea into a completed building is a lengthy and extremely complex undertaking. The large number of people involved—construction contractors, planners and owner-builders—make it necessary to coordinate all the different contributions to the process closely.

Architects and project planners represent the owner in technical matters and must work to ensure that the entire process runs as smoothly as possible. Looking after the owner's interests, they coordinate all the participants in the planning process and monitor the contractors on the construction site. Larger projects often entail twenty to thirty participants or more in the planning and construction processes, which results in complex links and interdependencies. The various participants are often unable to understand or judge how their specific work is linked to the project workflows as a whole. As a result, architects have a special coordinating responsibility since their planning encompasses the entire range of specialized tasks involved in a project, and they are therefore the only participants in the process who have the "big picture."

Scheduling is a tool that is used in all stages of this process. The present book explains its foundations and applications, addressing all forms and depths of representation and providing practical information on typical processes. Its goal is to give students a quick, real-world introduction to the material. Yet coordination work is not over once a schedule has been created. It is a work process that must be constantly updated and made more precise. A good deal of preliminary consideration and refinement of detail is required in order to specify the phases into which work on a site is ultimately organized. The following chapters describe which participants and steps need to be taken into account when creating a schedule.

SCHEDULE ELEMENTS

To begin with, a description of a few key terms and the various elements of a schedule is in order.

Period and deadline

Planners distinguish between a deadline and a time period. The word deadline describes a specific point in time, such as the day on which part of a project must be completed, while a period is a span of time (e.g. completion of a job within fourteen days).

Tasks

Tasks are the very foundation of the schedule and refer to self-contained work units (e.g. tiling the ground floor). If several tasks are combined (e.g. tiling and plastering), the result is a summary task › Chapter Creating a schedule, The structure of the project schedule

Planning the duration and sequence of tasks

Task duration is the time needed to complete a task. It is a factor of production quantity and productivity. › Chapter Creating a schedule, Planning task duration

The calculation of duration is referred to as duration planning. Establishing the dependencies between activities is referred to as sequence planning. Taken together, duration and sequence planning form the basis of construction scheduling. › Fig. 1

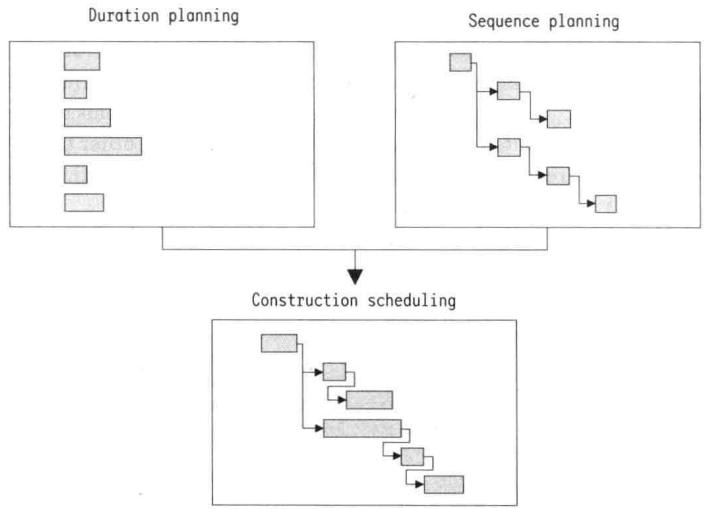

Fig.1:
The relationship between duration planning, sequence planning and construction scheduling

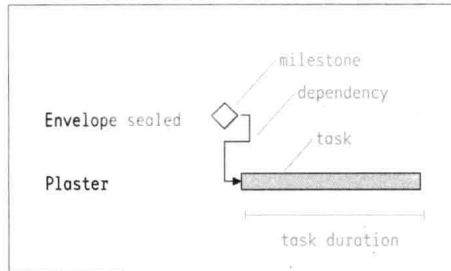

Fig. 2:
Typical scheduling terms

Construction methods and resources

Construction method refers to the technical procedure for carrying out a task.

The equipment and labor necessary to perform a task are called resources. While preparing for a building project, construction companies plan their resources in order to calculate costs precisely and define construction methods. The result serves as the foundation for their bid. While calculating resources has only limited significance for the architect doing the scheduling, smooth workflow requires a realistic assessment of task durations, for which resource planning provides a foundation. › **Chapter Creating a schedule, Depth of representation**

Milestones

A milestone is a task without a duration. It is a special event entered separately into the schedule. Typical scheduling milestones include the start of construction, completion of the building structure, sealing the building envelope, final inspection and putting the building into operation. › **Fig. 2**

Dependencies between tasks

In most cases, tasks are not isolated items on the schedule but are integrated into a web of dependencies with other tasks. There can be several reasons for this. The normal case is a sequential dependency: task B can

\\Example:
In any construction process there may be many ways to achieve the desired results. For instance, a reinforced concrete ceiling may be built of prefabricated elements or cast on site. Wall tiles can be laid in a thin bed on plaster or in a thick bed on a rough wall.

only begin once task A is finished (e.g. ground-floor walls → ground-floor ceiling → upper-floor walls).

That said, some tasks can only be performed jointly in a parallel process (e.g. setting up scaffolding floor by floor as the structure of a multistory building goes up). Often these process dependencies can be broken down into sequential dependencies by using a higher level of detail.

By contrast, it is often impossible for finishing contractors to work in parallel during a number of construction phases (e.g. screed and plastering work). In this case we speak of one task interfering with another. This is why it is essential for planners to examine mutual dependencies between specialized tasks and, if necessary, to divide the project into optimal construction phases. › **Chapter Creating a schedule, Planning task sequence and Chapter Workflows in the planning and construction process**

Types of relationships

Various types of relationships play an important role in the graphic representation of dependencies between two tasks. Construction scheduling distinguishes between four types: › **Fig. 3**

- Finish-to-start: Task B can only begin after task A is finished. This is the most common type of relationship and may apply to activities such as the construction of interior walls (A) and interior plastering (B).
- Finish-to-finish: Task A and task B must be completed by the same time. This type of relationship exists when tasks A and B provide the foundation for an additional task. Examples are installing windows (A) and sealing the roof (B), which create the airtight building envelope necessary for interior work.
- Start-to-finish: Task B must end when task A begins. In this type of relationship, one task can be scheduled at the latest possible point in time before it interferes with another task.

\\Note:
If sequential dependencies are not examined in detail during scheduling work, the result can often be disruptions and delays in the construction process. If, for instance, a disabled-accessible, steel-framed door needs to be installed, the required electrical outlets must be installed before plastering is done. Overlooking such dependencies may result in further work being required on finished surfaces.

\\Tip:
The most popular construction scheduling programs support the types of relationships described above. As a rule, they assign each task its own number, which can be used to denote dependencies. For example, if a task needs to begin after task no. 5, the previous task is marked 5FTS, where FTS stands for a finish-to-start relationship.

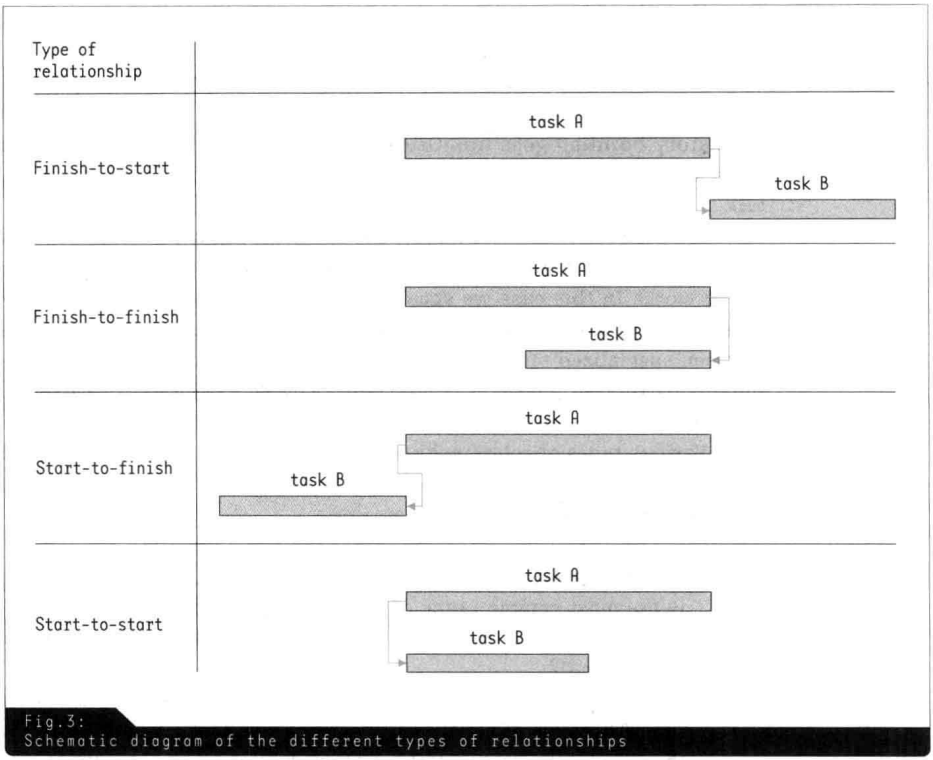

Fig. 3:
Schematic diagram of the different types of relationships

_ Start-to-start: Task A and task B must start at the same time. This makes sense if the work can be performed in parallel—if, for instance, workers from one trade can use a crane that is operated by another contractor to deliver large building elements.

FORMS OF REPRESENTATION

There are different ways to represent a schedule graphically. The following forms of representation are used to communicate schedule contents in a clear and useful manner, depending on the goal and purpose of the schedule: › Fig. 4

_ Bar chart
_ Line diagram
_ Network diagram
_ Deadline list