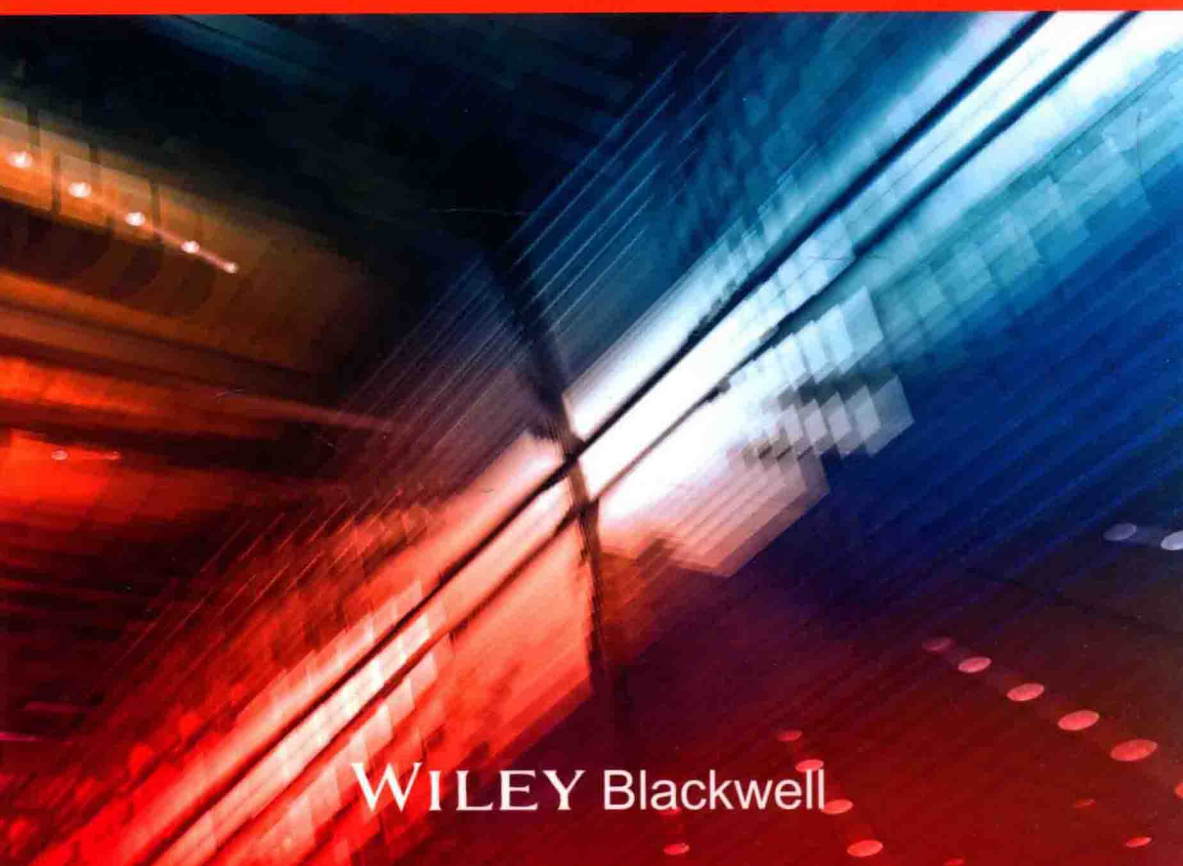
The Engineer's Manual of CONSTRUCTION SITE PLANNING

Jüri Sutt, Irene Lill and Olev Müürsepp



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About the Authors

Jüri Sutt has nearly 50 years of experience in construction management as a practicing manager, researcher, consultant and lecturer which has included designing the construction technology for large mines in Siberia, a gas trunk pipeline in Libya and managing a construction firm. In 1965, he pioneered the use of IT in construction management research in Estonia. Between 1965 and 1980, J. Sutt was a member of several USSR scientific councils in the field of construction management, and from 1965 to 1978, he was the head of the Construction Management Department of Estonia's State Building Research Institute which developed scheduling and cost estimating IT systems that were widely used in the Soviet Union.

He has been an adviser to four ministers responsible for building during Estonia's transition to a free market economy and led working groups elaborating construction market regulations in the 1990s. In addition, he has provided consultancy services for clients' projects and contract management and has gained expertise in contract disputes in the last 15 years.

In 1960, J. Sutt qualified as a construction engineer. He was awarded the Candidate of Science degree in 1968 (equivalent to a PhD), and, in 1989, the Doctor of Science (habil.) in mathematical methods and IT in economics. The principal outcome of his research has been the methodology of IT simulating production – economic activities of construction firms enabling experimentation with different economic mechanisms and management strategies in construction enterprises.

Since 1989, he has been Professor of Construction Economics and Management at the Tallinn University of Technology.

Irene Lill graduated from Tallinn University of Technology as civil engineer, and defended her degrees in the same university (PhD and MSc in Economics). She has over 20 years of academic experience in the university. She has been working in research closely with Jüri Sutt, initially as professor and student and as good colleagues today. Since 2005, she has been professor and head of department of Building Production in Tallinn University of Technology.

Olev Müürsepp graduated from Tallinn University of Technology as a civil engineer. He has nearly ten years of experience working as a site and project manager in a construction enterprise and three years in a large design firm as a consulting engineer in the field of design of technology and organisation of construction. For 10 years, he has worked in the Construction Management Department of Estonia's State Building Research Institute as a researcher in the field of modelling technological and organisational decisions in civil engineering. In 1987, he defended his PhD in this specialist area of construction engineering. Since1991, he has worked as associated professor in Tallinn University of Technology.

Preface

This handbook deals with the problems of engineering preparation for building in a construction company, both during the bidding phase and after a contract has been concluded.

The handbook's recommendations can also be used in the design phase, when the building contractor is not yet selected. In this case, it has the aim of assuring the constructability of the designed building and of calculating a control estimate for the owner in order that bids can be weighted and contractors' potential duration of construction can be evaluated. In the design stage, the methods used are similar to those of the contractor in the bidding phase, when aggregated norms are used.

The key problems consist of identifying the composition of complex project organisation and level of detail of the initial data, the inspection of the construction site, compiling the construction site layout and the construction schedule, and the cost estimate of construction site expenses. Suggestions for calculating the resource allocation are presented: for the selection of cranes and lifting devices, the planning of temporary buildings and roads, and for technological networks, fire safety, fencing and lighting. On-site safety precautions in planning of the construction site management are discussed.

The owner's construction costs are determined through cooperation between the owner and the designer / consultant, according to preliminary design task as set out by the

owner and the designer's technical and aesthetic competence. The structural designer must ensure the building's strength, stability, compliance with environmental criteria, etc. These costs are also affected by the detailed plan requirements validated by the local authorities. Another concern is that not enough attention is paid to construction management and building technology during the design of the construction contract conditions, and their subsequent negotiation. This, however, impacts the duration of construction, and based on this the contractor will be able to make the lowest price offer without reducing the quality of constructing. Often ignored is the fact that temporary works and temporary facilities on the building site form up to 12% of total costs, depending on the type of the building, site conditions, seasonality and the building owner's stipulations on duration.

This can be explained by the fact that construction site management and temporary facilities costs are not reflected in the final physical form of the building and will therefore remain unnoticed unless specially outlined by the consultant. Construction site management is reflected in the economic result of the owner's investment in the construction project, especially for business projects. The quicker the construction is completed, the sooner it becomes profitable.

For example, for a building that costs €100 million, with an annual profit rate of 10%, shortening the duration of construction would provide an additional monthly profit of approximately €0.8 million, and furthermore, it would enable the saving of about €0.5 million on the construction loan interest payments. Nevertheless, it should not be forgotten that for the contractor, this may entail organising the work into several shifts, bearing in mind winter conditions, etc., and the resulting additional costs will need to be compensated.

For this reason, the importance of the preparatory engineering work, called construction site management design, cannot be underestimated. Overall, it is divided into three phases:

- The project's main designer orders the construction site management project from a specialised consultancy company. The result forms the basis of the owner's financial plans (loan agreements) and the conditions of the contracts with designers and builders.

- The contractor prepares the construction site management project for calculation of bidding price and construction deadline.

- The firm that wins the competitive bidding process prepares the construction site management project consisting of the site plan and time schedule, at the same time calculating the cost price and compiling working drawings.

This handbook describes the specifics of the last two stages, bearing in mind that in the first stage, that is the design phase, the preparation of the construction site management project is similar to the contractors planning of site management in the bidding phase. However, it may be less detailed because the construction company is as yet unknown. However, how can the owner prepare a financial plan and predict the temporal parameters of the loan agreements without calculating the duration of construction? Preparing a time schedule requires a scheme plan of the site and temporary works. Preparing a construction site management project in the design phase certainly requires involvement of a specialised consultant or an impartial contractor.

This handbook is meant for planners of construction site management, construction engineers and construction site

quantity surveyors, but also for students who specialise in civil engineering and construction.

The authors are grateful to J. R. Illingworth, D. J. Ferry, P. S. Brandon, H. Bauer, R. Salokangas, L. Dikman, F. Harris and R. McCaffer who have analysed different aspects of construction site management and inspired the authors of this handbook to approach the construction site problems from a different perspective – as a set of simultaneous problems.

In compiling the book, Jyri Orlov (MERKO AS), Taimo Kikkas and Enn Siim (Skanska EMV AS) helped the authors by providing useful hints and suggestions, and the authors are very thankful to them.

If there are discrepancies between recommendations given in the present handbook and prescriptions given in local laws, codes, instructions or standards, local regulations must be followed.

His co-authors - Irene Lill and Olev Müürsepp - and his publishers were saddened to hear of the death of Jüri Sutt, who passed away on April 20th 2013.

Contents

Introduction

The aim of construction site management planning is to find solutions to erect buildings in the cheapest, fastest and safest way possible, based on construction sketches and layouts, valid design and building standards, and on the owner's wishes concerning construction time and demands for the quality of the construction. Planning of site management is based on knowledge of building technology and different methods of the time scheduling of construction work.

To fulfil this goal, one must prepare:

- the budget of the construction expenses;
- the time schedule of construction works;
- the construction site layout(s);
- the cost estimate for the set-up of temporary buildings and site management;
- the list of risks.

In the methodological sense, this task entails the planning of alternative solutions from the viewpoints of building technology and site management, the assessment of those

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