

**Zeitschrift:** IABSE reports = Rapports AIPC = IVBH Berichte  
**Band:** 51 (1986)  
  
**Artikel:** Project organization and contract management  
**Autor:** Burger, Rudolf / Knöpfel, Hans  
**DOI:** <https://doi.org/10.5169/seals-39564>

### **Nutzungsbedingungen**

Die ETH-Bibliothek ist die Anbieterin der digitalisierten Zeitschriften auf E-Periodica. Sie besitzt keine Urheberrechte an den Zeitschriften und ist nicht verantwortlich für deren Inhalte. Die Rechte liegen in der Regel bei den Herausgebern beziehungsweise den externen Rechteinhabern. Das Veröffentlichen von Bildern in Print- und Online-Publikationen sowie auf Social Media-Kanälen oder Webseiten ist nur mit vorheriger Genehmigung der Rechteinhaber erlaubt. [Mehr erfahren](#)

### **Conditions d'utilisation**

L'ETH Library est le fournisseur des revues numérisées. Elle ne détient aucun droit d'auteur sur les revues et n'est pas responsable de leur contenu. En règle générale, les droits sont détenus par les éditeurs ou les détenteurs de droits externes. La reproduction d'images dans des publications imprimées ou en ligne ainsi que sur des canaux de médias sociaux ou des sites web n'est autorisée qu'avec l'accord préalable des détenteurs des droits. [En savoir plus](#)

### **Terms of use**

The ETH Library is the provider of the digitised journals. It does not own any copyrights to the journals and is not responsible for their content. The rights usually lie with the publishers or the external rights holders. Publishing images in print and online publications, as well as on social media channels or websites, is only permitted with the prior consent of the rights holders. [Find out more](#)

**Download PDF:** 13.07.2025

**ETH-Bibliothek Zürich, E-Periodica, <https://www.e-periodica.ch>**

## Project Organization and Contract Management

Organisation du projet et évolution du contrat

Projektorganisation und Vertragsabwicklung

### Rudolf BURGER

Consulting Engineer  
Motor Columbus  
Baden, Switzerland



Dr. Rudolf Burger, born 1948, graduated in Project Management at the ETH in Zurich. With 8 years of practical experience, he joined in 1980 the Institute for Engineering and Construction Management at the ETH in Zurich. In 1985 he joined Motor-Columbus, where he is a project manager.

### Hans KNÖPFEL

Lecturer  
Swiss Fed. Inst. of Technology  
Zurich, Switzerland



Dr. Knöpfel, born 1941, graduated in structural analysis and design at the Swiss Fed. Inst. of Technology (ETH) in Zurich. He joined the Institute for Engineering and Construction Management in 1973 and became involved in teaching and research of project management.

### SUMMARY

Today, the conceptual set-up of project organization before tendering and contracting and its development and review during contract fulfilment is much more than a primitive art. The project organization can be designed and tailored to the actual objectives, phase, services, works, contract partners, and environmental conditions. Highly qualified organizational work is appropriate for the important tasks of quality assurance and to using human talents and effort effectively.

### RÉSUMÉ

La conception de l'organisation du projet avant l'appel d'offres et l'adoption du contrat ainsi que les projets de détail et la modification en cours d'étude et d'exécution sont devenues aujourd'hui plus qu'un art primitif. L'organisation du projet peut être prévue et organisée en tenant compte des objectifs finaux, des phases du projet, des différentes prestations, des partenaires du contrat et des conditions de l'environnement. Un travail spécialisé et de haute qualité est requis pour obtenir une qualité supérieure et un emploi efficace et satisfaisant des talents de tous les partis concernés par le projet.

### ZUSAMMENFASSUNG

Das Konzipieren der Projektorganisation vor Ausschreibung und Vertragsabschluss und das Detaillieren und etappenweise Modifizieren derselben während der Vertragsabwicklung ist heute bedeutend mehr als eine naive Kunst. Die Projektorganisation kann auf die jeweiligen Projektziele und -phase, die allgemeinen und speziellen Leistungen und Projektbeteiligten und die Wechselwirkungen mit der Umwelt ausgerichtet werden. Eine hochqualifizierte organisatorische Arbeit ist dem allgemeinen Bestreben nach höherer Qualität und dem wirksamen und befriedigenden Einsatz der Talente der Projektbeteiligten angemessen.



## 1. INTRODUCTION

A **project** is an undertaking consuming limited time and resources. In systematic, **multi-level** construction project management, there are many kinds of projects, for example:

- the entire construction project from the owner's initial ideas to a constructed facility in operation
- a feasibility study
- the design of an electrical subsystem
- the construction of access roads
- the delivery of a set of large turbines
- the set-up of a plant operating organization.

A project tunes and gears the effort of the respective team to a common goal.

The **project organization** (1) is the group engaged in planning and realizing the project. This organization should be tailored to the requirements of the specific project and its actual phase. Organizational methodology creates better prerequisites for the work of the persons and organizations involved, improves the overall quality of the end result, and supports the actual organizational work. In addition to methodology, adequate experience, theoretical knowledge, and know-how and skill in the widest sense, and the coincidence of personal and project objectives are essential for the successful organization of construction projects.

The **contract** is a legally enforceable agreement between two or more parties. When undertaking a project, an organization may use

- Resources of its own.  
Then the persons involved in the project work for it on the basis of their **employment** contract and internal organizational decisions.
- Outside resources.  
Then other organizations provide capital, goods or services on the basis of **lending, work, or consultancy** contracts.

In addition, the project organization may let facilities or sell goods within the range of the project mission which leads to **other** types of contract.

When discussing the influence of contract management on project **quality assurance**, emphasis is normally on writing and checking specifications. In this paper, attention is drawn to the set-up and review of the organizational conditions for the project performance. Organizational work should be done before contracting, and maintained during contract fulfilment. This means to recognize the suitable work tasks and functions for each project phase, to allocate them to a tailor-made project organization that is performing them optimally, to design and maintain adequate information and decision procedures, and to ascertain the engagements by contracts.

Actual **problems** arise from

- Under/overestimating the legal aspects  
(missing knowledge of construction law and/or the opinion that contract management should be the lawyer's business)
- Hasty/lengthy contract establishment  
(high time pressure leading to unclear or contradicting clauses / inefficient, time consuming negotiations)
- Contradictions between contract and organizationally favorable arrangements  
(organizational work not done at all or not done before establishing the contract).

Similar problems can occur in the technical and economic fields.

## 2. CONSTRUCTED FACILITIES

The end result of a construction effort is an **operated physical system** (3) in a defined environment, i.e. a dynamic and open system. A system should have a definable, e.g. goal-oriented, behaviour. If this is not the case, it is a deficiency of the system's design, skills or quality or a deficiency of the analyser's knowledge. The constructed facility is to serve specific purposes, i.e. future functions in its environment. The overall task to erect a physical structure with an established performance target must be a part of the owner's goal concept. From conception to completion, its scope and objectives should be clearly defined again and again.

The impact of the environment must be identified, analysed and taken into consideration at all times. The **framework conditions** are classified in their logical order (2): Technological, economic, legal, and socio-psychological. Not everything that is technically feasible will also be paid. Not everything that is technically feasible and payable will also be authorized. And not all the technically feasible, authorizable projects that we can afford are really desirable. The framework conditions affect the goal structure of the construction project. Unlike boundary conditions, they may change in the course of time or may first have to be established during the project time.

Technical, economic, social, cultural and mathematical actions all include an important **human aspect** as opposed to states and transformations taking place without the assistance of a human being. Projects can be realized, if they create a sufficient amount of motivation to reach a positive outcome of the respective decision. Engineers should not rely on promoting unwanted projects, and they should be able and willing to take over the responsibility on the overall effects of their projects.

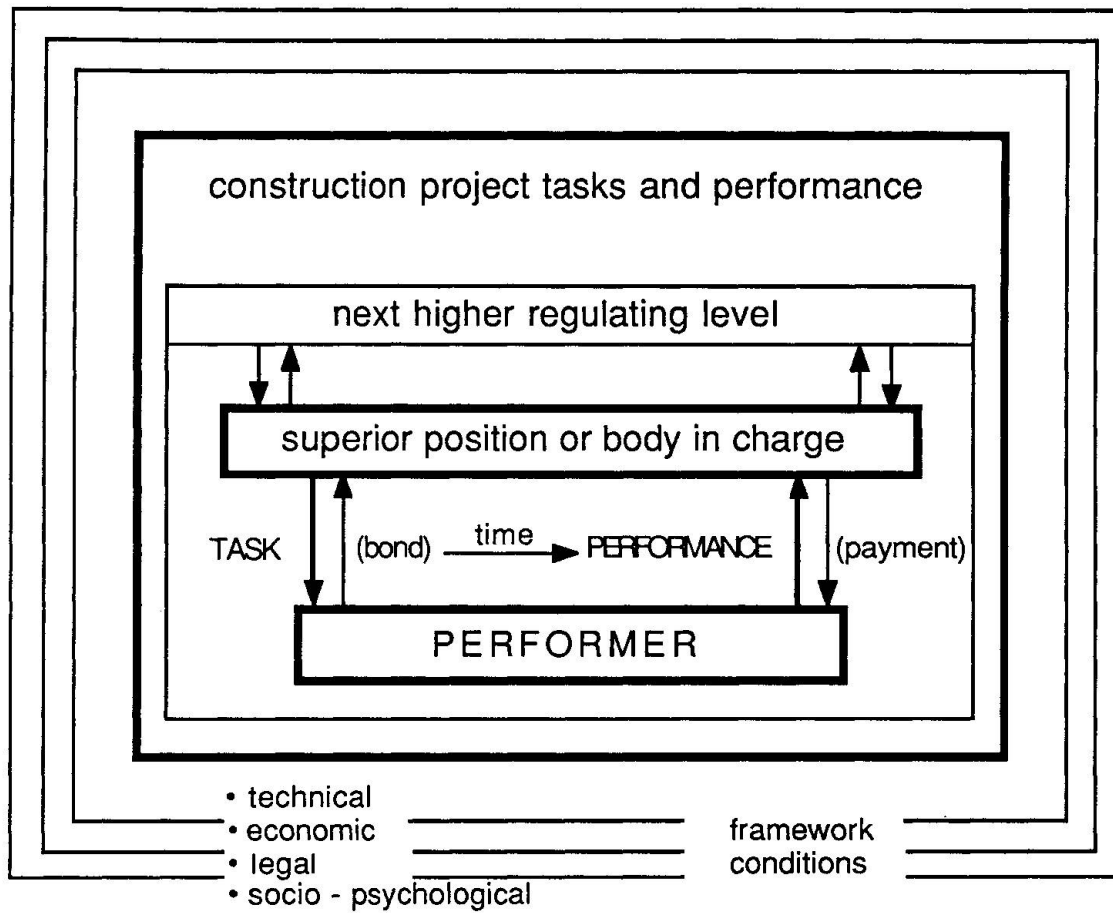
## 3. PROJECT ORGANIZATIONS

Organization theory says that a detailed analysis of the complex overall task should be the starting-point for the design of the organization's structure. The characteristic features of a **task** are:

- the substance of the task, defined in terms of quantity and quality, executed on a certain subject or object with the necessary aids
- the allocation of the parts of the task to the individual performers, building up the structure of the organization
- the definition of the procedures to be observed and run when performing the task.

The persons as doers are the decisive elements in construction project organizations. Goal-oriented work requires that the tasks are derived from situations and objectives.

The situations, the objectives and the tasks and performance are key elements of **project management** and mark the starting-point of every organizational structure. Project management coordinates the work tasks by designing and reviewing the project organization, by checking the technical interfaces, by time scheduling, and by benefit and cost management.



**Figure 1:** Construction project tasks and performance

Tasks and performance are managed on different levels. Using the same general methodology makes the coordination of the system easier. Tasks can be split into two functions (Figure 1): the function of the superior position or body in charge and the function of the performer. The superior position takes over a **regulating function** in line with the cybernetic systems theory, whereas the performer becomes the so-called regulated system that actually deals with the problem or work task. A controlling decision of the superior position in charge is frequently the result of a complex opinion-collecting and intention-forming procedure. The processing capacities of both the regulator and the task performer must be sufficient, if not, the next higher level has to act.

The **objectives** of a person as a goal-oriented performer in a construction project organization can be allocated to three different ranges:

- individual objectives (personal objectives)
- the parent organization's objectives (employer's or client's objectives)
- the objectives of the project team (project organization).

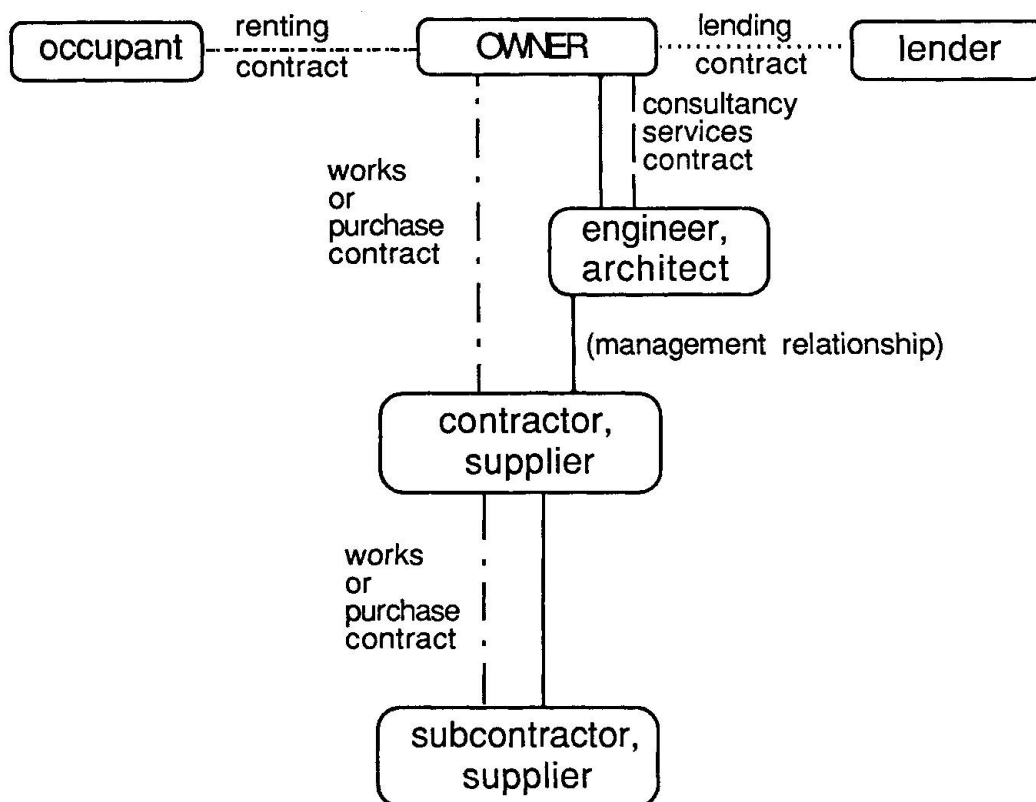
The objectives of a project organization can be achieved with less conflicts, if the personal objectives of key persons engaged in the project, and the objectives of the parent organizations are going in the same direction as the project objectives.

#### 4. CONTRACTS

The contracts (5) are the legal form of mutual obligations that the parties agree upon. Usually, the owner gets services and goods from the performer and the performer gets an amount of money from the owner. The most frequent **contracts**, in **construction projects** (Figure 2), can be characterized by:

- the services or goods transferred:  
services, works, goods (purchase), employment, money (lending), facilities (letting, leasing)
- the price type:  
lump sum, unit price (per unit of quantity), cost plus (per resource unit).

Further subdivision (e.g. according to the types of services: project management, engineering, architectural, geotechnical) and combination (e.g. turn-key) are quite common. Other kinds of differences are the type of contract award (qualification procedure, bidding, negotiation), the type of activity referred to (operation of constructed facility, new construction, maintenance and replacement), and the location of the facility (culture, applicable law, market, technical standards).



**Figure 2:** Frequent contracts in construction projects

The complete **contract agreement** usually consists of the following documents: conditions (general, special, supplementary), drawings and specifications, addenda, an agreement form, and modifications (amendments, change orders, interpretations). In a more logical order, these documents refer to the following subjects:



- the inputs from the owner (task description)
- the output of the performer (specifications, results to be achieved)
- the prices for the performer's (and owner's) contributions
- the responsibilities and the procedures (liability, resources provided, time schedule, payment conditions, structure of the project organization, change procedures, etc.)

and to the following chronological sequence:

- general (for any project)
- special (for a specialty area of any project)
- supplementary (unique to a given project)
- additional (during bidding or negotiation)
- agreement form (for signing, very important and particular clauses)
- modifications (during contract fulfilment).

A more similar structure of contracting in all countries could contribute to improving the international exchange of experience and research results.

## 5. METHODOLOGY FOR ORGANIZATIONAL WORK

The appropriate design of the project organization for each phase is a most important factor for the success of a construction project (1). The idea of **extending the quality** of the existing and new constructed facilities to

- a favorable life-cycle performance and operation
- beneficial interaction with the environment
- and new aspects of welfare

has got a growing acceptance. Expert knowledge in a large number of specialty areas can be used to enhance the benefit of the socio-technical systems. The owner's organization, the project scope, the external experts and pressure groups, the operations planning and management, and quick computer information became more important than in the past. Project management is facing new challenges to its organizational skills (4).

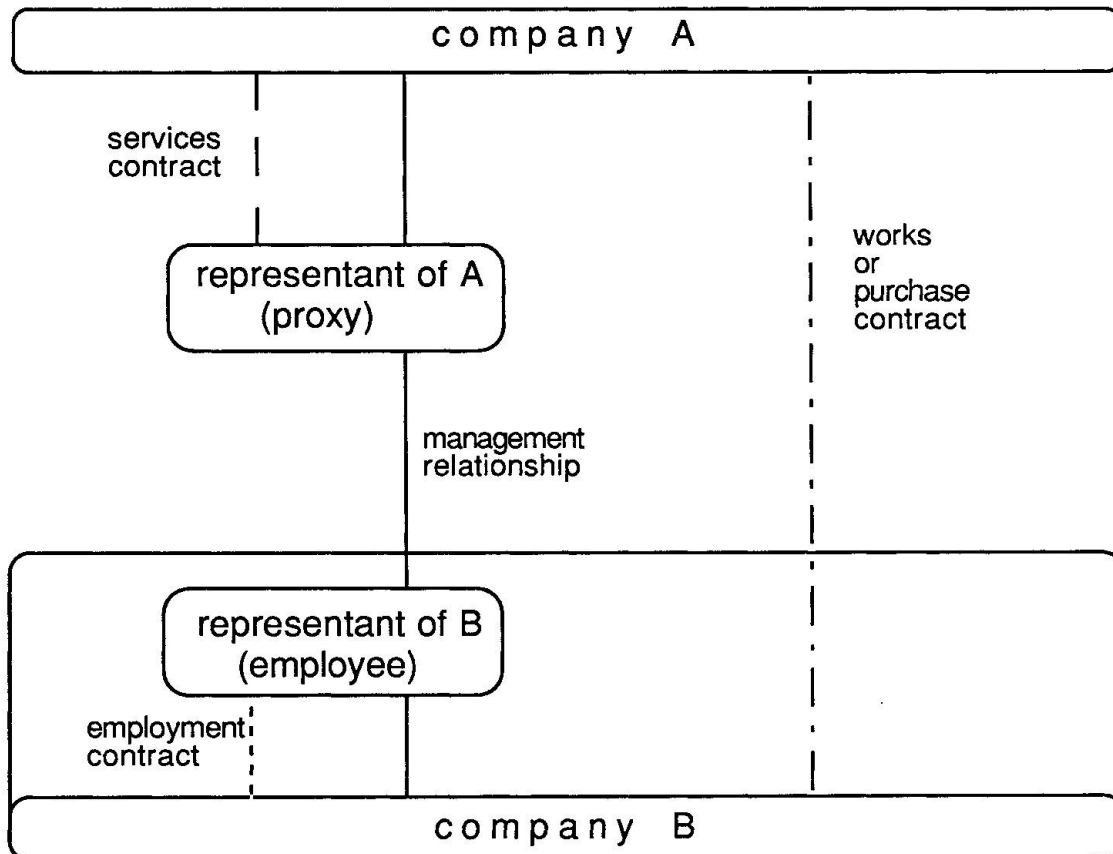
A systematic analysis of **eight selected projects** in Switzerland including industrial buildings, traffic facilities and heavy construction in urban areas has shown the relevance of organizing from the start to the end of construction projects (2). A similar study was undertaken in the United States (6). Thinking in terms of systems and alternatives is not so common as it should be. A major problem arose when project management did not govern well enough the project as a whole. In successful projects, the boundaries were appropriately defined, and numerous framework conditions were taken into account. The realization of targets was under full control and the project organization was able to react and had the foresight to act. Due consideration was taken of all persons affected by the construction project and their probable interest. The set-up of the project organization was straight-forward. Sometimes, persons in key positions react quite helplessly and emotionally towards socio-psychological influences.

The methodology proposed consists of three parts:

- A method for **analysing** construction project organizations that is a systematic list for checking project definitions, project organization structures, specifications for services, objectives and procedures, and management tools.
- A procedure for **developing** and **modifying** project organizations that is an application of the general problem solving process.

- A set of **rules** for the design and the management of project organizations that are recommendations from the real projects and from organization theory.

Emphasis is on systematically dealing with the project environment and the goal structure of all persons involved or affected, as well as on a procedural model for developing and modifying the project organization. A first test has shown that expert systems are an effective tool for organization analysis and qualification procedures.



**Figure 3:** Contract and management relationship

Some **organizational deficiencies** are reducing the quality of today's project performance. The tasks in the "non-construction" areas such as the tasks of the owner, the process and industrial engineers, the persons representing the project environment, the operators of the constructed facility, and sometimes even the project management tasks are not sufficiently specified. In addition, the skills of managing projects professionally and of coping with multidisziplinary problems (such as the organizational and legal implications of representation, Figure 3) could be improved in many permanent organizations. Systematic project management in the owner, agency, consultant, contractor, and user organizations is not only an advantage for these companies but also a major achievement towards a well orchestrated total project management.





## 6. PREPARATIONS FOR CONTRACTS

If each contract document had to be created from scratch, lots of problems would arise. It is favorable to study the **standard** structure and substance of contracts on the basis of general experience, systematic analysis and development, and a fair balance of interests apart from the concentrated work on a specific contract. The standard documents shall provide a professional **starting-basis** for the specific work on an individual project. In Switzerland, both the general conditions for construction work (7) and the standard agreement for engineering and architectural services (8) were improved considerably in the past ten years.

The conditions for engineering and architectural **services** deal with

- the input from the owner, a task description (cahier de charge, Pflichtenheft, project guideline) including the owner's and project objectives for each phase and the existing information on the project.
- the definition of the professional services (these services are the most important part of the agreement)
- the methods and figures for calculating the fee (which is the necessary economic basis and incentive for the work of the engineer and architect)
- the general legal contract conditions concerning liability, general duties, copyright, change and closing down procedures etc. (they are concentrated in one part rather than distributed all over the contract).

The general conditions for construction **works** include the general business conditions, the reimbursement to the contractor, the change orders, the responsibility, and the commissioning. Responsibilities and duties of the contractor also appear in many technical and safety standards. The technical specifications become more standardized as well by the growing application of standard specifications in Switzerland. Computer processing and electronic data transmission will accelerate this trend. Finally, the standardization of drawings is advancing.

Concerning the **project organization**, the following rules should be observed:

- The conceptual part of the organizational work should be done **before** the bidding documents are established and the contract is signed. Particularly, the definition and delimitation of tasks and responsibilities, the determination of interdependencies and procedures, the careful analysis of the permanent organizations and persons involved.
- Professional organizational work should be done again and again **during** the performance of services and works. Particularly, each new phase of the project should be initiated properly with a final report about the previous phase, a review of the organization and a new start.
- The project organization should be reduced and dissolved by doing the **last** piece of organizational work carefully as well. Particularly, an appropriate documentation, instruction of the organization operating the facility and clear and written decisions on the fulfilment of the contract by all parties are appropriate.

With the last revision of the general conditions for engineering and architectural services of the Swiss Association of Engineers and Architects, the duty of proposing the project organization became a basic engineering and architectural service to the owner, if they offer complete direction, design and supervision services, as opposed to specialty services.

## 7. REFERENCES

- (1) Burger, R. (1985): "Bauprojektorganisation - Modelle, Regeln und Methoden", Diss. Nr. 7824, ETH Zürich.
- (2) Burger, R. (1985): "Project Organization - Models, Rules and Methods for the Set-up and the Review", Proc. 8th INTERNET World Congress, Rotterdam.
- (3) Knoepfel, H. (1983): "Systematic Project Management", Intl. J. of Project Management, Vol. 1, No. 4, Butterworth, London.
- (4) Knoepfel, H. (1984): "Organization and control of large quasi-public construction projects", Proc. ANIMP.OICE.INTERNET Symposium, Sorrento, Italy.
- (5) Halpin, D.W. and Woodhead, R.W. (1980): "Construction Management", Wiley, New York.
- (6) Tatum, C.B. (1983): "Decision-making in structuring construction project organizations", Technical Report Nr. 279, Construction Institute, Stanford University.
- (7) SIA-Norm 118 (1977): "Allgemeine Bedingungen für Bauarbeiten", Schweiz. Ingenieur- und Architektenverein, Zürich.
- (8) SIA-LHO 102, 103, 108 (1984): "Leistungs- und Honorarordnungen", Schweiz. Ingenieur- und Architektenverein, Zürich.

Leere Seite  
Blank page  
Page vide