Zeitschrift: IABSE reports = Rapports AIPC = IVBH Berichte
Band: 53 (1986)

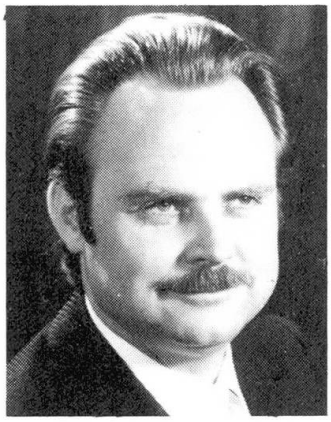
Artikel: Organization of the design process for complex constructions
Autor: Rösel, Wolfgang
DOI: https://doi.org/10.5169/seals-41117

Organization of the Design Process for Complex Constructions

Organisation de la planification pour des constructions complexes

Organisation des Planungsablaufs bei komplexen Bauvorhaben

Wolfgang RÖSEL
Prof. Dr.
Universität Kassel
Kassel, Bundesrep. Deutschland



Wolfgang Rösel, geb. 1936, studierte Architektur an der TH Darmstadt und an der TU Berlin. Er promovierte an der Fakultät für Bauingenieur- und Vermessungswesen an der TU Berlin. Planung von Industriebauten. Baumanagement grosser, komplexer Projekte. In der Lehre vertritt er das Fach Projektmanagement/Industriebau. Zahlreiche Veröffentlichungen sind diesem Themenkomplex gewidmet.

SUMMARY

Museums are technical and complex buildings. They bring unusual tasks in construction and in technical installations, which are issued by the architectural design and the special conditions of the project. These circumstances lead to a specified project organization. Planning management solves the problem to organize the process in a way that avoids risks of costs and scheduled dates.

RÉSUMÉ

Les musées sont des bâtiments complexes présentant de multiples problèmes extraordinaires pour le projet de la structure et l'aménagement des installations, lesquels découlent directement de ce type particulier de construction. Ces circonstances demandent une organisation particulière de la direction du projet qui doit tenir les devis et les délais.

ZUSAMMENFASSUNG

Museen, als technisch komplexe Bauwerke mit vielfachen, ungewöhnlichen Aufgabenstellungen in der Tragswerksplanung und in der technischen Gebäudeausrüstung, die sich aus architektonischem Entwurf und den besonderen Bedingungen des Projekts ableiten, erfordern eine sehr ins einzelne gehende Organisation. Das Planungsmanagement erfüllt die Aufgabe, den Planungsprozess so zu organisieren, dass Kosten- und Terminrisiken nicht entstehen.

1. CONTRACT AND PROJECT ORGANIZATION

1.1 Reasons für Planning Management

With the planning and construction of large projects which we attended to, it is only natural for my colleagues and myself that the planning in relationship to the execution of a project goes hand in hand as one process. According to the procedure of the cybernetic control system success depends upon the control of the work cycle with differences to the given data. Normally the construction procedure is considered as the guide process, i.e. all of the planning services are to be organized so that an uninterupted, unhindered and a price favorable construction execution is made possible.

The analysis of construction procedures of many public structures - which I partially determined the expert opinion of - revealed often the evidence that mismanagement in the planning led to disturbance of the execution procedures. The results as a rule were not only considerable exceedings of the expected completion dates, but also considerable price increases. Very critical public discussions led to the establishment of a planning management also for public buildings. The city of Frankfurt am Main has had good experience with this.

1.2 The Contract

The contract from the town council of the city of Frankfurt, which was awarded to my architect and engineering office BAU-REAL, located in Darmstadt, includes the execution of the planning management with the aim of keeping the given planning dates and execution dead lines.

The contract comprises in detail the development of an organigramm, which covers all of those involved in the planning, including the later users of the museums, the elaboration of a construction procedure concept, the design of an information flow plan, the plotting of the network of all planning activities, determination of the planning duration in detail and the calculation of dead lines. Essential components of the contract are the checks, which are to be carried out periodically, for all of the planning procedures and, in case differences occur, the necessary development of control suggestions for the guiding of the procedure with the aim of regulating occurred differences from the required time.

1.3 Project Organization

The town council of the City of Frankfurt made an agreement for single contracts with planners with those museum projects, which we took care of, and commissioned different firms according to trade. Along with the planning architect, in the planning area there will be a number of consulting engineers commissioned for main plane structure planning, installation for heating, ventilation, climate, sanitation, electricity, high- and low-voltage current, elevator and mechanical conveying and handling, construction physics, soundproofing, surveying, color design, security and museography. The representatives of the town council take over the metropolitan Building Surveyor's Office with its special department for construction planning, the awarding of contracts and contract matters, electronic data processing and the department for technical installations. The construction department services in the planning area - from the invitation to bid to the construction supervision - lie by the Frankfurter Aufbau-AG, a partner firm of the city, which normally takes over the assignment of metropolitan projects along with the planning architects as a proportionate service.

For the project organization it is important which architectural i.e. construction architectural value the city of Frankfurt measures for the buildings.

The planning architects (O.M. Ungers, H. Bofinger, A.J. v.Kostelac, P. Kleihues, H. Hollein) are normally well known for their artistic status.

2. MUSEUMS AS TECHNICALLY COMPLEX BUILDINGS

2.1 Technical Complexity

Museums are to be seen as technically complex buildings, because, according to their function, they need extensive technical structure equipment, in order to meet the users demands. There are not only exhibition rooms to be provided, in which one must guarantee certain room conditions, but also meeting rooms, workshops, administration rooms, archives and laboratories are needed. This explains the number of planning participants working on a museum project.

2.2 Use of Old Construction Elements

The characteristic of the German Architectural Museum, the German Cinema Museum and the Museums for Jewish History is that they were housed in existing buildings. The hull of these buildings represents the facade of old villas, which are under monumental preservation. As for the Museum for Prehistoric and Early History, the partial ruins of the former Church of the Carmelites and a side chapel were worked into the construction concept of the museum.

The use of remaining old construction elements, of which substantial parts could be used, means that the technically complex characteristics are often only under very difficult circumstances to be realized. For example, in the former Rothschild-Palace, where the Museum for Jewish History is, it was necessary to reinforce the floors for a better load capacity. At the same time valuable ceiling paintings and stuccowork had to be preserved. Moreover, it was necessary to place other technical installations for heating and electricity in the ceiling area.

2.3 New Building

The Museum for Contemporary Art will be built according to the plans of the Viennese architect Hans Hollein. The technical complexity resolves not only with regard to the technical structure equipment, but also because of the unusual architecture and room shapes. Thence, unusual demands arise for the production technology of the shell construction.

3. CHARACTERISTICS OF THE PLANNING MANAGEMENT

3.1 Planning Management as Joint Chief of Staff

We exercise the planning management als joint chief of staff along with the project direction of the Building Surveyor's Office. We have no order competence or the competence to take measures against the planning participants and the resident engineer. All work results are made available by us for the project director, who then can take the necessary steps. Examples: the use of adjusted calculated durations and dead lines as contract dates or the enforcement of dunning proceedings or rule suggestions, as long as the necessity i.e. reasons were presented by us.

3.2 Construction Procedures Concept

The construction procedures concept has essential influence on the planning procedures. We work out this as the first planning measure before beginning with the actual planning organization. The construction procedures concept includes the analysis of the local construction site conditions regarding

the architectural draft and the external conditions, such as conditions at narrow inner-city construction sites, necessary measures for the preservation of historical and monumental construction elements, expected weather conditions, supply situation of the construction site, etc.

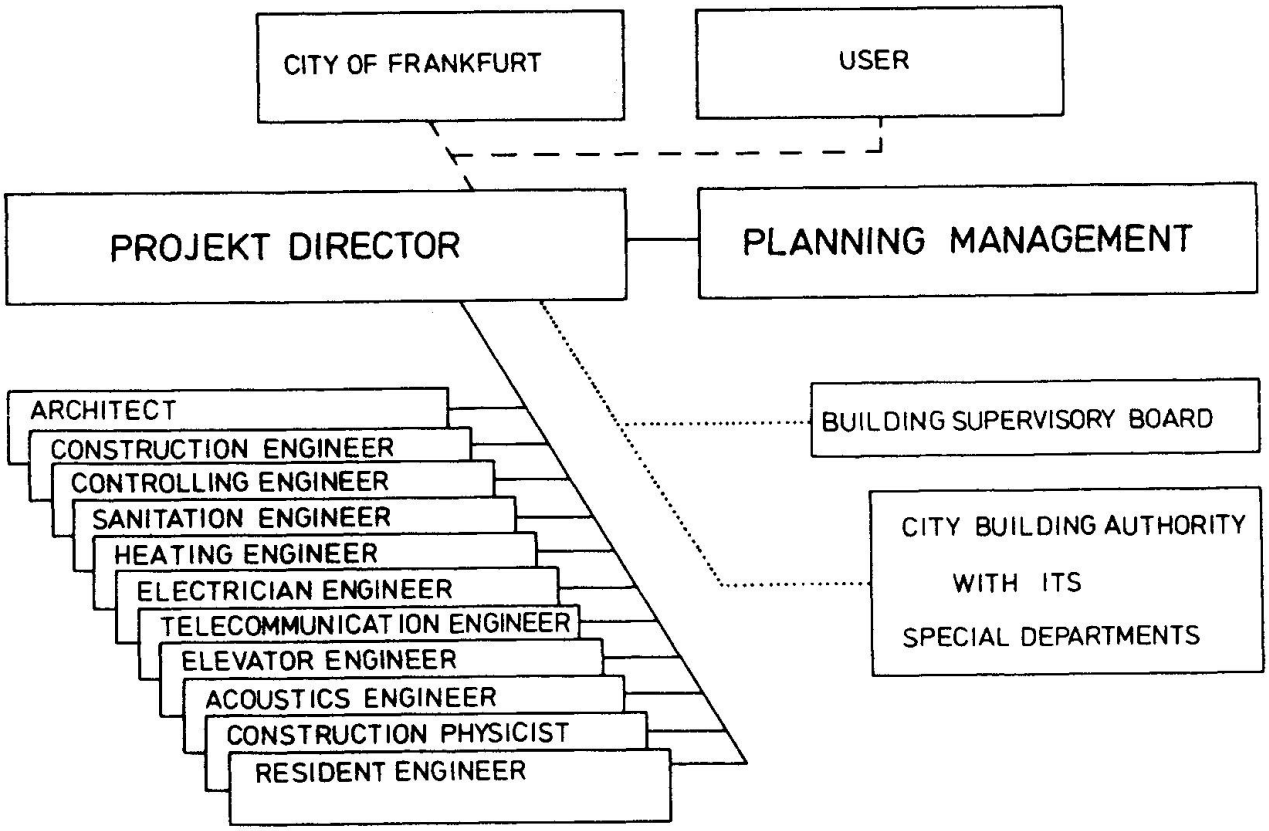


Table 1 Construction Management

An essential part of the construction procedures concept is the working out of a - at the moment - non-commital suggestion for the construction site set-up of the construction firm and for the following trades of the technicions and craftsmen for the completion. Difficult foundations, ground water conditions, constructions pit sheeting and such create essential characteristics, which in co-ordination with the planning participants and, if needed, under consultation of specialized firms enter into the construction site planning. Also the determination of possible sites for superstructure cranes including the selection of the general crane types is done at this early point in time. Therefore it will be possible to derive consequences from the use of pre-fabricated large construction parts of reinforcedconcrete, wood or steel for the planning and construction procedure.

The construction procedure concept builds with the - at the moment - non-commital suggestion of the construction site set-up planning an important part of the invitation to bid documents. The bidding construction firms work out the calculation of their bid with this suggestion. Before the final distribution of the contract, they must submit the construction procedures concept and the construction site set-up plan, if necessary modified, but in the final form. Experience shows that construction firms take over these in the

planning approach conducted pre-considerations, because possible changes, especially in the main plane structure, could essentially disturb the planning concept, which could lead to new considerations.

3.3 Management of the Planning Participants

The management of the planning participants concerns itself mainly with the organization of the information flow. The most important information carriers for construction projects are the drawings. First of all they are arranged by each planning participant in their entirety in exact lists. Then in co-ordination with the planning management, the expected necessary time for each single drawing - including any other necessary preparatory work - is determined. It will also be individually determined how the plan rotation is to take place, if it is necessary according to the individuality of the planning steps that several planning participants must work together in order to finalize a certain drawing. For example, it can happen with complex projects that because of the co-ordination of notches, openings and slits, which must be worked into the plans for reinforced concrete construction parts, a time span of up to 6 weeks may be needed.

A special feature is that the active planning architects for this demanding museum project are all especially well authenticated artistic architects. As a rule, they received the contract as prize-winners of a preceding competition. The construction assignment is foreign to them at least in its complexity and entirety with a certain procedure schema. As a rule, artistically working architects do not have esperienced working large offices, but work together with a staff that is also artistically ambitioned.

The architects of the artistic architecture are academicals, but neither builders nor craftsmen. Their own and original architectural ideas deviate from the usual planning methods and often require new execution techniques. Their way of working is for the most part empirical. The planning process of artistic architecture does not usually comply with the criteria of determinded procedures, but partially takes a stochastic course. The originality of the creative work process specifies in itself the operation of the architect office. At the same time the working out of crative details often causes retroactive influences on the already completed planning declarations. This often means a change in other planning departments such as in the main plane structure or in the building technical installations or in the appointments.

For the formal explanation of geometrically complex form connections for the outer frame and the interior it is recommended to use models on a small scale. Afterwards the final drawings, the constructive preparation and finally the description for the bid for public reward can be made. Sometimes it is advisable to make small scale "true to life" models, which are not only for the formal explanation but also make it possible to study the production stipulations, the construction's physical conditions and the constructive problems. Finally, this way of working helps considerably to determine the production prices with more accuracy and simplifies the work, because the contractor can gain a more exact picture of the designing intentions and the specifications for the production and mounting.

At the beginning of the management work in planning information must be gathered as to the way the architect's office work, the qualification of his colleagues and the work discipline. From experience we know that the artistic architect does not trouble himself much with the organization and direct guidance of his office. That is why the construction manager unespectedly finds himself in the situation of seeking contact directly with the project official in charge and deals with him in direct personal dialog concerning management matters. Success shows itself in such a way that the colleagues experience directly the functional meaning of their planning work in connec-

tion with the project. In this way they are motivated for the aim of the project, which is to work for the smoothest possible planning and construction execution. In this manner the effect is reached the work is done naturally without actually realizing that there may be any problems at all.

3.4 Duration of the Planning Activities

An especially difficult task is the determination of the durations of the planning activities. One cannot derive generally accepted universal values. They must be determined in each single case, with regard to the way the planning participants work, respectively in close co-work with the planners. Experience shows that many architects calculate the time needed for their planning services much to high. Through a control calculation for the applied costs, there often appears a deficit in relation to the payment. This induces the architects to use a less expensive planning process - as far as this is possible in relation to their way of working - or, for example, to reduce the number of planned drawings.

3.5 Performance Attending Planning Management

Especially when using monument-protected, historical construction elements, the necessity of the performance attending planning management arises. This results from the fact that many for the planning decisive facts can finally be explained in the course of the execution. For example, it is only evident after a building has been cleaned out, in which qualitative condition the remaining construction will be found. Even investigations done before the planning respectively the execution begin show no sufficient information concerning the actual condition. That ist why it will be necessary to work over respectively partially re-do the planning, if unseen facts turn up during the execution phase. This generally also holds true to changes, although it does not often come to program changes with buildings from public authorities because of the specified process. From esperience one knows that so-called changes in planning are actually no real changes but, on the contrary, detrimental influences from incomplete or deficient parts of the planning services.

The necessity of the planning management during the execution results in the participation of the planning manager on all construction discussions and his complete information about all of the execution precesses, in order to draw conclusions for the planning work at the right time.

3.6 Deadline Framework

With complex museum buildings of high construction creative quality, the given deadline framework counts, for which political occasions such as elections are the determining factor. Moreover, in the organization plan of a large city such as Frankfurt am Main there are definite decision procedures specified, on which the politically legitimate bodies are to participate. This has a result that - for example - all of the preparations for a decision must be submitted up to 22 weeks before the closing date. The instructions for the placing procedure also require long total lengths of time.
For example: with the acquisition procedure of picture frames, beginning with the preliminary choice - which is made by the architect and the project director - to the delivery, a regular time span of 6 months passes.

Netzplan 10002 Sortierung 16 5

V	Index	K-Text	Vorgang – Bezeichnung	PK	D	FAT	FET	SAT	SET	GP
	Teilnetz-Nummer 11		Bilderrahmen							
40	0	HBA/65A-Arch.	Gr. 11 Vorauswahl/Details	9	5.0	14. 9.83	20. 9.83	7.10.83	13.10.83	17.0
50	0	Nutzer	Gr. 11 Zustimmung Vorausw./Det.	9	15.0	21. 9.83	11.10.83	14.10.83	4.11.83	17.0
60	0	Beschaff.Amt	Gr. 11 Erstellen LU	9	15.0	12.10.83	2.11.83	7.11.83	28.11.83	17.0
70	0	Beschaff.Amt	Gr. 11 Auswahlfirmen		10.0	12.10.83	25.10.83	14.11.83	28.11.83	22.0
80	0	Firmen	Gr. 11 Angebotsfrist	9	18.0	3.11.83	29.11.83	29.11.83	22.12.83	17.0
90	0	Beschaff.Amt	Gr. 11 Zuschlagsfrist	9	40.0	30.11.83	31. 1.84	23.12.83	23. 2.84	17.0
100	0	Beschaff.Amt	Gr. 11 Bemusterung/Endauswahl	9	20.0	30.11.83	3. 1.84	23.12.83	26. 1.84	17.0
110	0	Firmen	Gr. 11 Lieferzeit	9	30.0	1. 2.84	13. 3.84	24. 2.84	5. 4.84	17.0

Table 2 Assorted date exerpts for the acquisition procedure "picture frames" of the Architectural Museum, which lasted a good half of a year.

3.7 Agreement Deadlines

In the frame of the planning management it is also important along with the organization of the actual planning procedure and the determination of all of the dicisive deadlines to calculate the dates in advance, for which agreements or decisions will be necessary from the client respectively the later users. These likewise need a difinite amount of time and they are often only to be attained after a certain preparation time, which the decision maker needs. That is why we are supplying date exerpts for all of the decisions, which inform the decision makers as to when a statement from them will be necessary. This very successfull process effects that decisions are actually made by the planned point of time, because otherwise it would be easy to proove, that because of an agreement or a decision made too late a self-inflicted delay from the client or user would be the result.

Dt. Filmmuseum Frankfurt/Main Aufgestellt Liste Stichtag zurück am Ausgabeabt. Blatt-Nr.
Planung Museographie/Einrichtung Bau-Real Darmstadt 20 17.10.83 9

Netzplan 20002 Sortierung 3 5

TN	V	Index	K-Text	Vorgang Bezeichnung	PK	D	FAT	FET	SAT	SET	GP
	Empfänger	Nutz									
1	20	0	Nutzer	Zustimmung zu Einrichtungspl.	0	10.0	15. 9.83	28. 9.83	15. 9.83	28. 9.83	0.0
1	40	0	Nutzer	Gr. 1 Zustimmung	5	5.0	6.10.83	12.10.83	21.11.83	25.11.83	30.0
3	40	0	Nutzer	Gr. 3 Zustimmung	5	5.0	6.10.83	12.10.83	21.11.83	25.11.83	30.0
4	40	0	Nutzer	Gr. 4 Zustimmung	4	5.0	6.10.83	12.10.83	11.11.83	18.11.83	25.0
11	40	0	Nutzer	Gr. 11 Zustimmung	4	5.0	6.10.83	12.10.83	11.11.83	18.11.83	25.0
2	40	0	Nutzer	Gr. 2 Zustimmung	0	5.0	13.10.83	19.10.83	13.10.83	19.10.83	0.0
5	40	0	Nutzer	Gr. 5 Zustimmung	4	5.0	13.10.83	19.10.83	21.11.83	25.11.83	25.0
6	40	0	Nutzer	Gr. 6 Zustimmung	3	5.0	13.10.83	19.10.83	11.11.83	18.11.83	20.0
8	40	0	Nutzer	Gr. 8 Zustimmung	2	5.0	13.10.83	19.10.83	4.11.83	10.11.83	15.0
7	40	0	Nutzer	Gr. 7 Zustimmung	2	5.0	20.10.83	26.10.83	11.11.83	18.11.83	15.0
12	40	0	Nutzer	Gr. 12 Zustimmung	0	5.0	25.10.83	1.11.83	25.10.83	1.11.83	0.0
9	40	0	Nutzer	Gr. 9 Zustimmung	2	5.0	27.10.83	3.11.83	21.11.83	25.11.83	15.0
10	40	0	Nutzer	Gr. 10 Zustimmung	0	5.0	27.10.83	3.11.83	27.10.83	3.11.83	0.0

Table 3 For the users of the Cinema Museum assorted agreement dates for the set-up planning, arranged according to the earliest beginning date.

3.8 Information Flow Planning

The planning of the information flow is relatively easy to carry out, if it concerns definite information carriers, which regularly arise as a product of the planning activities. The drawings, calculations, descriptions, invitations to bid and such can be counted here. Important is however the organization of verbal information exchange. Along with the discussions on the specialized level, for example architect and construction engineer, construction

engineer and engineer for construction physics, etc., at regular intervals there will be definite appointed meetings arranged. These meetings, scheduled far ahead of time, obligate each of the planning participants including the project direction and the users to take part. A special invitation is not sent out for these obligatory discussions. Only for justified exceptional cases can a participant be excused by the project director from taking part. The informational meetings have prooved to be successful, since the participants learn about the planning connections and in many cases can win information, which is important for their own work.

4. RESULTS OF THE PLANNING MANAGEMENT

4.1 Co-operation

Those who participate on the planning appraise it as a positive result of the planning management that the co-operation is essentially encouraged. The open presentation of all connections contributes to this, plus the planning of the information flow, which is understandable or each participant.

4.2 Benefits for the Client

The client receives from the planning management especially the benefits of good preparation for the execution of the work at the construction site. It is possible to make contracts with the performing firms, which are based on extensively advanced and in some areas concluded planning. Thus, infringements of deadlines and costs are not probable or can be prevented. It is even possible to reach the goal of giving the construction firm various reinforcement plans at the time of the contract awarding. The thereby prevented costs and deadline risks certainly justify the payment for the planning management, which is around 1,5 % to 2,5 % of the costs of the building.

BIBLIOGRAPHY

1. GIEGOLD, WILLIAM C.: Practical Management Skills for Engineers and Scientists, Lifetime Learning Publications. Belmont/Calif.: Wadsworth Inc. 1982
2. HARRIS, FRANK; McCAFFER, RONALD: Modern Construction Management, Student Edition, 2. Edition, Granada Publ.Ltd, Crosby Cockwood Staples 1977
3. MADAUSS, BERND-J.: Projektmanagement. Stuttgart: Poeschel 1984
4. SAYNISCHY, MANFRED; SCHNELLE, HEINZ; SCHUB, ADOLF; Hg: Projektmanagement. Konzepte, Verfahren, Anwendungen. München, Wien: R. Oldenbourg 1979