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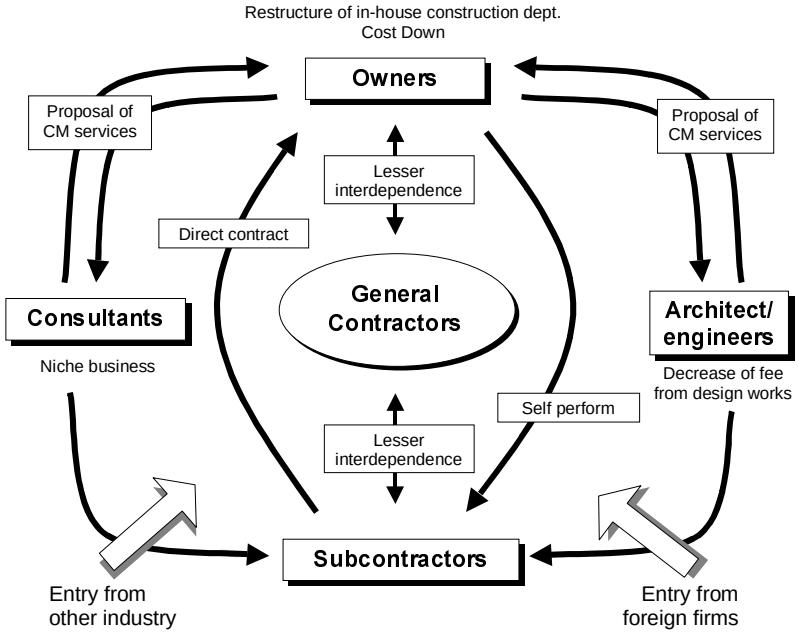
Odd Sjøholt

Construction Management in Japan – notes from a short visit



261 Project report 1999

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Key words:
Construction, Management, Building Process,
Research and Development, Japan

Illustration on front cover origins from
Takenaka Corporation, Mr. Sakamoto.

ISSN 0801-6461
ISBN 82-536-0665-6

150 ex. printed by
S. E. Thoresen as
Recirkulated paper:
Cover Cyclus 200 g
Content Fortuna 100 g

Address: Forskningsveien 3B
P.O.Box 123 Blindern
0314 OSLO
Phone: 47 22 96 55 55
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Preface

This report describes why I wanted to visit Japan to learn about Construction Management, how the tour was prepared and the outcome. The content is a sort of a diary with structured comments, without aspirations to have any scientific standing. The visit about two weeks is so short that it could only give some impressions. The writing is partly done in "I" form, instead of the more anonymous "we".

During 35 years as a researcher and consultant on Construction Management and related subjects I have experienced how several epochs have evolved within stationary industry and given impact to construction. Combined with increased international contacts this has raised my interest for understanding how different regional cultures' influence the local management methods. I have been lucky to visit already many countries and continents, and now my turn came to Japan.

Thanks to my previous very valuable contacts in Japan I could start in February 1999 to arrange my tour by use of e-mail. I even got an impressive great number of references by a short request on Internet through the net named CNBR. May be needless to say in these days, but *this study visit could not have been organised without my access to Internet*.

The preparation for the trip included reading a number of reports and articles, basically from the later years. The authors were both Japanese and visitors from abroad. The reading combined with my knowledge from Norway and other countries gave me the base for preparing topics for questioning.

I am very grateful for the possibility to go to Japan given by a grant for the travel from the *Scandinavia – Japan Sasakawa Foundation*. I am also very thankful for the positive interest from my Institute to do this study. It was anticipated that the experience could give impact on the R&D projects going on in the building process and management area.

My sincere acknowledgement goes to the companies, institutions and individuals in Japan whom so kind and willingly has helped to prepare the tour. The hospitality during my stay has been overwhelming, as can be read in the following notes.

The outcome of the visit has for me been very successful professionally as well as my private memories of Japan and the Japanese people are outstanding. The report itself may be seen as a receipt to all my supporters as well as an indication of current topics concerning R&D on construction management in Japan.

October 1999
Norwegian Building Research Institute

Odd Sjøholt

Content

1. Summary

This report gives some informal notes on management of construction in Japan, as seen by the eyes of myself, the Norwegian author, after a two-week study tour in May-June 1999. The two first chapters describe my understanding in forehand, and were written before the travel and sent to the people I was going to visit.

The introductory chapter *Norwegian baseline for the study* is summarising the management topics my Institute and especially myself have concentrated on since the 1960's. It clearly shows how different epochs of management focus topics have passed by over time. It should also indicate how a research institute as a foundation in a small country as Norway is central in developing practical management tools and applications in direct co-operation with the individual actors in the construction industry itself.

The following chapter *Preparations and studies before the travel* describes the knowledge of Japan achieved before the visit. It includes a listing and short abstract from literature on construction management in Japan, which I have read and used as a baseline for the chosen study topics. I have focussed on the Japanese differences from concepts and methods known from Norway and other Western Countries. Little information was found in the literature about any systematic R&D on construction management concepts, aiming at increasing the effectivity and efficiency as such. The chapter ends with a description and listing of topics for further questioning during the visit.

Visits, presentations and excursions is a chapter describing day by day the performed visits. The minutes for each day indicate all the main topics being treated. Each host provided information about his working area, and somewhat illustrated other relevant areas. The presentations given were of great value, and extracts is utilised directly or indirectly in the report. Discussions were deepest in the smaller fora, that means in the institutes and universities. I met representatives of many parts of construction, but was missing subcontractors and mediumsised enterprises. As the hosts represented different actors or interests in the construction sector the information gathered supplemented each other rather well.

Study results and conclusions is a chapter where a great deal of my prepared questions are enlightened. But also quite a lot of questions or details were not discussed, due to the limited allowable time or the actual fora I met. One other important reason is of course that many problems seen from a Norwegian angle are not relevant at the time being in Japan – and vice versa. The chapter is structured under a great number of headlines, each representing a sort of conclusion or finding. An overview based on adjusted headlines is as follows:

The construction sector faces great changes

- The *civil engineering sector* in Japan is much larger than in US as well as in Europe and the *maintenance sector* is much smaller
- The pressure in the national economy causes extensive changes in the construction sector
- The five large general contractors play a dominating role
- The number of labourers has been steadily increasing – despite of the reduced construction investment
- Workers employment conditions varies, there is no active labour union

Research on construction management

- The large five contractors' research is unique in world comparison
- Research and development of technologies is performed by the large contractors and results are exposed in building projects
- National institutes support the R&D basic and infrastructure
- Universities do basic research on construction management – but with little direct involvement in individual contractors
- Associations play a major role in exchange and development of new knowledge and creating consensus

Procurement methods and organisation of building projects

- Ministry of Construction signals changes to more total competitive procurement for cost reductions
- Public owners are reducing own costs by ways that also change the construction business
- Lack of transparency in construction projects is a frequent comment, and cost specification is increasingly required
- Suppliers network around general contractors may be dramatically changed in the future
- Project management and construction management concepts and services are slightly increasing
- The use of PM/CM in public sector is a big issue
- Low and insufficient design fee for public building and construction leads to free assistance/ service from contractors
- Procurement elements affect contractors' mutual ties
- There is an attitude of always success and no excuse

Owners' and clients' needs and requirements

- Systematic functional requirement analyses is still a missing link

Design work

- Integrated IT systems for design is in extensive practical use
- Shop drawings are made by contractors on site – a key to successful large projects

Construction work on site

- Large general contractors have management systems and competence to handle a great number of subcontractors
- Attending a safety meeting for 1400 workers in one room is quite an event
- Waste management is based on sorting at site for recycling
- Management systems embraces Quality, Cost, Delivery, Safety and Environment - QCDSE
- A site PC system is used for subcontractors' plotting of daily schedule
- Logistics of materials is detailed managed internally on each site
- A new total logistic management data-based concept is developed and introduced

Altogether the study result and conclusions gives the picture of ongoing changes that radically can affect the ways of organising and managing building and construction in Japan. The research and development of construction management in some way prepare for changes. Increased exchange of knowledge even between Japan and Norway might be beneficial for both parties, but it will be largely hampered by the fact that both countries have national languages far from reciprocal understanding.

References, literature as the last chapter is a listing of the relevant publications on management topics that I have been involved into as well as the material I have read and commented on before the study tour.

The appendix *Programme for Mr. Odd Sjoholt* shows the visit programme with detailed references that can be used for those who want to contact anyone mentioned or just to get information through web-sites.

2. Norwegian baseline for the study

R&D on Construction Management at the Norwegian Building Research Institute

My own professional work at the Norwegian Building Research since 1963 has centred on management and rationalisation topics. The goal has always been to achieve concrete and measurable improvements in the industry through combined research, development and direct implementation work.

In the 1960's the themes were from the beginning work-studies and process analyses, followed by better production planning and control methods. These methods were widely spread and implemented in Norwegian companies during the 1970's. We developed a very successful concept for a parallel guiding and training of 6-8 companies in so-called clubs, lasting 1-2 years. This concept is still much used by our Institute for development and implementation of improved management processes and tools.

A five-year period started at the end of the 1970's focussing on the working safety and environmental topics. A handbook and educational material was published.

In the midst of 1980's started the most remarkable period based on the quality concept, and our Institute has been heavily involved since then [1]. Nearly all sorts of actors or trades in the building and construction sector have been involved in clubs or individually. A common original framework for a generic management system *Construction Management System - CMS,* is developed by our institute, and adapted for different purposes [2, 3]. A detailed guideline is under writing.

Towards the end of the 1990's two more topics are added as supplementary management tools. One topic is about improved *logistics* procedures and scheduling involving designer, general contractor, subcontractor and the material suppliers. A guideline is published in Norwegian. The other topic is new *environmental management* procedures and tools through the whole building process. A first state of the art report from the Nordic Countries is written in Norwegian [4], and a guideline will follow. The environmental topic will without doubt take the lead for the coming years.

The Institute's management system concept is exported to some other countries as well. I have presented the principles presented at conferences in about 15 European Countries and in USA, Mexico [5], Brazil and Singapore. As a result of the great interest in quality I had the opportunity to organise an international state of the art report 1994 *Quality Management in Construction* [6]. This international contact was expanded through our arrangement 1994 in Hamar, Norway, of the international Eureka conference *Quality Management in Building and Construction* [7]. Finally to mention is our arrangement 1997 in Oslo, Norway, of the CIB workshop *Transfer of Construction Management best Practice between different Cultures* [8].

My latest international experience has been the participation in an ad hoc group WG Q(uality assurance), delivering a report to ISO/TC 59 Building Construction in January 1999, named *Quality management of construction and facilities* [9]. The goal was to investigate the needs

of the industry for additional ISO standards. The proposal defines some topics, and a basic idea is to support better integration of future systems.

As a consequence of the stepwise implementation of different management aspects in Norway and many other countries some companies today possess a number of parallel control systems. Such separate systems are for quality, safety, and environment - besides the cost and time control management. This leads to the need of integration and the development of common generic management systems [4, 10]. Our institute is on the way by means of a system shell launched in 1998. This is a software information tool for easy ways of systematising both company and project management systems. Model systems based on our Institute's *Construction Management System – CMS* are designed individually for various actors in the building process, and are distributed from our Institute by CD-ROM. We also know about other integration initiatives in different countries as well within companies and institutes [11, 12]. As this may not be the case in Japan, we are though interested in understanding how the concepts for management of Quality, Delivery, Cost and Safety are co-ordinated.

The Norwegian Building Research Institute started in 1998 a four-year strategic programme to focus on a more innovative and quality-focused building process. One particular objective is about the changes in building rules (Planning and Building Act) and how to stimulate the interaction between the authorities and the building firms. The other particular objective is how to integrate functional requirements in the process. The themes centre on interaction, information, communication, co-operation and contract relations. This topic seems also to gain international interest at the moment. As we know the Japanese mutual understanding and co-operation between the client and actors in the whole building process, I have been trusted through my visit to be updated in how this functions in the reality.

There is just to add that my personal interest at the start of the 2000's is twofold, first to be involved in the creation of the next generation of a generic management concept and method and second to learn more about how cultures affect the best practice. This is the background for my interest to know more about construction management in Japan.

3. Preparations and studies before the travel

Scope for my study visit to Japan

The scope is to study and discuss the management/leadership and planning/control methods in the Japanese building and construction industry. In this context I think e.g. upon management and leadership embracing strategies and goals and communication within an organisation. The planning and control methods and tools could be about management systems applied for company and project performance.

The goal is to compare the Japanese concepts and trends with practice in Nordic companies and to relate to the current R&D work on these topics at the Norwegian Building Research Institute.

In the comparison should also possible effects of cultural differences be detected and assessed.

Experience on measurement of efficiency and effectivity (productivity) is also of interest, although any comparison between countries has to be let out of the study.

In any way the scope and goal has to be indicative, as each of the individual occasions and visits should be performed as mutual discussions and based on common interests.

Method

The study method has the following steps

1. Prepare the study. Gather and study literature. Describe and relate known or anticipated relevant differences between concepts and methods of construction management practises in Japan and Scandinavia. Thereof formulate discussion topics and questions to raise in Japan.
2. Study tour. Select and prepare contact persons, make appointments.
3. Perform interviews and stimulate to open discussions. Make notes and gather information.
4. Analyse the material and experiences, make conclusions. Write a report and present to the funding, to the Institute, the visited persons and others who has shown interest.

Literature study – chronological references

An outline of Quality Assurance Activities at Shimizu (198?) [13]

This document gives on 23 pages a detailed description and shows process charts for quality control activities embracing technology development as well as order management. Four project management elements are introduced, Q(uality), C(ost), D(elivery) and S(afety). The same elements seem to be used by other major companies, and give a harmonised reference, which is not common in other countries.

Report from Study Tour to Japan 1st-21st of April 1990 [14]

Mr. Pål Cappelen, a researcher from Norwegian Building Research Institute wrote this report from a tour financed by the *Scandinavia – Japan Sasakawa Foundation*. The visits to

universities, institutes and Shimizu Corporation described the direct contracting from clients to the large contractors, indicating that Shimizu got 80% this way. The site work was performed entirely by already well-acquainted subcontractors, through negotiations or direct bid.

Kvalitet i byggandet. Kvalitet i Japan, USA, Australien och Singapore, minnesanteckningar från en resa (1992) [15]

A Swedish researcher Dr. Per-Erik Josephson writes this report (in Swedish) from a round trip. He reflects on how the Japanese employment seems to be more like a lifelong agreement. Loyalty is a more valuable asset to the company than contemporary talent. The company is concerned with the wellbeing of the employees and their personal development as members of the social environment, which the company provides. Another topic is the consensus process, which from a Western view is looked at as non-efficient. Safety management is apparently much focused, even if somebody in between questions how cost decisions affect also safety decisions, especially in other than the major companies. The author also reflects on the deployment of TQC activities, as someone indicates this spirit is not easy to keep going. One other reflection of myself is connected with the chart showing the contractor Toda's quality management process (page 55). I wonder if there is some organised harmonisation between system structures, e.g. flowcharts, as the similarity in structure design makes it easier to overview the different examples from Shimizu, Takenaka and Toda and Kajima (appendix B of the following [17]).

Quality Management in the Japanese Construction Industry (1993) [16]

A report by Mr. Tapio Koivu, a Finnish guest researcher at The Shimizu institute of Technology focus again on the co-operation between the partners in the building process. He gives a historic overview on how relationship between companies is connected to some sort of clusters and kinds of common financial network like ZAIKAI, KEIRETSU and ZAIBATSU. There are three bidding systems prescribed by the Public Accounts Act. Competitive and nominated bidding is closest to Western systems. He also describes how the designers end result is mainly drawings only in principle. The contractor conducts the following process on site for making the detailed shop drawings. Further on he points at the scope of Quality, Cost, Delivery and Safety - QCDS as a common goal known by all. It is also indicated that the working hours in the Japanese construction industry exceeds what is normal in Scandinavian countries.

Quality management in building and construction. Proceedings of Eureka conference, Hamar/Lillehammer, June 1994. Sjoholt, Odd, ed. Norwegian Building Research Institute. Oslo, 1994. (Out of print). [4]

Management and quality – as the basis of continuous improvement of the competitiveness of Takenaka Corporation [4, page 20]

Mr. Schunichi Hirao, Executive Vice President of Takenaka Corporation, wrote this thorough description of the total quality control introduction from 1976 and onwards and how the top management is fully involved.

Quality Management in the Japanese Construction Industry – a Nordic View [4, page 29]

This is a structured extract from [16].

Project Management in the Japanese Construction Industry (1995) [17]

This Norwegian M.Sc. thesis is written by Mr. Tom Sauthon, based on his study at Kajima Corporation. He also underlines the procurement method between customer and general contractor, based on trust and confidence and with very short written contract. The price offers

has up till recently had room for accepting changes during the construction without extra payment. He points at the close co-operation between the general contractors and "their" subcontractors, without an open price competition. It seems to generate a friendly atmosphere on construction sites as well as co-operation between workers. The general contractor takes care of the site management and co-ordination of the SC's. It is also said that most of the equipment and even material for the SC's work is procured by the GC. The delivery to the site is extremely well planned. Transports are coming to the site in exact correct order and the goods is brought directly to its final destination. As for the lifelong employment he indicates that the sub-subcontractors and further down must be very flexible in capacity, and the workers often have short engagements. It is understood that Quality Assurance is less focused than in 1980's. The QCDS aspects are said to be of equal importance, although Safety is marketed as most important. It is also indicated that there is an increasing weight on Q and C. The consequence should be an increase in formal procurement. Anyhow, the Delivery is steadily shortened and delays are not accepted.

The Principles of Construction Management (1995) [18]

Professor Masahiko Kunishima, University of Tokyo is the Chief Secretary of the Editing Committee of this comprehensive lesson-book, translated from Japanese into English. Research activities on construction management were initiated within Japan Society of Civil Engineers (JSCE) back in 1976. Academic research on the topic came up at Kyoto University around 1970, but only from 1993 the first Japanese course titled Construction Management was established at Tokyo University. The authors compares to some extent the Japanese practises with those of USA and Germany. Differences in social values are discussed as well as the weight of QDCS.

The Organization and Management of Construction; Shaping Theory and Practice. Langford, D.A and Retik, A, ed. E&FN Spon. 1996. [19]

Methodology of specialist contractors' involvement in design development for construction [19, volume Three, page 135]

Mr. Tomonari Yashiro, Musashi Institute of Technology, describes a case of Japanese innovative collaborative process with structured meetings between designer, SC and associated producers. By means of performance based specifications this method will be applicable to achieve more optimal shop drawings. Similar UK experience is referred to.

Development of construction management based on regional culture [19, volume One, page 119]

Professor Keizo Baba, currently Kochi University of Technology, discusses differences between Japan and USA. He describes how the contractors co-operate with the customer in Japan and through the consultant in USA. The forms of communication and control tends to be according to group norms/informal/negotiations by the engineer in Japan, as to in USA individual/formal/contractual clauses by the lawyer.

Transfer of construction management best practice between different cultures. CIB Proceedings Publication 205. Edited by the Norwegian Building Research Institute. Oslo/Rotterdam, 1997. [6]

Cultural Factors – a Framework before the Workshop [6, Appendix 2]

Even though not fully utilised by the workshop the three main levels in the framework structure I sketched for the discussions can be used for comparing some element between

Japan and Scandinavia. The three elements are the country, construction industry and company/building project, as shown in a following chapter.

Japanese report: Improvement examples from the 1990's: I) Total Quality Management (TQM) in the Construction Industry. II) Construction of Database and Linkages between Production Systems. [6, Page 140]

Mr. Schunichi Hirao, Executive Vice President of Takenaka Corporation, describes the progress of TQM up to 1997, including the ongoing implementing of IT and Internet communication for management and design. The principles behind the ongoing development of CAD and CAM systems are explained. The structural computation is linked to building frame drawings. Interference between services is avoided by overlaying techniques. Changes during the process should be easier to perform and assure.

Japanese report: Educational and Training Aspects of Transfer and Communication of Management Technology. [6, Page 27]

A hypothesis is that one type of people accepts to be communicated and educated with manuals and directives. Others are strong personalities who need more generic instructions to fulfil by own management. Examples describe how Takenaka Corporation took this into account for contracts in Singapore, United Kingdom and Spain.

Towards Best Practice in Safety Management: The goal of Zero Accidents. [6, Page 58]

This study by the Royal Swedish University of Stockholm goes on safety management in Japan compared with practices in USA, UK and Sweden. The authors strongly recommend other countries to adopt more of the Japanese attitude as towards zero accidents and even copy parts of the structured control processes on site.

Research, development and education for the future of the Japanese Construction Industry (1998) [20]

Dr. Toshikazu Takeda, Managing Director at the Technical Research Institute, Obayashi Corporation, writes this overview. The current priorities for R&D in the five leading contractors is classified as 40% Product, 35% Process (automated building system, computer assisted system), 15% Global environment (energy conservation, application of new materials) and 10% Material (high performance concrete, application of new materials). As for R&D on management topics as such little is described. The Process related topics seem to stick mostly to the Building itself.

Growth and Future Developments of R&D in the Japanese Construction Industry (1998) [21]

This report is an extract translated by the author from a Japanese report. It describes the Japanese structure of R&D between universities, national institutes and the major contractors (Tohryo). The major contractors are larger than in other countries and their investment on R&D is very much higher than any other country. The technological development work performed mainly by these companies has resulted in very impressive new design and constructions. The report describes the major five contractor's research institutes. It is indicated an increased real co-operation in the future, both between the companies and with the universities and institutes.

Customization in Japan: Opportunities and Constraints (1998) [22]

Ms. Dana Buntrock, Assistant Professor from University of Illinois at Chicago writes this report after 12 months study in Japan. It describes how contractors, manufacturers and subcontractors participate and contribute significantly in detail during the design process, creating customised and innovative solutions without having any contractual guarantee for a

further award or delivery. She points at how such development processes leads to extraordinary effort by the project members, may be up to 80 hours weeks. She further mentions agreements through clusters as a support for this mutual way of working and achieving such good results. One question she raises is about the design and co-operation processes involving many meetings and lots of people to obtain good solutions; how is the productivity affected?

Provisional comments on some Japanese distinctions regarding construction management

Overview of elements or factors characterising management practice

It is obvious that cultural elements or factors have a great influence on what can be seen as best construction management practises around the world. As a reference for discussions on this topic was launched a special framework model at a workshop in 1997 [8]. The model is divided into three categories:

(I) *Cultural factors and elements on the country level*; e.g. social conditions, ethics, politics, economy, education and physical environment.
(II) *Construction industry specific factors*; e.g legislation, authorities, structure of the industry, standardisation, employment regulations and a set of other elements linked to the practice in the domestic building and construction sector.
(III) *Company and building project internal factors*. Although managerial styles may be deducted from a country's own culture, variations can still be found within a single *company*. Even the customers influence this multiplicity in management systems. The social basis for communication might be of importance.

This framework model is used for indication of some distinctions for Japan and Scandinavia, as can be seen in the following table.

Country level, examples on cultural factors or elements	Japan	Scandinavia
• Social conditions, religion, ethnic/demographic characteristics, language variations		
• Physical conditions, geography, climate	High population density	Low population density
• Political ideologies, economics, market fluctuations, welfare, public financing of R&D, ethics	Contractors private R&D	Social democratic High welfare level Public financed R&D No corruption
• Educational levels, proportion skilled/unskilled	High basic education.	Skilled construction workers

⇩

Construction industry level, examples on cultural factors or elements		
• Legislation, laws and regulations (products, buildings, health, environment, safety) international directives (e.g. EU)	Construction business license. Ministry grading of companies. Designer license.	EU harmonised regulations
• Authorities, governmental and local practice, public or private inspection, building permit/application		Plan and Building Act requires inspection and control documentation from companies
• Structure of the market, professional clients/owners/developers, government, facilities management	Ministry of Construction. Banks, insurance companies. Partnering agreement with general contractors. Proposals for long term services.	Developers are increasing
• Structure of the designer industry, size of companies, infrastructure, import/export	Separate architect & engineering companies	
• Structure of the industry, size of companies, infrastructure, import/export	Large general contractors, *Zenecous*. Financial groupings. Several layers of subcontractors hierarchy. Some export, little import.	A few Internordic contractors growing further in size Many SME construction companies. Little construction import/export
• Building process, contracting system, degree of and procurement of design/build and subcontracting	Little competitive or nominated. Most direct, mutual trust. Advanced use of CAD. Shop drawings on sites.	d/b increasing, otherwise mostly given specifications and drawings. CAD not widespread.
• Building contracts, litigation	10 years guarantee. Little litigation.	Litigation happens in large projects
• Employment regulation, permanent/ad hoc, wage systems, labour union power. Working hours. Status in society.	Life long employment. Training. Wages? Bonus basic security, team reward.	A sort of permanent. Piece rate, but project negotiations. Strong union.
• Level of technologies, technical standards. Certification • Environment • Health and safety • Continual improvement.	Very high level of technology. Very few 9001 certified? Deming Prize (diminishing?) More 14001 certification in Construction? High-tech. Safety first. Q circles?	High level of technology? High level of technical standards. Even for specifications. Very few 9001 certified. Almost none 14001. *Health* & safety. Improvement projects
• Professionals' categories, peculiarities, vocabulary	Architects role?	Common European in general

⇩

Company and building project level, examples on cultural factors or elements		
• Leadership styles, military hierarchical or democratic principles (human relations) Bottom up/presidents order?	Company hierarchy many layers. Documented management systems. Informal information exchange.	Humanistic approach, teams
• Management principles, degree of control and inspection (communications) • Staff functions on QES (QCDS)	Project leadership. Communication. Consensus. Unanimous decisions. Information cycle, morning meetings, evening etc. system Secretaries, committees	Project and site managers are powerful, authoritative. Q&E&S managers
• Clients' or public works' requirements on management systems		

The table above indicates in the left column a set of cultural related factors or elements affecting or characterising construction management. The other two columns indicate some distinctions for the same factors in Japan respectively Scandinavia. The illustration is just showing a principle for analysis, and is not worked through. The interrelationships between elements in the different boxes are very complex, and not possible to detect in practical terms.

Preparation of discussion topics and questions on Japanese methods or concepts of construction management practice

Important introductory note

The following descriptions are absolutely not to be seen as specific questions to be asked or answered. It is merely a set of reflections I have made on the base of my short literature study and my previous sort of understanding of Japanese construction management. I sincerely do hope that my hosts during the visit will forgive me any misunderstandings and incorrectness. I also hope that they will concentrate and stick to the experiences and topics they feel relevant to discuss irrespective to the huge amount of questioning I have prepared. I know it will take days and weeks to discuss all the questions.

The topics below are structured in sequence according to the framework model presented on the previous page.

Influence of the Japanese economy on the basic culture and strategies in construction sector

How do companies adapt to changes in market and frame conditions, are fast decisions necessary, how to achieve consensus in short time, which impacts are most visible concerning construction management. Does it tear into the mutual co-operation concept, between customer, contractor, subcontractor, and supplier? How are the cost implications dealt with, what about cost reductions, price negotiations, number of employees, or other consequences?

Research on Construction Management in Japan

Which are the main tasks for co-operation between private R&D, universities and national institutes. Which priorities for the future are given for each of these organisations concerning R&D on construction management? Is management or leadership a relevant topic? Or building process management? What about the "old" rationalisation principles from Taylor and upward, improving work processes through the production chain? Is any humanistic profession (sociologist e.g.) interested in R&D connected with the construction sector?

How is the industry outside the major companies developed? Are there any governmental initiatives? Our Institute is currently involved in a European Commission project for stimulating small and medium-sized construction companies to participate in R&D.

Communication on building permit etc. between authorities and the construction project

What about the authorities' development of handling the applications for building permit? Is IT in increasingly use for communication? Is the handling time speed a problem? Are there other major problems? This topic has been in focus for our Institute the last 4 years, and we have created a sort of quality management system for common use by the authorities and the actors in the projects, with information linked by Internet.

The structure of the companies in the building and construction sector

This is an element connected with the dominating procurement methods. I understand that the major Japanese contractors do not have any *employed construction workers* themselves. They rely on a certain set of subcontractors. How is this structure for medium- sized companies?

In the Nordic countries all the larger contractors *still have own workforce* within the main construction works. And before entering a design and build contract they normally negotiate with subcontractors for other trades than their own and with suppliers to get offers.

Procurement

Procurement in its widest sense is at the time being much focused around the world and someone names it re-engineering. Much discussion is centred on both the design & build concepts and degree of formal contracts. A few countries are close to have the lawyers as prime actors – as others strives to create models where the actual partners co-operate, negotiate and trust each other during the process.

There seems to be a striving towards more effective and efficient sorts of direct procurement methods for total design and build. The other more traditional end is a clearly divided design and production, and contracts based on cost specified bids according to thoroughly design with drawings and specifications of quantity and prices given per item. Between those two are a lot of solutions.

The Nordic countries have a long tradition for the cost per item concept. For a period it came up (1970-90) the possibility for bidders to attach their own designed solution and proposal for cost reductions to their bid, especially in heavy civil engineering contracts.

From 1980 and onwards some larger companies marketed their ability to deliver design/build buildings (d&b). Their goal was to achieve 20% of their turnover as d&b. By now some homebuilders have the target to reach 80 % as complete deliveries to groups of buyers.

A special design/build contract under use is divided into two parallel contracts. One is for the building and construction and one for the technical installations (HVAC, electrical, sanitary). This split acquires improved management skills by the technical contractors project managers.

A recent Norwegian small-scale pilot project is realised where the contract came as a result of long mutual planning between the owner and the contractor. The contract document itself was only one sheet of paper stating the total price and the object to build. Researchers followed the project and the result is reported as promising.

The needs and requirements of the owners, clients, customers and users

The design/build contracts have been and still are under development. The way of specifying the owners/clients needs and frame conditions varies. The ideal base is "functional requirements" upon the building in use. This is not a very simple task, as the owner also wants to know a little about what the result will look like.
What are the requirements, and how are they derived from the needs of the owner/buyer/user? Is QFD in use in practice in Japan by now? How? Are there any general accepted criteria on measurable requirements? What systematic is used by the major contractors' professional salesmen? I would like to discuss this topic as it is in focus at our Institute at the moment.

Workers employment conditions

The working conditions for construction workers vary considerable around the world, including cultural basic settings. It is important to know and understand how this function as it is an important part of the construction management system. The topics listed below indicate some relevant elements or factors.

- Construction workers categories, education/training
- Work site organisation, social groupings
- Status in society
- Employment system, stability, long/short term
- Income level, wage system
- Social security

- Working conditions, work load
- Working days/hours, holidays
- Unions for employees, workers

Documented construction management systems, development, use, improvements

In my sense I take management as the ways of managing companies and building/construction projects. I am looking for *organisations systems, formal and informal functions* or duties/responsibilities/authorities from top management to the single workers. Some topics are listed below, even though many of them are overlapping:

- What sort of processes is managed, what sort of formal procedures for planning and control?
- How are the relationships between employees at different positions. In which degree are employees/workers involved in the planning and decisions regarding their own work?
- How are different types of requirements dealt with - like the owners/fulfilment of contract, the authorities requirements regarding occupational health and safety, environmental requirements, plan and building act requirements?
- Harmony between major contractor's management systems, flow chart, QCDS, safety management concept; which are common elements, is any co-ordinating industry committee or university etc. involved?
- Are there separate management systems for different aspects, or is it real integrated management systems?
- How is ISO 9000 looked at and treated? Does anyone care for the year 2000 draft?
- What is the interest about ISO 14000?
- BSI has also BS 8800 on safety, is it known and in any use?
- Have there been any previous trends over time, like Total Quality Control etc.?
- How is cost planning and control dealt with?

About company/project management and control principles, methods, tools, approaches or implementation.

- How is such framework established, developed, disseminated, checked, improved, changed, tailored?
- How are goals defined, measurable, as for efficiency and effectiveness?
- How are they measured or monitored/assessed a.s.o., and how is such information used?

Logistics

How can the perfect delivery as I have read about really be achieved?

What new development measures are the actual ones regarding logistics? Use of IT communication, barcodes, and satellite navigation? Are there any connections to IT-scheduling (e.g. MS Project) or to design drawings (CAD, CAM)? Our institute has developed a simplified application of MS Project for easier use by smaller companies, which seems to meet the needs better.

Information technology, PC, Internet – use in construction management

What is the status in average and at the top level? How is IT utilised? For management systems, communication, measurement, decision. What are the main challenges and future topics? Who are doing the development? Our Institute is currently involved in R&D on how to use object-oriented models to improve communication systems in construction.

4. Visits, presentations and excursions

Overall program and its realisation

The journey started from Oslo in the morning of Friday 28th May 1999, with arrival at Narita Airport, Tokyo after having travelled 17 hours in total. I stayed in Tokyo the first week, and then moved by Shinkansen to Osaka in the afternoon of 7th June. Finally I left Kansai Airport, Osaka on Sunday 13th June, and had a safe trip back to Norway.

The experiences from the travels and stay in Japan were very good, exceeding my expectations. One thing was the railway and subway services, running punctually and even cheap to use. The information was detailed and specific, and it was easy to find around. However, coming outside the main routes there were only Japanese signs and instructions, which made it a little more complicated. I picked out and booked my hotels myself from home by Internet, and the result was very satisfactory.

Almost all the appointments for the nine different visits were even settled in forehand, and a detailed itinerary was circulated to all my contact persons. The use of Internet was a must for this planning. During the preparations I felt an overwhelming willingness and positive attitude to organise the visits within my target. The final itinerary was far beyond what I could expect, and I could feel very pleased and relaxed when I started the journey. The performed program is attached as *Appendix.*

Already fro m the beginning I felt an atmosphere of extensive hospitality, which I experienced as one characteristic of Japan. I was given many carefully planned presentations and excursions, and was even taken to many pleasant treatments for social and informal discussions. Several days I was taken from my hotel in the morning and accompanied back in the evening. Needless to say that all these events together gave me a maximum of output both professional and personally. I am extremely thankful to the persons I met and in special to those who organised my visits so well.

In addition to the professional contacts and discussions I had the opportunity to see and admire many Japanese treasures and historical sites. One-day visit in Nara and one day in Kyoto was arranged with a personal accompany from Takenaka Corporation. The sights of temple buildings and shrines gave many impressions from the ancient Japanese culture, including artistic design as well as eminent construction craftsmanship. On my own I also went for sightseeing both in Tokyo and Osaka, and I got a rough picture of the built environment and the physical communication systems. A number of the modern buildings and complexes were standing as impressive landmarks, confirming the construction industry’s great capability. All together these impressions adds up to a background for the mission of the study visit – to overview the state of construction management in Japan today.

The rest of this chapter describes each of the nine visits, where I met more than 40 persons. Each description includes the name of participants, the agenda and a short minute.

Takenaka Research and Development Institute

The visit took place on May 31st, 1999.

Participants

From Takenaka Research and Development Institute, Chiba

TSUTSUI, Isao	General Manager
UEDA, Masatoshi, Dr.	Deputy General Manager
SUGANO, Shunsuke, Dr.	General Manager, Fundamental Research Department
MIYAGAWA, Tetsuya	Manager, Research & Planning Department
SASAKI, Yoshikazu, Dr.	Manager, Research & Planning Department
LALEIKE, Marius	Researcher, Research & Development Department

From Takenaka Corporation, Main offices in Tokyo and Osaka

HIRAO, Shunichi	Representative Director, Executive Vice President
JIDO, Junichi	Secretary-General, Secretariat, The Executive Committee of Company-Wide Quality Management
WATANABE, Haruo	Executive Secretary
GOTO, Hisao	Manager, System development, Information management center
SAKAMOTO, Hiromitsu	Manager, Office of Construction Management

Agenda

11:00-16:00

Welcome greeting
Introduction to Construction Industry in Japan and Takenaka Corporation, *H. Sakamoto*
Introduction to R&D Activities at Takenaka Corporation, *T. Miyagawa*
Introduction to Takenaka R&D Institute, *M. Laleike*
Video "People Friendly, Earth Friendly"
Observation tour to Laboratories and other facilities, *M. Laleike, C. Sato*

- Lounge
- Centrifuge Facility
- Large Structures Laboratory
- Fire Resistance Test Laboratory
- Wind Tunnel Laboratory
- AMD Laboratory
- Green Concrete
- Super Bridge
- Acoustic Laboratory

Q&A Discussion
Introduction to TQM and Integrated Design Construction System SISC-T, *J. Jido, H. Goto*

Minutes

Construction Industry in Japan

The total volume of *Construction industry* in Japan is of the **same magnitude** as of USA in total or as of the sum of 15 countries in Europe (1997). The *new building sector's* part of the total is also of the same magnitude in the three areas. But the Japanese *civil engineering sector*

is by far much larger and the *maintenance sector* is much smaller than in USA and the European countries.

The *construction investment* has been stable 1990-96, thereafter came a fall. The public part has increased, while the private investment has decreased. On the other side, the *workforce* has increased steadily since 1987, as much as near 30% up to 1997. The number of *registered contractors* has also increased in total. But there has been a substantial change in the structure, as the number of small companies has decreased and the medium-sized have increased.

The ongoing *changes in the construction industry* in Japan is characterised by the following
- Shrinking market, lower growth rate
- Bankruptcy of listed contractors
- Entry from companies from other fields (steel, engineering)
- CM (Construction Management) services is started to be provided for by design and consulting firms
- Self perform construction works is started by real estate firms and developers
- Internationalisation of the market, foreign firms register in Japan. Influence of World Trade Organisation.

Takenaka Corporation - overview

Takenaka Corporation is one of the *large five* in Japan. The revenue is about US$ 10.000 mill and the company has a staff of about 10.000. Takenaka's business is 96% *buildings* and only 4% are *civil engineering*. The other large companies deals roughly 25% with civil engineering, that means that Takenaka is the largest concerning buildings. In Takenaka about 60-65% are *negotiated contracts*, being reduced from about 80% ten years ago. *Design and build contracts* counts for above 50% in Takenaka, with variations +/-10% during years.

Takenaka Corporation – Research and development

Investment in R&D is about 1% of revenue, quite near the average of the large five, but double as much as the average in the industry in total. The investment is spread about fifty-fifty in the *R&D Institute* and in the different parts of the entire corporation. The R&D Institute outside Tokyo has about 250 employees, out of which close up to 20% holds a Doctoral Degree. The institute undertakes commissioned research and testing from other departments as well as performs autonomous research on advanced technologies. Takenaka holds a great number of technologies being realised in projects as well as under exploitation. This includes construction management tools for CAD, Construction Planning, Scheduling, Network Aided Construction and supports for Intra & Extranet. The facilities of the laboratory are comprehensive, and the equipment in many areas is at the leading edge.

Takenaka Corporation – Quality Management

The management has undergone stepwise developments under years. The company-wide quality control concept (TQC) was introduced in 1976. The current concept for quality management includes social environment factors as a part of a totality, embracing Quality, Cost, Delivery, Safety and Environment (QCDSE). Customer satisfaction and contribution to society are main drivers. The system is designed so it can be used for all individual steps in the construction process, clarifying departmental responsibility. Common management indicators are used for yearly evaluations to stimulate continual improvements.

The Integrated Design and Construction System, SISC-T

Since 1993 a system has been under development and implementation. A company-wide distribution started in 1998 of the *Synthesised Information & Interface System for*

Construction of Takenaka – SISC-T. The system allows construction staff to take part in early design stages. The clue is the gradually processing of all information from the very first planning in an increased accuracy and depth of project information up to the final working drawings. Examples on the system packages are as follows:

- Building Design & Build Query, Volume study (3D Study), Schematic Drawing
- Facade Study, Preliminary Drawing
- Structural Analysis, Structural Design
- Automated Drawing Generation, Detailed Drawing
- Mechanical Engineering Design and Working Drawings
- Construction Planning (Scaffolding planning), Automatic Estimation (Quantity take off)
- Working Drawings (Drawing overlay)

Summary

The minutes is based upon a thoroughly documentation given from the company, as books, brochures and leaflets. In addition a great number of copies of foils were handed over. Some information existed even in forehand, see literature [4, pages 20 and 29] and [6, pages 27 and 140]. Another visit in Osaka is referred later in this report. The totality gives a very broad input from Takenaka to the overall study result and conclusions.

Shimizu Corporation, Institute of Technology

The visit took place on June 1st, 1999.

Participants

From Institute of Technology

MATSUMOTO, Shinji, Dr.	Deputy Head
MINE, Naoto, Dr.	Deputy General Manager, Special Projects Department
NAKAMURA, Hiroyuki	Senior Research Engineer, Construction Engineering Department
AKIMOTO, Manabu	Senior Research Engineer, Information Technology Group

From Sanno Kyodo Building Project (site visit)

TOMITA, Shinichi	Project Director
SAWAMOTO, Keiji	Planning Manager

Agenda

10:00-12:15	Greeting and Introduction of Shimizu Institute Introduction of Norwegian Building Research Institute Information exchange Construction Business in Japan and Shimizu Business, *N. Mine, S. Matsumoto* Questions and answers Logistics in Construction Industry, *H. Nakamura* 4D-CAD System for Project Scheduling, *M. Akimoto*
13:00-15:30	Site visit, Sanno Kyodo Building Project, *accompanied by N. Mine* • Presentation of the construction methods and management, *S. Tomita, K. Sawamoto* • Excursion in the building and visiting staff centres, *K. Sawamoto* • Attendance to a safety meeting for all workers • Attendance to a daily planning meeting for all foremen

Minutes

Construction Business in Japan

Presentations and discussions supplemented the information and confirmed the minutes from the previous visit at Takenaka.

Shimizu Business – and the Institute of Technology

The company is one of the *large five*, with revenue about US$ 11.000 mill and a staff of about 15.000. Shimizu's business is 80% *buildings* and 20% *civil engineering*. *Investment in R&D* is about 0,8% of revenue, a ration close under the average of the large five. *The Institute of Technology* has a staff above 400, out of which more than 20% holds a Doctoral Degree. The research topics cover a wide range of areas, basically of technical nature. Both design and construction methods from an innovative point of view are included, based on laboratory and site studies as well. Pure *management methodologies* are also included, but in a smaller scale. The organisation chart names the following teams: *Construction Engineering group*; Quality Assurance, Construction Information Technology, Building Materials, Construction

Technology, *Information technology group:* System Engineering, Network Technology, Multimedia Technology.

Logistics in Construction Industry – a new Shimizu concept

Surveys from small size construction projects indicate a rate of 3-6 trucks/day, with a working time 40-70 min./truck. The average actual loads range from about 50-80% of the load capacity. Multi-sites delivery occurs in 55%, mainly for HVAC and Finishing. Estimation of freight charge in construction cost ranges from 5-10%. Shimizu wants to improve through a better sharing of project information between all partners/ subcontractors. The target is to reduce *Physical distribution cost* with 50%, *Construction waste* –50% and *Construction period* – 20%. Even the CO_2 should be significantly reduced. The new concept has a scope of a seamless physical distribution system covering procurement to recycle/waste. The elements are:

- *Physical supply*: Pickup and delivery inventory, consolidation, multi-site delivery
- *Receiving & shipping:* vertical and horizontal transfer
- *Remove:* reverse logistics, recycle/construction waste

A *Project Information Sharing Server* is a core element in the system. All manufacturers are connected through this server with the overall scheduling. Inventory data from site gives information of progress of works. A weekly progress chart of work on a day to day basis shows for each supplier:

- Ordering (linked with schedule of manufacturers)
- Planned workdays (linked with inventory in site)
- Latest supply dates
- Allowance of supply dates

The idea is a co-ordination of truck transport, to allow for one common carrier/vehicle to fetch from different factories and/or to deliver to different sites. The sharing server allows for adjusting the weekly schedule within minor adjustments of dates, thus obtaining an optimum collection and delivery of goods. A pack of management systems operate via a project database as a complete functional physical distribution information system for construction logistics. This includes use of barcodes and an EDI interface with the supplier, manufacturer, retailer and carrier. The trucks have installed a satellite navigation system for easier control.
The system is put into use for one site (1999), and seems to function very well. Further projects will follow. The project manager has currently contact with European countries through a project on Artificial Intelligent Systems.

4D-CAD System for Project Scheduling

The combination of CAD and a schedule system (e.g. like Microsoft Project) allows showing the construction process for structural parts from day to day. This can be used to prepare the optimum work progress preventing safety risks. Changes in work routing for a certain day can be made on the CAD drawing and the schedule will be changed accordingly.

Sanno Kyodo Building Project (site visit)

Presentation of the construction methods

This is *the largest ongoing building project in Japan 1999, as one building with a total floor area about 220.000 m^2*. The purpose is rental offices, shops and parking, with in total about 15.000 workplaces. Before rental the areas are quite open without any walls or columns. The

interior work is to be ordered by the client, and will be delivered by the owner Mitsubishi Estate Co.

A number of industrial fabricated methods are developed and used for construction, like the following:

- Top down construction method underground, allowing early start of high rise work
- Pre-loading method of system toilet
- Local Area Network (LAN) through the site
- Column welding robot, girder and beam prefabrication method
- Unit installation method of aluminium curtain wall
- Collision prevention system of six cranes, new operation system of shackle (prevention of rotating)

The site work started early in 1996 and is to be completed early in 2000. At the time of the visit the interior finishing was going on, and about *1400 people were working* at the site. Normally the same subcontractors for pure craftsmen/workers (e.g. floor covering) are chosen from one project to the next. This is because of the importance to have a firm and good relationship with the subcontractors as to be able to increase and decrease the workforce substantially in short time. Subcontractors providing both material and work may change more from time to time, allowing for some competition. The normal working time is 6 days a week. If there is no work for somebody on a Saturday they normally have to find another job to provide the income. The workforce has no labour organisation. The site staff normally spent a free Saturday every forth. The management and staff on site counted about 100. Up to 80 architects and engineers did the detailed design including shop drawings. Another 10 persons dealt with Quality assurance activities. Logistics and transports were organised on PC's by 6-8 people in a special department. Every day before 10:00 the next day's delivery had to be noticed from each subcontractor and they were co-ordinated to one total plan for materials reception and storing plan. The same procedure applied for establishing the next day's plan for use of the hoisting equipment. The site had its own internal web-site.
The waste management on site was based on minimum spillage and a controlled return system with sorting at sources. A special instructive and educational area was arranged for the workers. A number of posters explained and instructed how to handle different sorts of materials. Some exposures showed by specimen how certain materials might be recycled into marketable products.

Attendance to a safety meeting for all workers

The company has a set of site meetings as a standard, like many other large Japanese general contractors. One type of meeting is a safety meeting for all workers in the beginning of each month. This happened to be the day of the visit, 1st June. All the 1400 workers were gathered for one hour, sitting in the same large room. The sight was rather impressible, glancing at all the hard hats of different colours. The man in front gave information and pointed at large drawings hanging on the wall.

Attendance to a daily planning meeting for all foremen

All 100 foremen meet for 30 minute every day to report and plan for the following day. This is possible only because of a planning system connected to a database. Each foreman has just before the meeting to plot on a PC his workers progress of the current day and the plan for the next day. A number of PC's are installed in the meeting room, and the foremen are queuing for their turn to plot. The site manager leads the meeting and shows successively the individual plans on a screen. Any comments seem to come at once, concise and shortly – and promptly lead to decisions.

Summary
The minutes is based upon a wide documentation given from the company as brochures and leaflet. In addition a set of foils were handed over. Some information existed even in forehand, see literature [13 and 16]. The concrete examples on R&D and the site visit gave a distinctive input from Shimizu to the overall study result and conclusions.

Building Center of Japan, Tokyo

The visit took place on June 2nd, 1999.

Participants

From Building Research Institute (BRI), Ministry of Construction

HIRANO, Yoshinobu	Associate Director for Housing Information
HASEGAWA, Naoji	Head, Environment Conscious Materials Division
TAKAHASHI, Satoru	Head, Building Production Division, Housing & Building Economy Department
MAKATAYAMA, Miho	

From Institute of International Harmonization for Building and Housing (iibh)

HOTATE, Toru	General Manager (see also below, BCJ)
NISHINO, Kanako	Researcher
ITO, Naohisa	Researcher (about one year stay, belongs to Tokyo Gas)
SHINKADO, Koji	Researcher (do., from a housing company)

From The Building Center of Japan (BCJ)

HOTATE, Toru	General Manager, International Department

From other governmental entities

TOTSUKA, Akira	Research Officer, Construction Department, Labour Welfare Corporation (previously Ministry of Construction
TANAKA, Atsushi	Director for accessible and usable building, Building Guidance Division, Housing Bureau, Ministry of Construction
SAITO, Takashi	Deputy Director, General Affairs Division, Building Department, Ministry of Posts and Telecommunications

Agenda

10:00-13:00	Greeting and Introduction of Institute of International Harmonization for Building and Housing and the Building Center of Japan, *T. Hotate* Introduction of Building Research Institute, *Y. Hirano* Introduction of Norwegian Building Research Institute Planning of the workshop
13:30-17:00	**Workshop: Construction Management and related topics** Construction management in ISO standards and some related development work in Norway, *O. Sjoholt* Construction Management in Governmental Agencies, *A, Totsuka* The Changing of the Japanese Construction Industry, *T. Saito*

Minutes

Institute of International Harmonization for Building and Housing

The objective is to promote domestic development by international harmonization of technologies, systems, codes and standards and to maintain communication with foreign countries and organisations. The income is membership fees from 50 national organisations

and associations. Companies also place employees as e.g. researchers for a period at the institute. A set of committees are set up, e.g. ISO advisory committee.

Building Center of Japan

The goal is introduction of new building technology to society. It is a non-profit organisation set up in 1965. One increasing topic is evaluation services, like Technical Appraisal, Building Confirmation and Inspection, Approval of Prefabricated Housing and ISO System Assessment.

Building Research Institute (Tsukuba Science City)

The goals can be summarised as: prevention of disasters, improvement of the living environment, rational organisation of building production and the development of new building techniques, effective use of energy and resources and promotion of international co-operation. Management topics are dealt with in the departments of Building Production and Housing and Building Economy.

Norwegian Building Research Institute

This topic is basically dealt with in a previous chapter of this report: *Norwegian baseline for the study*.

Workshop: Construction Management and related topics

Construction management in ISO standards and some related development work in Norway

The presentation was focused on the following (see also [7]):

- *ISO TC 59's WGQ, recommendations for changes.* Both Mr. Hirano and Mr. Sjøholt were members of the WGQ. Recommendations were given about development of standards or guidelines focused on construction. This included Processes in construction and facilities management, Integrated management systems for agents as well as for projects, Processes for development and implementation of management systems. TC 59 decided in June 1999 to create a new working group to plan for future actions.

- *ISO 9001:2000 and ISO 9004:2000, new principles.* The drafts of March 1999 indicate a substantially improvement from the construction point of view. Detailed assessment can be found in [4].

- *BS 6079:1996 Guide to project management.* A baseline for defining the construction process is given in *Figure 9 Project management life cycle*.

- *ISO 10006:1997 Quality Management in Project management.* An important concept for giving a management system in construction a structure like a matrix (columns and rows) is given. Phases and processes are described in *chapter 4.4 and in Table 1*. This concept is used in Norway [4].

Construction Management in Governmental Agencies

Contracts are up to now for 95 % based on traditional common specifications and minimum standards. Detailed specifications are given for each project. From 1995 onwards a cost fee contract and design build has been introduced. A guideline on quality assurance has been applied as well. A study group of 1997 is focusing on use of value engineering and lump sum contracts. Building projects of some size are often split into two or more contracts, e.g. allowing for Technical Engineering as a separate one.

The Changing of the Japanese Construction Industry

- *A background for the oral presentation from the speaker in the workshop is given in the following note of 9th March 1999:*
  "The Japanese construction industry has faced a huge deficit and depression reflecting the Japanese economy turmoil. Some middle class companies, such as NIHON-KOKUDO, TADA Construction, TOKAI-KOGYO and so on, have been bankruptcy. Needless to say, regional and small construction companies also faced bankruptcy. It is the fact that the number of construction companies' bankruptcy in Japan is the highest ranked.
  This situation affected to the relationship between contractors and sub-contractors. Traditionally, not only Japanese construction companies but also other industrial societies have a long term relationship between contractors and sub-contractors as KEIRETSU in Japanese, which means a big construction company has sub, sub-sub-, ..., companies with long term contracts and developing human skills like one company.
  But, today the Japanese economic depression has broken this relationships from reliability to cost-base relationship. Because, even a big construction company, there is a huge deficit for bad management of real estate companies and banks for the certification of insurance by a construction company. Sub contractor has an anxious about the sudden death of a big construction company having a contract relationship with sub-contractors, so that sub contractors select the contract company and also a big construction company select sub-contractors by price competition not long-term relationship. Accordingly, one of the strength of the Japanese industry, long-term relationship and pyramid structure with many sub-contractors, has been broken gradually, which means the structure of Japanese social will become from internal society to self-independent industry with the acceptance risk and benefit in her own."

- *Changing the client attitude.* During the boom in the early 1990's the client was satisfied with a contractor delivering a "fashionable" building, and the price was not much bespoken. Today, after a 20 % fall in construction output, clients strive to reduce costs. To be more cost effective they ask for increased cost transparency and are splitting project contracts more separately, e.g. for general contractor, steel etc.

- *Changing the public client and public procurement.* Today the traditional design-bid-build is dominant, supplemented by some simple projects following the design-build concept managed by one contractor. There is a need for better transparency of costs, allowing for risk versus cost analysis. Contract forms in the future must also include Project management/Construction management (PM/CM) organisations. This is a consequence of the decrease of public clients' employees to obtain a smaller government administration. The government reform will reduce the capacity to perform in-house design, which instead will be contracted to private companies. Even the procurement will be a necessity for consultants. In total the role of the public client will change from being the owners architect to do management of the construction project.

- Ministry of Post and Telecommunications. This Ministry owns about 25.000 post offices and employ 300.000 workers. The overall business situation forces the ministry to decrease the facility investment. One set of activities has been the use of Value Engineering, Value Management, Private Finance Initiative – and in the future also PM/CM. New procurement methods might be based on performance concepts. Lessons can be learned from the housing industry and prefab housing.

Summary

The workshop brought up a number of topics, and especially viewpoints on the changes in the industry and public procurement in the future adds surely to the total study results.

University of Tokyo, Department of Civil Engineering

The visit took place on June 3rd, 1999.

Participants

KUNISHIMA, Masahiko, Dr.	Professor, Department of Civil Engineering, Construction Management/Infrastructure Systems Lab. Also: Institute of Environmental Studies, Graduate School of Frontier sciences.
YOSHIDA, Tomonary, Dr.	Assistant Professor

Agenda

09:00-12:00	Greeting and introduction of Department of Civil Engineering, *M. Kunishima* Construction Management in Japan, traditions, changes and improvements, *M. Kunishima*
12:00-17:00	R&D on Organisation and Management of Building Construction, organised in the Department and through AIJ committees (symposiums etc), *T. Yoshida*

Minutes

Department of Civil Engineering, Construction Management/Infrastructure Systems Laboratory

The main research fields are; 1) Studies on construction management concerning public procurement system including a bidding and contracting system, and identification of ways and means to enhance structural improvement of construction industry; 2) Studies on infrastructure development and management including those of developing countries. The staff includes two professors and two associate professors. At the moment there is a dozen doctor and master students, half of them from other East Asian countries.

Construction Management in Japan, traditions, changes and improvements

A lesson-book *The Principles of Construction Management* [18] describes this topic very well. A number of aspects are analysed in respect of Japanese conditions and compared with the same in Germany and US. It is underlined that differences in e.g. values causes differences in construction management. Some Japanese basic values are mentioned, e.g. freedom from individual anxiety, public safety and security, harmony, equality, safety, group activity (teamwork), morality, justice and loyalty.

A discussion during the visit touched a number of topics.
Some of the points made are referred here, even they are just separate comments on different topics:

- The traditional culture in the industry is to deliver successfully projects in time. No projects must in principle be known as unsuccessfully, and there is no room for criticism.

- A handbook for standard or average prices is used by the owner to establish (but was not to publish before recently) ceiling prices in public projects before the bidding. The lacks of transparency on public projects is under change.

- A completion guarantee in case of e.g. bankruptcy has to be given by competitors to the winning contractor. This may cause some mutual ties between companies. Only a few years ago it was cancelled.

- Advance payment is given in local as well as central government projects from 30-40 %. This is paid within two weeks, and act as a liability to the bank. This may be a substantial part of financing a company.

- Re-employment of former governmental officials in private or quasi-public institutions has been beneficial to the companies. The officials might have important information, e.g. data about new projects. In the period after 1945 the governmental agencies were more important and attractive for competent workforce than private employers were. But today a new regulation restricts officials to re-employ for private for two years. In addition the open information about new projects is increasing.

- There are gaps between principles and practices of Consulting Services Works.

- A governmental owner must be responsible for cost estimation and design. He may hire help. The norm for design fee is sometimes not enough, and based on the number of drawings and sheets. A designated consultant may again ask for help to fulfil his task, e.g. from a contractor, who may assist for a very low financial compensation. This might be a way to start up new consulting companies. During bidding the assisting contractor knows the project best, and may be able to give the best bid. The competitors also know who has been involved in design, and it may affect their interest in the bid.

- Officials have not until recently been allowed to specify a technology that only one company can apply. Therefore such a company has invited others to learn this specific new technology, and organised a technology association. This might have solved the formal problem for the officials, but still the first company might be the only one being really able to perform the work.

- Public owners know that they must give something to all contractors to survive. That leads to small size construction projects or requirements on e.g. 10-15 companies to establish Joint Venture.

- Public owners are often looked at as fearful, and their representatives are treated in the best way in any situation. Vice versa the owner's inspection on sites does normally not give any feed back directly, and the results are secret.

- Changes and improvements in the public are ongoing. Governmental changes are a little slow dependent on the uncertainty in short span investments. Big cities are main drivers in changes, as the smaller communities are more conservative and influenced by politicians.

- Changes in the industry are partly driven by the big five. Some of the next 50-100 largest is actively changing, while the mass of the small companies is rather conservative.

R&D on Organisation and Management of Building Construction, organised in the Department and through AIJ committees (symposiums etc)

This discussion touched a number of topics, partly overlapping with the previous one.
Some of the points made are referred here; even they are just separate comments on different topics:

- R&D for practical purposes is mainly done in-house by larger companies. Universities and institutes are able to gather data more widely, and may even decide on own topics. Active researchers within construction management are a small group of people, and much exchange of information is related to personal knowledge.

- There is none or little R&D in direct co-operation between companies and universities. The main contact is within associations, e.g. Japan Society of Civil Engineers (JSCE) and Architectural Institute of Japan (AIJ). The latter has a group for *Organisation and Management of Building Construction*, which has arranged a national symposium every year since 1985. A great number of papers are presented, and the proceedings altogether give a very good outline of what is going on in this area in Japan. Research committees on different topics, e.g. Building Economics function as discussion forum with informal exchange of information between the participants on a personal basis. Meetings may start late in the afternoon and continue in the evening.

- The department wants to create hybrid cultures, and invites sociologists and others to co-operate. The economists anyhow assess the construction sector to be the most difficult one.

- Employees at public universities (like Tokyo) are prohibited to have their own firms. In practice they may assist in external projects in other ways.

- Certificates according to ISO 9001 have passed 100 in number, and certificates according to ISO 14001 are approaching 50. Some companies complain that it does not give benefits in marketing and it has additional costs. Others claim that there are internal benefits.

- Some CM contracts appear in Japan for small projects; e.g. the British company Bovis led the establishment of BP petrol stations as CM contracts in co-operation with Japanese contractors.

Summary

The information given is important as viewpoints from outside the industry itself. The minutes may be very fragmentary, but seems still to be of great value for this short study. A number of published papers have been handed over.

Nihon Sekkei, Inc.

The visit took place on June 4th, 1999.

Participants

OI, Seiji	Managing Director, Senior Architect
IZUMI, Atsuhiro	Councillor, International Department Also: Director of ND Consultants
Also attending:	
EGUCHI, Tadashi, Dr.	Professor, Musashi Institute of Technology

Agenda

10:00-14:00	Development and implementation of CM or PM as procurement methods in Japan, *S. Oi, A. Izumi*

Minutes

Nihon Sekkei is a company for planning, architecture, engineering and project management with about 700 architects/engineers. There are several Japanese architectural/engineering (A/E) firms of the same size, there might be about 15 firms having between 100 and 400 staff. *ND Consultants* is a company jointly owned by Nihon Sekkei and Leo A. Daly (an American A/E firm). The company is marketing itself, mainly for foreign companies in Japan, as an independent body providing project management service acting on behalf of the client.

Governmental projects are normally contracted on the basis of in-house design with a following bid and build. Public clients usually have more in-house staff than private owners. But they are powerful in the market, and may ask for technical information as a free service or for a low fee in the programming stage of a project. The architect may get advice about which local design firm should be chosen as coordinating architect. In general the design fee for public projects is very low, down to 1,2%. In private projects the fee may vary from 4-5% down to 3-4% for large projects. For tendering some similar qualified contractors may be invited for bidding. The lowest price will normally come from the contractor who knows the project from the early stage by their marketing efforts, and should be below the budget.

The low design fees might be seen in connection with the Design & Build services from contractors in private projects, where the design and management is not invoiced as a separate sum, and might by some clients be looked at as free service. And as a parallel the Japanese contractors usually don't use any outsourcing consultants for development of their management, they claim to have no need and don't want to pay for such expertise.

Design & Build is a safe way for the owner's staff who is responsible for the project. General contractors in Japan cover a wide technical field, have in-house architects and engineers as well as R&D. This is not normally the case in US. Japanese clients are normally satisfied having only one contract and single point of responsibility. They don't want to contact many persons, and don't normally even have in-house staff with capability for construction management. Large contractors are flexible and may offer both Design and Build or only Build.

Up till now the subcontractors normally haven't competed so much by bidding. Belonging to a family network of a general contractor with other subcontractors and suppliers of different trades give another way of being involved in projects. The responsibility against the client goes through the general contractor. As there is little transparency of costs some might question if this is the most cost-effective way of organising.

A project behind schedule is very rare in Japan. The discussion did not go deeper into this saying, but there are comments upon the topic from other visits.

The need for cost reductions in all industries including construction leads to new approaches. To establish fair bidding environment is seen as one element. In general the increase of transparency of costs are bespoken as an important objective.

There is an overseas “power” supporting CM/PM, particularly from US. Groups of subcontractors have been in projects of foreign countries to study PM. They want to have direct contracts with the client, but are afraid of the reactions from the general contractors.

There is a slight movement towards PM/CM, and the next 5-10 years may bring changes. Some examples are already under way. One such huge building construction project in Tokyo is 90% owned by a foreign government. The remaining 10% are owned by one of the largest developers in Japan. This is an unusual case in Japan in which PM method is applied. The architect is from US and Nihon Sekkei is co-operating. An American PM company's Tokyo branch is behind the project manager, supporting in CM/PM in the western style. Calls for a tender was due in July 1999 in the project for steel structures, curtain wall, mechanical and electrical works as separate contracts. The big five general contractors are watching the project, including the contractor who works mostly for the Japanese developer.

Another example in Japan is the US client Amway, whose business concept is a very expansive home sales chain. They built a warehouse & distribution center in the suburbs of Tokyo applying CM method. The owner executes a design/build contract with a contractor. A separate service is procured from a CM consultant (ND Consultants) as a construction manager on behalf of the owner. The tasks are to review design documents prepared by the contractor, advice as to changes, control the budget, quality, schedule, invoices etc. The construction manager is also leading the site meetings, but is in general partly dependent on the main contractor for their capability to keep very tight schedule.

ND Consultants is working along a learning curve, and the medium-sized projects about US$ 100 mill today may change to larger ones about US$ several 100s mill in short.

Summary

The viewpoints from a design and project management consultant’s side are very valuable to get a complete picture of the construction management in the building industry in Japan, and they add perfectly to the other visits. Again to complain that the minutes may be rather unstructured, but the understanding as a whole is hopefully integrated.

Musashi Institute of Technology, Department of Architecture

The visit took place on June 4th, 1999. The venue was of practical reasons in the neighbourhood of the previous visit in the Shinjuku area, namely at the Tokyo Metropolitan Government Building, a visitor's area in the 50th floor.

Participants

EGUCHI, Tadashi, Dr.	Professor, Faculty of Engineering, Department of Architecture

Agenda

14:00-17:00	Cost calculation and procurement methods in Japan and Norway, state of the art and current changes, *T. Eguchi, O. Sjoholt*

Minutes

The institute is located in the outskirts of Tokyo. The Department of Architecture is by tradition rather active in the management field in addition to the more traditional architectural themes.

Cost calculations and procurement methods is a wide area, and the two discussion partners had already for a year or two exchanged papers and viewpoints by e-mail correspondence.

The procurement methods in Japan have tended over decades to establish mostly in-house cost calculation methods in companies with little transparency for their clients. This gives the owners small possibilities to analyse by themselves alternatives and cost consequences. Even the lifecycle considerations before investing in new facilities are difficult to perform completely. The words *increased transparency* has been much used for a long time, and is connected to the establishing of more transparent procurement methods.

To simplify this complicated topic one might illustrate this by saying as a minimum to have design and management specified separately in contracts. In general it means to use of *cost on* in all cost calculations as a principle. Unit rates in Priced bill of quantities could be based on cost rates rather than price rates, the latter including overhead and profit. The hypothesis is that this in general will give opportunities for increasing the total project efficiency.

Procurement methods and limited cost transparency have deep roots in the construction industry and changes will come along only slowly. Owners may be the mains changing drivers.

Summary

The viewpoints on cost analyses in building and construction concern a dimension, which supplement the other visits. Some papers have been handed over, giving more background.

Ministry of Construction, Economic Affairs Bureau

The visit took place on June 7th, 1999.

Participants

MISAWA, Makoto	Deputy Director-General for Construction Industry Affairs
MURANO, Kiofumi	Director, Construction Market Access Division

Agenda

10:45-11:45	Mission of the visit in Japan and current governmental relationships in Norway, *O. Sjoholt* State of the art and changes influenced by Ministry of Construction, *M. Misawa, K. Murano* – Plan and Building Act, process for application and handling of Building Permit – Public building and construction work, procurement methods

Minutes

Norwegian Building Research Institute and relationship to Government

The institute is an independent foundation, which about twenty years ago was partly governmental financed. Today the government assigns the institute for performing specific as projects. For the time being the Plan and Building Act of 1997 is a specific topic, where the institute plays a major role in establishing new procedures in the municipalities and the industry and even to evaluate the effects of the change. During the meeting a detailed flow chart of the new building permit application and approval process was handed over (regrettably only in Norwegian). Some foils were shown on a "System Model" applied for the municipals' handling procedures of building permit applications. Further more was shown how the Internet is used for a web site containing all information and forms from municipalities regarding the building permit process.

State of the art and changes influenced by Ministry of Construction

Plan and Building Act, process for application and handling of Building Permit

A new Plan and Building Act of 1999 introduces two ways for design. One is the traditional way based on a set of minimum physical requirements. The other is opening up for increasingly use of performance requirements, leading to solutions of "any kind" as long as it is above the base level.

Foreign governments like US are happy with the change to performance requirements, e.g. it gives the timber industry and builders an easier opening to the market.

Another change that affects the process is a beginning of outsourcing of local government activities. The approval must still be inside the government, but some paperwork will be outlet to licensed actors. The construction industry signals that this is welcomed and that they are ready.

Payment of consultants is preliminary given in case by case after negotiations, and bidding for the lowest price is not yet seen as a target.

Public building and construction work, procurement methods

The use of Design & Build procurement is only allowed for the public if specific technology is said to be necessary.

The objective for the public sector is to have an open and competitive procurement, which comes first. Competitions based on a client brief are not a reality yet, but future development might create necessary knowledge.

The use of PM/CM in public sector is a big issue. The public has excellent engineers, and they may in many cases range over those of contractors. Regarding private owners they may have less in-house expertise, and can gain more in using PM/CM.

Another obstacle for introducing PM/CM is the fact that contractors never specify the costs for management, and the necessary fee is a sort of hidden. So the owners are not very eager to hire management consultants for a service which they have experienced as free.

It is foreseen that the owners increasingly will request more transparent cost structure from contractors. This might in second hand give the information needed for assessing a more extended use of PM/CM. The final decision for any public or private owner is dependent on a change of the attitude to not be willing to pay for a PM/CM service.

Summary

This short visit was very important as being the only one giving information and viewpoint from the governmental side.

Takenaka Corporation, Osaka

The visit took place on June 8th, 1999.

Participants

From Main Office in Osaka

HIRAO, Shunichi	Representative Director, Executive Vice President
WATANABE, Haruo	Executive Secretary
NOMURA, Mitsuru	Architect, Deputy Senior Manager, Building Design Division
HAYASHI,	Building Design Division
ICHIKAWA, Hikofumi	Manager, Business Promotion Section, Business Promotion Department
TSUKIYAMA, Masami	Business Promotion Department

From Osaka International Convention Center (site visit)

YAMAGUCHI, Tadashi	Site Manager
HAMADA, Mikio	Senior Manager, General Affairs
FUJINAGA, Hiroshi	Manager, Planning

Agenda

09:00-10:00	Building design department, presentation, *M. Nomura* Office tour, demonstration of visual presentation methods for clients
10:15-11:45	Site visit at Osaka International Convention Center – Project presentation, *T. Yamaguchi* – Site tour, *H. Fujinaga*
12:45-17:30	Round trip by car for excursion two specific studies, *S. Hirao, H. Watanabe, H. Ichikawa, M. Tsukiyama* – Akashi Bridge – Nojima Fault Preservation Museum

Minutes

This visit should be seen in connection with the visit also to Takenaka on May 31st.

Building design department

The capable in-house design staff and a large total capacity are one basic factor for the success of Takenaka's business in our days. The number of first class licensed architects exceeds 3000 persons. It is said that some people call Takenaka a design firm with a construction department. The design department is grouped in offices and teams, dealing with e.g. housing, healthcare facilities, facilities planning and management, thermal storage, nuclear and thermal power, LNG facilities, seismic isolation – and construction management as well as information engineering.

The Japanese construction society has a culture where it is a habit to devote prizes for excellent deliveries. It is important to get prizes to show competence. Takenaka names a number of prizes that they have won, also in competition with specialist design offices as well with the other large contractors.

Office tour, demonstration of visual presentation methods for clients

The presentation of a building during the sketching and design to clients is based on a number of methods, chosen to fit the client's preferences. A manual artistic sketch may be the first one. A comprehensive CAD programme is developed, allowing for a stepwise increased detailing of the plans. Complicated presentations may be elaborated in 1-10 days. The client may during presentations have changed viewing angles, colours etc.

A specific showroom is used for presenting around 10 slides in parallel, giving the observer a three-dimensional view from any position within the designed building. The feeling by observing is like being in the building in full scale.

Site visit at Osaka International Convention Center

Project presentation

Osaka Prefecture is the owner, creating a convention and exhibition hall. Total floor area is about 67.000 m^2 with a main convention hall counting at maximum about 2700 seats. The floor plans are flexible to fit different purposes and can admit different events at the same time. In this case the facade designed by the architect indicates large space girders, which are not necessary of structural reasons. A similar comment goes on a large half-moonlike landmark, which cover the much smaller antenna on the roof.

Construction period is from November 1996 to December 1999. Takenaka is a main contractor in a JV.

Takenaka happened to own a neighbour building, and could use two floors for site office and workers facilities as the tenant had moved out. A presentation of the building and construction methods was given at the site office.

Site tour

The concrete as material is purchased by the Main Office. The labour force is employed separately by a subcontractor. As for steelwork and piling Takenaka as well buys the material separate. Mechanical works includes material delivery. The site manager directs the labour force. Altogether there is about 100 subcontractors, each having their own bosses. In total there were about 1100 workers on the site.

A detailed hoisting plan is scheduled on PC based on daily plans delivered from each subcontractor. The subcontractors don't normally have PC's, so the contractor has to transfer hand-written input to their internal systems.

Material is delivered on the ground floor and brought up to the respective floor shortly after delivery. Thereafter each subcontractor takes responsibility for further transport.

The tour included demonstration of the waste management and sorting in different fractions in buckets, containers etc. on the ground floor. Large explaining signs were hanging above each fraction.

Round trip by car for excursion two specific studies

Akashi Bridge

This bridge opened in 1998 constitutes a major part of one of three connection routes between the main Japanese isle Honshu and a southern one named Shikoku. The Akashi Kaikyo Bridge starts just south of Kobe, and can be seen far away as a rather impressive construction. The total length of this suspension bridge is 3910 meter with a main span of 1990 meter, being currently the longest suspension span in the world. Not to refer here the advanced technologies

applied – just mentioning a high strength wire used for the two main suspension cables. The cables being 1,1 meter in diameter consist of 290 strands, each composed out of 127 yarns, all of which have a diameter of 5,23 mm. The excursion was completed by a visit to an exposure site at the south end of the bridge. A model of a cross section of the main cable in scale 1:1 was a very instructive way of demonstrating the construction to the public.

Nojima Fault Preservation Museum

The great Hanshin-Awaji Earthquake on 17th January 1995 struck the areas of Kobe, Osaka and Awaji Island. This experience reminds everybody about the nature's forces, which has to be taken into account by all building and civil engineering construction, in exposed areas like Japan. The previous visits in research laboratories at Takenaka and Shimizu had given broad lessons about new technologies e.g. with damping measures to avoid or reduce damages from earthquakes. This memorial park visit was an important one demonstrating the nature and consequences of the specific fault in 1995. After political considerations it was decided to preserve a small area on the Awaji Island where the fault effect could be visible as a great educational tool for the coming generations. Groups of people seemed to arrive all the day, and they were nearly crowding through a hall built over the exposure landscape. Photos, maps, explanations were supplemented with a 140-meter fault preservation zone including a cross section of a trench being moved horizontally and vertically. Even a private partly cracked house is being preserved as it was just after the fault.

Summary

The visit to the design office was the only one during my stay in Japan, and gave a short glance of approaches towards clients. The site visit added to the Shimizu one and underlined some Japanese traditions and gave additional viewpoints. The bridge view gave an example of outstanding Japanese civil engineering. The fault demonstration was maybe the visit giving most new reflections. My previous understanding of earthquakes in general was restricted to reading and TV reports.

Kyoto University, School of Architecture, Department of Architecture and Architectural Systems

The visit took place on June 11th, 1999.

Participants

FURUSAKA, Shuzo, Dr.	Associate Professor, Construction System and Management
TSAI, Tsung Chieh	Doctor Student, Risk management

Agenda

10:00-12:00	R&D on Construction Management, overview of reports from the department, *S. Furusaka* Specific projects: – Client satisfaction on building construction projects in Japan – International Comparison of Procurement and Management of Construction Projects, ICPM Research programme – AIJ workgroup on Systematic in Programming Stage
12:00-14:00	Risk management as a doctor study, *T-C Tsai* Installation and demonstration of two CD-ROMs from Norwegian Building Research Institute (in Norwegian) – Knowledge database – Byggforsk System Model, a pack of examples on Factory delivered wooden houses

Minutes

R&D on Construction Management, overview of reports from the department

The Department of Architecture and Architectural Systems investigate and teach about innovative methodology for synthetic study of architecture. Seven professors have each a defined research field. The actual field and department for this visit is *Construction Systems and Management.* The staff is one professor, one associate professor, one lecturer and one research associate. The department is active not only in Japan (e.g. AIJ committees) but also in international forums, e.g. CIB arrangements.

Specific projects and reports:

Client satisfaction on building construction projects in Japan (1999)

This study is a part of a strategic study performed for the Japan Institute of Architects (JIA). Most distinctly complaint from clients was the missing of cost and time plans from architects, ranging much below the information given from the design & build contractors. It is in general recommended to architectural practices to consider building up a management orientation as an additional or separate knowledge and service.

Sub-package problems of Building Contractors (1990)

The scope of work for trade contractors is free to choose in Japan, as there are no labour organisations to intervene. That means that any combination is possible, only labour force or including more or less materials, shop-drawings, design, maintenance etc. The management and the responsibility and guarantee has to vary accordingly in a contract. One discussion goes about what is the optimum for the general contractor in a project, and how can this be assessed and decisions taken. This discussion is closely related to the principle of “Exclusive subcontractors”, which work for many years exclusively or mainly for one general contractor.

Process Model of Design and Construction Activities of a Building (1999)
The discussion is based on the judgement that the *management* of the whole process of building in the era of information technology seems to be deficient. Most studies of processes do not cover the whole process. Architectural Institute of Japan deals only with architectural design processes. Engineering is regarded as accessories, and the design and estimates of time and cost are not integrated or optimised. To overcome these problems research is done, resulting in a new process model structured for concurrent engineering. The next step is to develop a corresponding computer system.

International Comparison of Procurement and Management of Construction Projects, ICPM Research programme
This programme aims at increasing efficiency in Asian projects where US/European companies are participating. The focus is first to clarify properties about project performance and management in Japan. Second is to integrate foreign system into the Japanese approach. Third is to propose a management system suitable for international projects. A research team consists of 15 persons from Japanese companies and universities. A core team includes nine representatives from universities in Japan, UK, France and Canada. A number of large projects will be investigated and analysed in each country according to a common format. The programme will be terminated in March of 2001.

AIJ workgroup on Systematic in Programming Stage
Development of programming seems to build on performance requirements. An AIJ research team consists of people from companies, e.g. Nihon Sekkei.

Risk management as a doctor study

A doctor study is under way, and a report was given to the 3rd International Conference on Concurrent Engineering in Construction, the CEC'99 conference August 1999 in Helsinki, Finland. As a consequence of my visit at Kyoto University an introduction was also given for the Doctor student to the Norwegian University of Science and Technology in Trondheim, Norway. He paid a visit there as well as to the Norwegian Building Research Institute in Oslo, Norway in August 1999. The exchange of information was valuable, amongst other regarding the following two Norwegian products.

Installation and demonstration of two CD-ROMs from Norwegian Building Research Institute (in Norwegian)

Knowledge database

The institute has published a system of Building Design Sheets for 40 years. Each sheet contains 2-8 pages about architectural planning, building details and building management and maintenance. The format is like a cookbook for directly implementation in projects. Currently updating includes the latest results from research and technology. The new IT technology has resulted in a CD-ROM version, which has increased the efficiency incredible. The Plan and Building Act and the Norwegian Building Regulations are included, and cross-references are given for easy information retrieval. Further development of the IT system is under planning, as this pack has a standing which in reality means a monopoly for building and construction information in Norway. The current CD-ROMs were handed over and installed for free demonstration (only in Norwegian).

Byggforsk System Model, a pack of examples on Factory delivered wooden houses

The institute ("Byggforsk") has since 1988 provided a data based system model for management of companies and building and construction projects. The real feature is a two-dimensional structuring of the management task (a matrix). Columns are structured according

to the building process (10) and rows contain generic management elements (10). This concept was in 1998 supplemented by a new computerised shell for administration of the system content in a database, *Byggforsk System Model.* Each trade may have their own pack of examples, integrating procedures and forms for management of quality, environment and occupational safety. A current CD-ROM with examples for factory delivered wooden houses was handed over and installed for free demonstration (only in Norwegian). The Department has reported that the program is in use for students already, and a connection is established between the institutions to discuss further customising and development.

Summary

The topics covered in the discussions were mainly just in the core of the study, and of great value. A number of papers were also handed over. In addition a complete book with all papers from the department up to May 1999 was received during the visit in August 1999 in Oslo. Even though the main part of the volume out of 390 pages is written in Japanese the book contains 9 papers in English.

5. Study results and conclusions

Reliability and confidence of the study results and conclusions

The main sources for the study are personal discussions and excursions in Japan as well as written material studied before and after the visit. It is evident that the very short study just reflects a limited number of aspects. The conclusions may in general be based on too little understanding of the totality. Further more it is clear that many of the conclusions are more or less subjective. This is mainly due to the eyes seeing and to the ears listening. And as long as the informants' represent different sectors and have different functions the information given will also reflect viewpoints that in this respect might be seen as partly subjective.

The structure of this chapter is partly based on the previous subchapter *Preparation of discussion topics and questions on Japanese methods or concepts of construction management practice.* The prepared questions were not used particularly in any of the visits, but some of the hosts had prepared answers on some specific topics. The discussions in many ways brought up new topics, and changed some of the focuses I had in forehand.

This chapter is written with rather few references to specific visits and documentation. This makes it easier to combine information from different sources. The weakness is the possibility to check the reliability, but as explained this chapter has to be seen as a subjective summary and not a research report anyhow.

The construction sector faces great changes

The civil engineering sector in Japan is much larger and maintenance much smaller than in US and Europe

The total volume of *Construction industry* in Japan is of the **same magnitude** as of USA in total or as of the sum of 15 countries in Europe (1997). The *new building sector's* part of the total is also of the same magnitude in the three areas. But the Japanese *civil engineering sector* is by far much larger and the *maintenance sector* is much smaller than in USA and the European countries. It might be foreseen a growth in maintenance.

The construction market in Japan has been rather domestic dominated, but some change has started. The opening up for overseas companies increases and speeds up introduction and customisation of Western management concepts to Japan.

The pressure in the national economy causes extensive changes in the construction sector

The ongoing *changes in the construction industry* in Japan was characterised by one company as follows

- Shrinking market, lower growth rate
- Bankruptcy of listed contractors
- Entry from companies from other fields (steel, engineering)
- CM (Construction Management) services is a little bit started to be provided for by design and consulting firms
- Self perform construction works is started by real estate firms and developers

– Internationalisation of the market, foreign firms register in Japan. Influence of World Trade Organisation.

The five large general contractors play a dominating role

The *large five* in Japan constitutes the basic of the knowledge and competence in the construction industry. Included is a net of suppliers and other infrastructure being tight connected to their respective general contractor. This peculiar Japanese situation gives a great power to those companies. Their business concept is in large based on direct negotiated contracts with the owners, mainly for Design & Build. Mastering construction management is a must, and those companies have during decades developed and improved their organisations and management concepts. On the other hand, as the basic structure is a net of "related" companies, any change of concepts to more transparency and open competition has to take some time. Changes in the industry are partly driven by the big five. Some of the next 50-100 largest is actively changing, while the mass of the small companies is rather conservative.

The number of labourers has been steadily increasing – despite of the reduced construction investment

The *construction investment* has been stable 1990-96, thereafter came a fall. The public part has increased, while the private investment has decreased. The number of *registered contractors* has increased in total. But there has been a substantial change in the structure, as the number of small companies has decreased and the medium-sized have increased. The *workforce* has increased steadily since 1987, as much as near 30% up to 1997, but I don't really know the explanation.

Workers employment conditions

The visit did not give deep insight in construction labour. It was said that recruitment is hampered e.g. because of dirty work and no IT use in work. Workdays on one specific site were six days a week. Workers without feasible work on the site on Saturday used to do some paid work elsewhere to keep the income reasonable. The workforce has no active labour union or common organisation. The involvement of workers in site planning is based on intensive *information, instructions and warnings* through meetings.

Research on construction management

The large five contractors' research is unique in world comparison

The large five invest about 1% of revenue in R&D, double as much as the average in the construction industry in total. R&D Institutes in each of the companies employ 2-400 people, and as many as 20 % holds a Doctoral Degree. All R&D for practical purposes is mainly done in-house by larger companies. The research topics cover a wide range of areas, basically of technical nature. The facilities of the laboratories are comprehensive, and the equipment in many areas is at the leading edge. A great number of advanced technologies being realised in projects as well as being under exploitation.

Pure *management methodologies* are also included, but in a smaller scale. One organisation chart names the following teams: *Construction Engineering group*; Quality Assurance, Construction Information Technology, Building Materials, Construction Technology, *Information technology group:* System Engineering, Network Technology, Multimedia Technology. The topics include construction management tools for CAD, Construction Planning, Scheduling, Network Aided Construction and supports for Intra & Extranet.

Research and development of technologies is performed by the large contractors and results are exposed in building projects

The laboratory and site visits gave outstanding examples on advanced R&D results being transformed into practice. One specific area is technologies to avoid or reduce damages from earthquakes, e.g. with damping measures. Construction methods are developed according to industrial fabricated principles, particularly for large projects.

National institutes support the R&D basic and infrastructure

Some national institutes or organisations focus mainly on common national tasks. Examples are international harmonization of technologies, systems, codes and standards and introduction of new building technology to society. An increasing topic is evaluation services, like Technical Appraisal, Building Confirmation and Inspection, Approval of Prefabricated Housing and ISO System Assessment. Core management topics are little dealt with. The size of the national institutes is much below the contractors' R&D staff.

Universities do basic research on construction management – but with little direct involvement in individual contractors

R&D on construction management have achieved a firm position within universities. In Japan the connection is mostly to *architectural* faculties or departments. The research seems to be performed by technicians, even though leadership and management are a partly humanistic topic.

Universities decide on their own topics. They seem not to perform studies for individual contractors, which is done in many other countries, giving the researchers rather practical experience. The main contact is by active participation or leading roles within associations' research teams. Current challenges for the Japanese construction industry is often chosen as research topics. A few examples of academic approach are seen, involving mathematics. There exist several sorts of funding sources, but I haven't got an overview.

Researchers within *construction management* are still a small group of people in Japan, and much exchange of information is related to personal knowledge. International contact is extensive, e.g. through CIB. The communication is much focused within the Pacific Rim. A number of students come from other Asian countries.

Associations play a major role in exchange and development of new knowledge and creating consensus

There is none or little R&D in direct co-operation between companies and universities. The main organised contact is within associations, e.g. Japan Society of Civil Engineers (JSCE) and Architectural Institute of Japan (AIJ). The latter has a group for *Organisation and Management of Building Construction*. A great number of papers are presented in symposiums, and the proceedings altogether give a very good outline of what is going on in this area in Japan. It is a great loss that the majority of papers are only in Japanese. Research committees function as discussion forum with informal exchange of information between the participants on a personal basis. This seems like formalising an informal process, where some key persons offer and exchange knowledge, which would not have been published otherwise. These organisations have a sort of neutral standing, and do in general represent business interests. Similar organisations in other countries focus less or little on management, in my knowledge.

Procurement methods and organisation of building projects

Ministry of Construction signals changes to more total competitive procurement for cost reductions

Changes and improvements in the public are ongoing, even a little slow. Big cities are main drivers in changes. Governmental contracts have up to now for 95 % been based on traditional common specifications and minimum physical requirements. Detailed specifications are given for each project.

A new Plan and Building Act of 1999 is opening up for use of performance requirements, leading to solutions of "any kind" as long as it is above the base level. This gives as well overseas companies an easier opening to the Japanese market.

The objective for the public sector is to have an open and competitive procurement, which comes first. Today the traditional design-bid-build is dominant. Building projects of some size are often split into two or more contracts, e.g. allowing for Technical Engineering as a separate one.

From 1995 onwards a cost fee contract and design build has been introduced. The use of Design & Build procurement is only allowed for the public if specific technology is said to be necessary. Design & Build is a safe way for the owner's employee clerks. They don't want to contact many persons, and don't normally even have in-house staff with capability for construction management. Large contractors are flexible and may offer both Design and Build or only Build.

A study group of 1997 is focusing on use of value engineering and lump sum contracts. Competitions based on a client brief are not a reality yet, but future development might create necessary knowledge.

Advance payment is given in government projects from 30-40 % within two weeks. This seems not to be under discussion at the moment. This payment may be a substantial part of financing a company.

Public owners are reducing own costs by ways that also change the construction business

Another change that affects the process is a beginning of outsourcing of local government activities. This is a consequence of the decrease of the number of public clients' employees to obtain a smaller government administration. The government reform will reduce the capacity to perform in-house design, which instead will be contracted to private companies. The approval must still be inside the government, but some paperwork will be outlet to licensed actors. In total the role of the public client will change from being the owners architect to do management of the construction project.

I did not track information about how authorities' are developing IT-techniques for handling of the applications for building permit, e.g. use of Internet.

Lack of transparency in construction projects is a frequent comment, and cost specification is increasingly required

The need for cost reductions in all industries including construction leads to new approaches. To establish fair bidding environment is seen as one element. In general the increase of transparency of costs are bespoken as an important objective.

The procurement methods with just total prices based on in-house cost calculation in contracting companies gives the owners small possibilities to analyse by themselves alternatives, lifecycle considerations and cost consequences.

As clients want to be more cost effective they ask for increased cost transparency in procurement and are e.g. splitting project contracts for general contractor, steel and having design and management specified separately in contracts etc. Unit rates in Priced bill of quantities might be based on cost rates rather than price rates, the latter including overhead and profit.

The public owner to establish ceiling prices in public projects before the bidding uses a handbook for standard or average prices. The ceiling price was untill recently *not published*. This lack of transparency is under change.

Public owners are often looked at as fearful, and their representatives are treated in the best way in any situation. The owner's inspection on sites does normally not give any feed back directly, and *the results are secret*.

Procurement methods and limited cost transparency have deep roots in the construction industry and changes will come along only slowly. Owners must be the mains changing drivers.

Suppliers network around general contractors may be dramatically changed in the future

The principle of "Exclusive subcontractors" is widespread, as companies traditionally are working for many years exclusively or mainly for one general contractor – or indirectly as a "sub-sub" for one subcontractor.

But, today the Japanese economic depression has broken this relationships from reliability to cost-base relationship. Contractors select subcontractors by price competition not long-term relationship. Subcontractors may be anxious about a sudden bankrupt of a contractor. Their capability varies a lot, as the scope of work for trade contractors is free to combine in different ways. Some may provide only labour force and others may include materials, management, shop-drawings, design, maintenance etc. The larger companies are studying CM/PM as a mean to have direct contracts with the client, but are afraid of the reactions from the general contractors.

Accordingly, one of the strength of the Japanese industry, long-term relationship and pyramid structure with many sub-contractors has been broken gradually. The structure will be a self-independent industry with the acceptance of risk and benefit in her own.

Project management and construction management concepts and services are slightly increasing

There is a slight movement towards PM/CM, and the next 5-10 years may bring changes. Some examples on small or medium-sized projects are already under way. All projects have foreign owners, as BP of UK, Amway of US and the Singaporean Government. Even overseas CM/PM expertise is involved in the projects in co-operation with Japanese companies. The big five are watching the projects, particularly the contractors who traditionally have been working mostly for some of those clients.

One research programme analyses procurement and management in Japan and how to integrate foreign systems and how to modify for international projects. This might be seen as an indication of the interest for and influence from management of construction in Western countries.

The use of PM/CM in public sector is a big issue

As mentioned before there is a need for better transparency of costs, allowing for risk versus cost analysis. It is foreseen that also the public owners increasingly will request more transparent cost structure from contractors. This might in second hand give the information needed for assessing a more extended use of Project management/ Construction management (PM/CM). The use of PM/CM in public sector is a big issue. The public has excellent engineers, and they may in many cases range over those of contractors. Another obstacle for introducing PM/CM is the fact that contractors never specify the costs for management, and the necessary fee is a sort of hidden. So the owners are not very eager to hire management consultants for a service which they have experienced as free. The final decision for any public or private owner is dependent on a change of the attitude to be willing to pay for a PM/CM service.

Low and insufficient design fee for public building and construction leads to free assistance/ service from contractors

A governmental owner must be responsible for cost estimation and design. He may hire help. The norm for design fee is sometimes not enough. A designated consultant may again ask for help to fulfil his task, e.g. from a contractor, who may assist for a very low (sometimes zero) financial compensation. During bidding the assisting contractor knows the project best, and may be able to give the best bid. The competitors also know who has been involved in design, and it may affect their interest in the bid.

The low design fees might be seen in connection with the Design & Build services from contractors, where the design and management is not invoiced as a separate sum, and might by some clients be looked at as free service.

As a parallel can be mentioned that the Japanese contractors don't use any consultants for development of their internal management, they claim to have no need and don't want to pay for such expertise.

Procurement elements affecting contractors' mutual ties

As officials haven't been allowed to specify a technology that only one company can apply a series of technology associations have been established. The first company teaches some members, but might still be the only one able to perform the work.

Public owners know that they must give something to all contractors to survive. That leads to small size construction projects or requirements to establish Joint Venture.

The attitude of always success and no excuse

The traditional culture in the industry is that no projects must be known to be unsuccessfully and there is no room for criticism. A construction project is foreseen to keep up with schedule and budget, and a project behind schedule is very rare in Japan. It is said that during at least the last construction boom the contract prize would allow for reasonable changes for free during the process to please the owner. Regarding time schedule the use of overtime work might often be considerable to keep the delivery target.

The focus on success is also promoted within the Japanese construction society. There are a number of different prizes for excellent deliveries. It is important to get prizes to show competence. Companies use the prizes that they have won as an element in marketing future services.

Owners' and clients' needs and requirements

Systematic functional requirement analyses is still a missing link

The systematic registration and analysis of the needs and requirements of the owners, clients, customers and users seems not to be under research at the time being. This was in some way disappointing, as it was one topic expected to be focused on in Japan. The development approach is said to build on performance requirements. A specific Research group is established by AIJ, with members from organisations and companies.

The large contractors are communicating with their clients by extensive visual aids, which are ranging from manual artistic sketches to comprehensive CAD presentations and three-dimensional slides giving full-scale image.

Apparently the clients are satisfied with the visual approaches and are not missing the functional analysis. But a study of clients' satisfaction about the design services summarises complaints for missing cost budgets and time schedules from architects. Information given from the design & build contractors was assessed as more satisfactory. To compete better, architectural practices should improve the management knowledge and service.

Design work

Integrated IT systems for design is in extensive practical use

The large companies are investing in in-house applicable systems for integrated design and construction. One company reports a five-year development and testing period, ending up with a rather extensive system. The clue is the gradually processing of all information from the very first planning in an increased accuracy and depth of project information up to the final working drawings. Scaffolding planning and quantity take off is included. Further visions were not discussed, but should obviously embrace total cost control and logistics.

General research is done on a new process model structured for concurrent engineering, which in short will be developed with a corresponding computer system.

Shop drawings are made by contractors on site – a key to successful large projects

As many as about 80 architects and engineers employed by the contractor did the design including shop drawings on the large sites visited. The co-ordination between drawings and production schedules seemed rational and necessary.

Construction work on site

Large general contractors have management systems and competence to handle a great number of subcontractors

The sites visited were really large with respectively 1100 and 1400 workers at work, and about 100 subcontractors. The procurement was partly based on firms having a long-term relationship, e.g. providing labour force in a flexible way. Other firms had competed to be chosen, like some subcontractors providing both material and work.

The site manager and his staff direct all the labour force. The largest part of the staff is occupied with shop drawings. A group of about 10 people' deals with Quality assurance activities and some others care for logistics. Even the staff has nearly a six days week, as they only have a free Saturday every forth.

Attending a safety meeting for 1400 workers in one room is quite an event

The large companies have a set of site meetings as a standard. One type of meeting is a safety meeting for all workers in the beginning of each month. At one site one could observe all the 1400 workers together attending a one-hour meeting getting information of the production and of safety measures.

Waste management is based on sorting at site for recycling

The waste management on site was based on minimum spillage and a controlled return system with sorting at sources. A number of posters explained and instructed how to handle different sorts of materials. Some exposures showed by specimen how certain materials might be recycled into marketable products.

The labourers had their own space for washing and dressing, and they had taken the responsibility to clean and tidy up the whole area them selves. The result was remarkable good.

Management systems embraces Quality, Cost, Delivery, Safety and Environment - QCDSE

The large contractors have developed the company-wide quality control concept (TQC) since more than 20 years. The current concept for quality management includes social environment factors as a part of a totality, QCDSE. Even if the concept focuses on integration it was not demonstrated any systems and tools taking care of the totality – like the integrated IT system for design. It is said that customer satisfaction and contribution to society are main drivers for the QCDSE.

Certificates according to ISO 9001 have passed 100 in number, and certificates according to ISO 14001 are approaching 50. Like in other countries, some companies complain that a certificate does not give benefits in marketing and it has additional costs. Others claim that there are internal benefits.

Contacts to institutes and public owners indicated that the interest for ISO standards related to construction management might be growing, but that the knowledge about the content is not common widespread to day. Japan seems interested in following further international co-operation regarding the ISO construction management relevant topics.

A site PC system is used for subcontractors' plotting of daily schedule

An extremely interesting observation was the daily planning meeting for all foremen on a large site. All 100 foremen met for 30 minute to report and plan for the following day. This was possible because of a planning system connected to a database. Each foreman had just before the meeting plotted on a PC his workers progress of the current day and the plan for the next day. A number of PC's were installed in the meeting room, and the foremen were queuing for their turn to plot. The site manager led the meeting and showed successively the individual plans on a screen. Any comments came at once, concise and shortly – and led promptly to decisions.

Another tool for planning was demonstrated as a 4D-CAD System for Project Scheduling. A combination of CAD and a schedule system (e.g. like Microsoft Project) allows showing the construction process for structural parts from day to day. This can be used to prepare the optimum work progress preventing safety risks. Changes in work routing for a certain day can be made on the CAD drawing and the schedule will be changed accordingly.

Logistics of materials is detailed managed internally on each site

Logistics and transports on the large sites were organised by means of PC's by a special group of people. Every day before 10:00 the next day's delivery had to be noticed by a hand-written format from each subcontractor. The plans were co-ordinated to one materials reception and storing plan. The same procedure applied for establishing the next day's detailed plan for use of the hoisting equipment. Material is delivered on the ground floor and brought up to the respective floor shortly after delivery. Thereafter each subcontractor takes responsibility for further transport. The logistics is by evidence a crucial factor for a rational production. It seems established a good practice.

A new total logistic management data-based concept is developed and introduced

One large contractor have developed and tested a logistics co-ordination electronic communication programme. The clue is a common *Project Information Sharing Server* with logistics data open for all actors, suppliers and carriers in a project. The primarily goal is to minimise the external transports to and from a site, to reduce construction waste and to shorten the construction period. One basic idea is a better co-ordination of truck transport, to allow for one common carrier/vehicle to fetch from different factories and/or to deliver to different sites. The system elements are:

- *Physical supply*: Pickup and delivery inventory, consolidation, multi-site delivery
- *Receiving & shipping:* vertical and horizontal transfer
- *Remove:* reverse logistics, recycle/construction waste.

The sharing server allows for adjusting the weekly schedule within minor adjustments of dates, thus obtaining an optimum collection and delivery of goods. The communication is based on use of barcodes and an EDI interface with the supplier, manufacturer, retailer and carrier. The trucks have installed a satellite navigation system for easier control. This concept and the management tool might have a potential for international transfer.

Relevance in Japan of Norwegian management research

Knowledge database on CD-ROMs from Norwegian Building Research Institute (in Norwegian)

Demonstration of a Norwegian knowledge system clarified the benefit of the generic system structure but for the content it was seen as limited to Nordic conditions. The institute is currently publishing a system of Building Design Sheets about 2-8 pages each covering architectural planning, building details and building management and maintenance. The format is like a cookbook for directly implementation in projects. The volume is accumulated through 40 years and is covering almost "everything".

Trade specific construction management system on CD-ROMs from Norwegian Building Research Institute (mainly in Norwegian)

Presentation of this generic data based system for management of companies and building and construction projects gained immediate interest. The features are:

- A two-dimensional structuring of the management task (as a matrix), covering the building process and generic management elements.
- A computerised shell for administration of the system content in a database, *Byggforsk System Model.*
- A number of pack of examples for different trades, integrating procedures and forms for management of quality, environment and occupational safety.
- A CD-ROM with examples for factory delivered wooden houses (only in Norwegian).

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Appendix. Programme for Mr. Odd Sjøholt

Date	Contact	Organisation	Address Postcode	E-mail Fax (F) Phone Web-sites
29th May Morning	Tokyo, Narita	Arrival		
29th May	Hotel Ibis		7-14-4-Roppongi Minato-ku TOKYO 106	info@ibis.co.jp +81 3 3479 0609 (F) +81 3 3403 4411
30th May		Roundtrip	TOKYO	
31st May Whole day	Executive Vice President Shunichi Hirao	Takenaka Research & Development Institute	5-1, 1-chome, Otsuka, Inzai-shi CHIBA 270-1395	 0476-47-3050 (F) 0476-47-1700
1st June Whole day	Dr. Matsumoto Dr. Naoto Mine	Institute of Technology, Shimizu Corporation	Etchujima 3-4-17 Koto-ku TOKYO 135-8530	mine@tech.shimz.co.jp +81 3 3820 5959 (F) +81 3 3820 5149 www.shimz.co.jp/english/
2nd June Whole day	Ass. Director Yoshinobu Hirano	Building Research Institute; Tokyo 1 Tatehara, Tsukuba-shi, IBARAKI 305-802	Mini Work-shop at IIBH, 30-Mori bldg., 3-2-2 Toranomon, Minato-ku, TOKYO 105-001	hirano@kenken.go.jp +81 298 64 6671 (F) +81 298 64 6616 www.goin.nasda.go.jp/
3rd June Whole day	Professor Dr. Masahiko Kunishima	University of Tokyo, Dept. of Civil Engineering	Hongo 7-3-1, Bunkyo-ku TOKYO 113-8656	kuni@ken-mgt.t.u-tokyo.ac.jp +81 3 3818 5692 (F) +81 3 3812 2111 http://civil-sv.civil.t.u-tokyo.ac.jp
4th June Morning	Managing Director Seiji Oi	Nihon Sekkei Corporation	29Fl. Shinnjuku I-LAND Tower 6-5-1, Nishi-shinjuku, Shinjuku-ku TOKYO 163-1329	oi-s@nihonsekkei.co.jp +81 3 5325 8688 (F) +81 3 5325 8601
4th June Afternoon	Professor Dr. Tadashi Eguchi	Dept. of Architecture, Musashi Inst. of Technology	1-28-1 Tamazutsumi, Seatagaya-ku TOKYO 158-0087	eguchi@ipc.musashi-tech.ac.jp eguchi-t@mx6.nisiq.net +81 3 5707 2192 (F)
5th June		Roundtrip	TOKYO	
6th June		Roundtrip	TOKYO	
7th June Morning	Deputy Director General Makoto Misawa	Ministry of Construction, Economic Affairs Bureau Construction Industry	2-1-3 Kasumigaseki, Chioda-ku TOKYO 100-8944	fwkb7869@mb.infoweb.ne.jp +81 3 5251 1927 (F) +81 3 3580 2837
7th june Evening	Hotel Nankai Namba, Osaka	Bullet train	1-17-11 Namba-naka, Naniwa-ku OSAKA 556-0011	+81 6 6632 5061 (F) +81 6 6649 1521
8th june Whole day	Mr Watanabe Mr Ichikawa	Takenaka Corporation Building Design Department	1-13, 4-chome, Hommachi Chuo-ku OSAKA 541-0053	hirao.shunichi@takenaka.co.jp +81 6 271 0398 (F) +81 6 252-1201 www.takenaka.co.jp/takenaka_e/
9th June		Roundtrip	OSAKA	
10th June	Mr Watanabe	Roundtrip	NARA	
11th June Morning	Dr. Shuzo Furusaka	Kyoto University, Dept. of Architecture and Architectural Systems	Yoshida-Honmachi Sakyo-ku KYOTO 606-8501	furusaka@archi.kyoto-u.ac.jp +81 75 753 5748 (F) +81 75 753 5738 www.kyoto-u.ac.jp
12th June	Mr Ichikawa	Roundtrip	KYOTO	
13th June Morning	Osaka, Kansai	Departure		