



EC 5th Framework

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PERFORMANCE BASED BUILDING THEMATIC NETWORK 2001-2005



LEGAL & PROCUREMENT PRACTICES

PeBBu Domain 6 Final Report

Performance Based Building Thematic Network
Funded by EU 5th Framework Research Programme
Managed by CIBdf



LEGAL & PROCUREMENT PRACTICES

PeBBu DOMAIN 6

FINAL DOMAIN REPORT

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October 2005

This work was performed as part of the tasks for the EU-funded Performance Based Building Network.

Performance Based Building Network (PeBBu) is a thematic network funded under the European Commission's (EU) 5th framework - Competitive and Sustainable Growth and has been operational from October 2001 till September 2005. This project has been managed by CIBdf, The Netherlands. The PeBBu Network has been facilitating in enhancing the existing performance based building research and activities by networking with the main European stakeholders and other international stakeholders. The network has also been producing synergistic results for dissemination and adaptation of performance based building and construction. More than 70 organisations worldwide have been participating in the PeBBu Network.



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FOREWORD

The PeBBu Network set out to stimulate and pro-actively facilitate the international dissemination and implementation of PBB - Performance Based Building in building and construction practice, and in this context: to maximize the contribution to this by the international R&D.

Domain 6: Building Process - Legal and procurement Practices had a special emphasis on:

legal issues as related to the definition of quality of buildings in performance criteria and the definitions of possible related liabilities depending national and international legal framework

review of related legal practices and procedures in support of collecting best practices and producing legal guidelines.

These emphasis produced many challenges; not least the differing jurisdictions and legal systems found in member nations. Domain 6 sought to overcome the challenges by a process of work involving:

- Four Domain workshops in Manchester (UK) July 2002, Sofia (Bulgaria), Manchester (UK) January 2004 and Porto (Portugal) November 2004.
- A systematic and rigorous literature review was one of the first tasks of this domain and the results were published in the first domain report.
- National case studies carried out by the members.
- A Delphi survey.

The highlight of the Domain's work was the Manchester meeting in 2004, which brought together the entire PeBBu Network; this meeting was coordinated by the Domain 6 researcher Tim Morse together with the CIBdf Secretariat. The synergy from all the PeBBu members was a dramatic tangible contribution.

As to a future perspective Domain 6 has been frustrated by the dearth [total lack] of empirical data. The benefits, incentives and triggers for PBB are well documented but in a journalistic manner. Thus, PBB need greater clarity and rigour. It is clear that PBB poses many challenges for legal and procurement practices in building and construction but because of the unstructured nature of the field [discipline] it is not clear how these can be approached [overcome]. The PeBBu Thematic Network has been an invaluable first step in approaching the challenges.

Acknowledgements are due to the members of Domain 6; the Researcher Timothy Morse and Dr Kim Haugbølle. The contribution of Michael O'Shea, Edward Davies and Katherine Sneddon at Masons [latterly PinsentMasons] was invaluable.



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EXECUTIVE SUMMARY

The received wisdoms about construction around the world are that the construction industries perform poorly when compared with other industries and sectors. These received wisdoms are most frequently expressed as:

Construction produces products which:

- Are expensive;
- Take longer than anticipated;
- Are not to the required technical standard.

Much of construction procurement theory and practice attempts to reconcile these 3 conflicting forces: cost; time and quality. Where any change to one variable inevitably affects the others e.g. simplistically a high quality building costs more and takes longer.

The definition of quality in terms of performance criteria raises problems for construction procurement, and legal issues. The establishment of pragmatic performance criteria is fraught with problems; and the legal framework may lay down liabilities in differing ways depending on whether the building is prescribed by result or by performance. In the UK for example the duty on a designer may vary between a duty of care (design only) and a duty of result to provide a building fit for the purpose intended (design and construct).

State of the Art

There is no current state of the art which could be applied across the European Union; rather a collection of national practices in the domain. The work in this domain was to review these practices and procedures to collect best practice, future work might produce guidelines.

Barriers

The main barriers for the further development of PBB are perceived to be the limitations placed on innovation and initiatives towards value. These require further continuing investigation.



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Introduction; Scope & Objectives; Frameworks



CHAPTER 1



1 INTRODUCTION; SCOPE & OBJECTIVES; FRAMEWORKS

1.1 Introduction

During the period 1998 - 2000, CIB the International Council for Research and Innovation in Building and Construction initiated and commissioned various international programmes and R&D projects related to Performance Based Building. Based on the achievements from those projects CIB proposed in 2000 the establishment of the Thematic Network PeBBu: Performance Based Building. This Network is to elaborate on the activities carried out by CIB, its commissions and its members since it adopted Performance Based Building as a Priority Theme in the CIB Pro-Active Approach in 1998. The European Commission decided to fund the PeBBu Network through a Network subsidy within the Growth Programme that is part of the 5th Framework Research Programme, with a start date of October 1, 2001 and run for 4-years until September 30, 2005.

This final domain report describes the work undertaken by Domain 6 which was concerned with Legal and Procurement Practices in Building and Construction. It is a revision of the first two Domain Report that were published in 2002 and 2004.

1.2 Objectives

1.2.1 Objectives for the PeBBu Programme

The following objectives of the PeBBu Network were set at the outset of the Programme:

Stimulation and pro-active facilitation of international dissemination and implementation of Performance Based Building in building and construction practice.

and in that context maximization of the contribution to this by the international R&D community, through:

Stimulation and facilitation of the international programming and coordination of research and implementation projects as concerns Performance Based Building as effectively as possible in order to make optimal use of limited available resources and to prevent unnecessary recurrences.

Stimulation of actual investments in such research and implementation projects.

Providing the EU Network Members with an optimal access to knowledge and experience as available in non-EU countries in which respective developments have progressed further than in the EU.

Coordinated dissemination and implementation of results of international research in the area of Performance Based Building.

1.2.2 Objectives specific for Domain 6 Legal and Procurement Practices in Building and Construction

1.2.2.1 Domain 6 Methodology statement

The Domain 6 objectives have been met through the use of various methods. A Domain website has been established to enable all members and observers to access the work and findings of the Domain. This has enabled the coordinated dissemination of what has been documented by the Domain. This has been important in avoiding unnecessary recurrences of work.

Domain 6 proposed to meet its objectives by the collection of national practices and procedures through national monographs. Guidelines for monograph production were produced and circulated. Domain 6 then intended to utilise a Delphi methodology. Delphi is a method of combining the judgements of knowledgeable individuals. It is relevant when there is no determinate answers (eg., hard data or well established theory) available, but some persons (often called experts) have relevant information about the topic of concern. It is especially pertinent in the common case of disagreement among experts. In effect it is a procedure for aggregating the information know to the panel. The resultant group judgement is obviously no better than the composite information within the group.

The method was formulated in the early 1950s at the Rand Corporation by Olaf Helmer and Norman C Dalkey. Since then it has been applied in hundreds of investigations around the world, dealing with topics as diverse as forecasting long-term technological developments, the health effects of various concentrations of atmospheric pollutants, or the reliability of components in nuclear reactors. The method has proved to be a practical and efficient way to obtain 'best estimate' in uncertain contexts.

In its simplest form, the method has three features:

Anonymity. Each member of the panel submits his own independent answer(s) to the relevant question(s) by questionnaire or computer query.

Controlled feedback and iteration. The results of a given round of responses are summarised and reported to the group, who are then asked to reassess their replies in light of the feedback.

Formal group judgement. Given the final set of individual answers, the group answer is expressed as a formal aggregation; e.g., if the questions involve numerical answers, the group judgement may be formulated as the mean, median, or other measure of central tendency.

Anonymity is a restriction to combat the biasing effects of group pressure, dominant individuals, and the like, and assures, with formal group judgement, that the answer of every individual in the group is taken into account in the final group judgement. Iteration with feedback allows a certain amount of interchange among the members of the group but in a controlled manner. Formal aggregation gives a well-defined group response.

Unfortunately the lack of responses to national monographs meant that the Delphi group was limited.

The Revised Domain 6 Aim and Objectives

The overall aim was to review the practice and procedure of PBB in the member countries as this relates to the domain Legal and Procurement Practices in those countries.

Within the overall aim the following measurable objectives were set:

1) To consider the drivers to PBB

The drivers to PBB will of course vary from country to country. In order to establish the drivers that have the greatest impact across the EU it is necessary to identify the drivers in each member state. To collate such data the Domain Monograph specifically targets this issue. The Monograph responses will enable the Domain to establish what the key drivers to change are. The Member Country reports also give an insight into the drivers for change in the countries that are represented in the Domain.

2) Report on limitations on innovation, the effect on Performance Based Building of value and tendering restrictions, and the effect of legal and national jurisdictions.

It was decided that a report should be produced using a Monograph format. The Monograph guidelines were drawn up and distributed to both Domain members and contacts within the industry that are known to the Domain leadership. Response to the requests for monographs was limited but responses, of various nature [some complete monographs and some summaries] were received from:

Belgium; United Kingdom; Denmark; Spain; Eire; Greece; Israel; Finland; Netherlands; Canada

3) To investigate how initiatives towards value, and tendering restrictions affect PBB:

- a) Value for Money (UK Government procurement)
- b) Best Value (England and Wales Local Government Act 1999)
- c) Most Economically Advantageous Tender (MEAT)
- d) Other national practices and procedures.

To investigate how the various initiatives towards value and the tendering restriction already in place are affecting PBB it was decided that Topic Papers would be produced to show the findings of the Domain in these areas. Topic Papers examining Value for Money, Best Value, and Most Economically Advantageous Tender were written and posted on the domain website again response from members was disappointing. The fourth part of this objective; *d) Other national practices and procedures* was covered by the responses to the Monograph.

4) To document the limitations placed on innovation by:

- i) Professional indemnity insurers
- ii) The particular insurance problem of a 'funding gap'
- iii) Tendering rules e.g. requirements to circulate Contractor's Change Proposals to all tenderers.
- iv) Consideration of the scope allowed to contractors to affect construction

These issues are addressed in the Domain Monograph and will be answered by the respondents from the various member states. This will enable the trends from each country to be examined individually.

5) To investigate how national and legal jurisdictions affect PBB (NB common and civil codes).

6) To produce a review of national practices and procedures.

Both these objectives are again covered by the Domain Monograph.

Conceptual Framework

Towards a conceptual framework for research planning and coordination

At the outset of the project a conceptual framework for planning and coordination was established. A conceptual framework allows the problem under consideration to be examined in both strategic and tactical terms. There have been no changes to this framework thus far in the project. Beyond a conceptual framework, research needs an analytical framework by which the individual research moves forward.

1.2.3 Conceptual Framework

One of the early deliverables of the Domain Legal and Procurement Practices in Building and Construction was a (conceptual) framework for research planning and coordination. Figure 1.

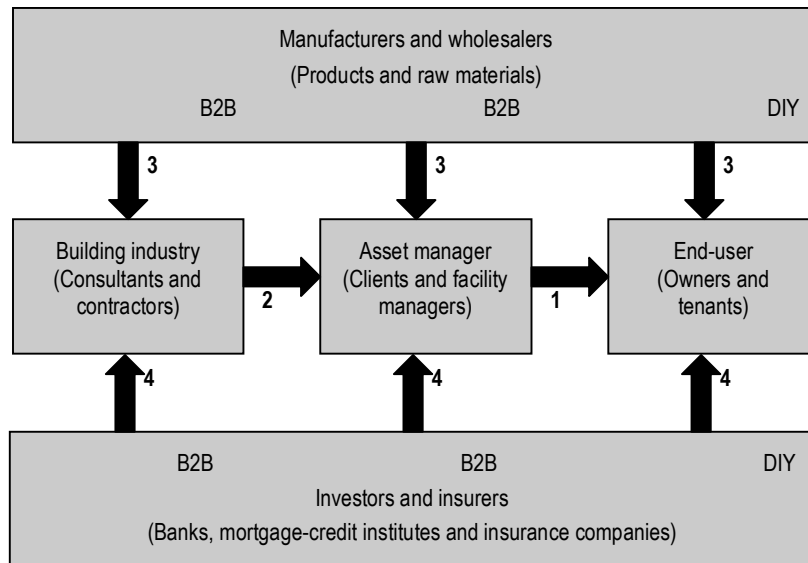


Figure 1. Conceptual Framework

Note: B2B = Business-to-Business (professional). DIY = Do-It-Yourself (non-professional).

The conceptual framework consists of the following points:

- an overview of the main issues;
- incentives for and barriers for future development;
- interrelationships within the scientific domain of performance based building and links between other related domains (namely Domain 7 Regulation and Domain 8 Innovation);
- recommendations for international prioritising of further research and for international collaboration in future research projects.

1.2.4 Analytical Framework

The analytical framework for the research is shown in Figure 2.

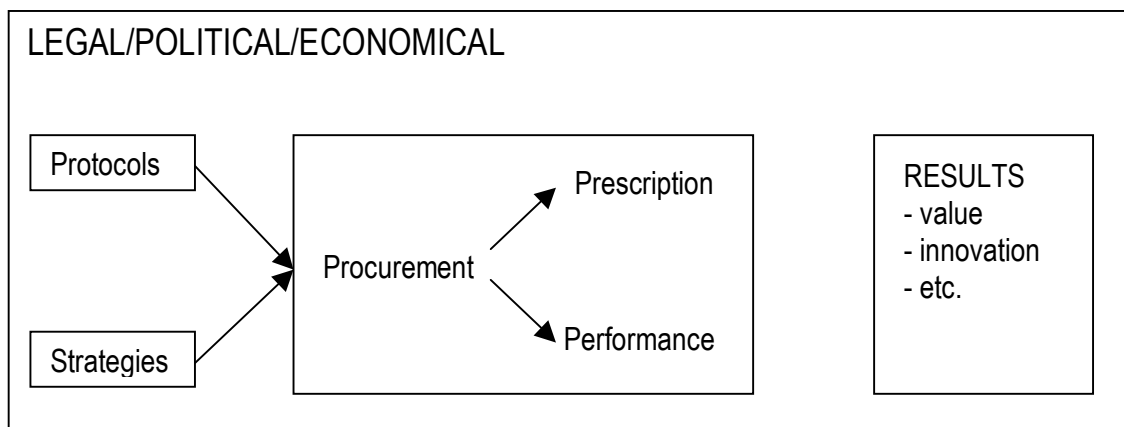


Figure 2: Legal/Political/Economic Framework

A further issue arises which is fundamental to the concept of PBB and was raised at the outset at the first Domain Workshop. This is concerning prescriptive versus performance specification. Inevitably at some point the two systems will coincide and the question becomes one of continuum rather than separation. The Danish member suggested a useful further analytical framework shown in Figure 3.

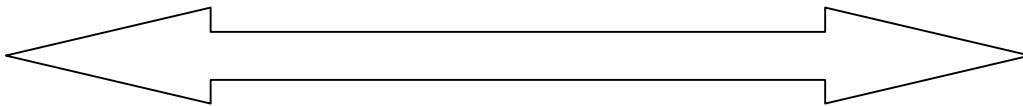
Prescription**Performance**

Figure 3 Performance vs. Prescription

It has been accepted that while a Prescriptive approach is not always best, neither is it proper to expect the Performance approach will always be best. It became clear from the various Domain meetings that part of any project evaluation is to establish if some elements would suit one approach more than the other; and therefore it would need to be discovered where a particular project, or element of a project, should be placed on the line between the two approaches.



Worldwide Inventory of PeBBu Related Research

CHAPTER 2

2 WORLDWIDE INVENTORY OF PBB RELATED RESEARCH

At the outset of the project a comprehensive and systematic literature review was carried out to determine what research was already being carried out on an international basis into PBB. This inventory was compiled and formed the basis for further work.

2.1 Literature Review: Performance Based Building/Construction

The search phrases used were
"Performance based building"
and
"performance based construction".

Databases searched:
British Library catalogue,
Web of Science,
American Society of Civil Engineers,
ABI Inform,
Expanded Academic Index,
Emerald,
General Business File,
Index to Theses,
International Civil Engineering Abstracts,
Technical Indexes,
Open.gov.uk,
Barbour Index (Project Management).

The results were:

CIB (1997) Final report of CIB Task Group 11 : performance based building codes. (CIB Report, publication 206) International Council for Building Research, Studies and Documentation; National Research Council of Canada, Institute for Research in Construction.

Coleman, G. (1998) Japanese fire safety engineering principles for performance – based building regulations. A novel approach. (Research Report no. 80) Great Britain Fire Research and Development Group

Hattis, D.B. & Becker, R. (2001) Comparison of the systems approach and the Nordic model and their melded application in the development of performance-based building codes and standards. **Journal of Testing and Evaluation. Vol 29** (4) July 2001. p.413 – 422

Abstract:The Systems Approach and the Nordic Model are methodologies that have been formulated and applied over the past 30 years to the development of **performance-based building** codes, standards, and specifications. Their respective use of similar terminology has differed, which has led to some confusion and has contributed to the perception that they are, in fact, quite different. Proponents of each methodology have occasionally stated this perception in public forums and by doing so have created the appearance of controversy. However, a comparative analysis of the Systems Approach and the Nordic Model demonstrates that they are, in fact, quite similar and complementary. They can be melded and

applied in a productive manner to the current widespread development of **performance-based building** codes and standards.

[Anon.] (2000) Developments in performance-based building codes and standards. **Forest Products Journal. Vol 50** (7-8) July – August 2000. p.12-21

Abstract: In the past, most building codes and standards have used prescriptive (or compliance) criteria. In recent years, there has been strong interest worldwide in developing codes and standards that are move performance based.

Wolski, A., Dembsey, N.A. & Meacham, B.J. (2000) Accommodating perceptions of risk in performance-based building fire safety code development. **Fire Safety Journal. Vol 34** (3) April 2000. p.297-309

Abstract: Differing perceptions of risk by various stakeholders have long played a role in influencing the development of prescriptive-based building fire safety codes. As **performance-based building** fire safety codes are developed, differing perceptions of risk will continue to be a significant influence. In this paper, the concepts of revealed preference, risk factors, risk adjustment factors and risk conversion factors are discussed, and two methods to address risk perceptions in a **performance-based building** fire safety code are introduced. The first method proposes the use of risk factors to classify buildings in terms such as low, medium, and high risk. Each class of building would be assigned a risk adjustment factor. Similar to safety factors, risk adjustment factors would be applied during deterministic building fire safety design to provide an increased level of safety in buildings where the risk perceptions would mandate greater safety. The second method would be used with a probabilistic-based building fire safety design approach, and uses risk factors to develop risk conversion factors (RCFs). In the probabilistic approach, a maximum expected-risk-to-life (ERL) value would be established by the code, with appropriate RCFs being applied to adjust maximum ERL values depending on how the building's fire safety risk is perceived.

Gann, D.M., Wang, Y.S. & Hawkins, R. (1998) Do regulations encourage innovation? - the case of energy efficiency in housing. **Building Research & Information Vol 26** (5) September – October 1998. p.280-296

Abstract: This paper addresses the impact of building regulations on constraints and drivers for innovation. It seeks to clarify whether a supposed shift from prescriptive to performance-based regulations has improved the environment for technical innovation in energy efficient housing in Britain. We argue that when '**performance-based** building regulations are treated as static sets of technical requirements, their effect is similar to more traditional prescriptive forms of regulation. A more progressive approach is possible in which regulations can be used as part of a portfolio of policies aimed at improving performance. In this mode, functional performance specifications can stimulate systemic innovation. A flexible 'performance based' form of standard could provide firms with the freedom, market incentive and institutional frameworks within which to innovate. The process itself could lead to information sharing and cooperation but for this to be achieved, competitiveness and regulatory policies need to be co-ordinated better. Regulatory objectives and mechanisms for achieving them need to match. Regulations need to accommodate technical change at different levels in the production process, including new product accommodate technical change at di development and systems integration.

Kashiwagi, D.T. (1997) The development of the performance based procurement system. **ASC Proceedings of the 33rd Annual Conference, Washington.** April 2 – 5 1997. p.275-284 [available at: <http://asceditor.unl.edu/archives/1997/kashiwagi97a.htm>] accessed on 1st August 2002



Issues to be addressed; State of the Art; Country Reports

CHAPTER 3



3 ISSUES TO BE ADDRESSED; STATE OF THE ART; COUNTRY REPORTS

3.1 Issues to be addressed

In the context of PBB Domain 6 Legal And Procurement Practices In Building And Construction focuses on the problems of:

meeting performance specifications via procurement

the legal issues which arise

This focus also considers the interrelationships within the scientific domain of performance based building and links between other related domains (namely Domain 7 Regulation and Domain 8 Innovation).

As a result of the work to date the work this domain can be summarised under a revised overall aim and measurable objectives.

The overall aim is to review the practice and procedure of PBB in the member countries as this relates to the domain Legal and Procurement Practices in those countries.

Within the overall aim the following measurable objectives are set:

To consider the drivers to PBB.

To document the limitations placed on innovation by:

Professional indemnity insurers

The particular insurance problem of a 'funding gap'

Tendering rules e.g. requirements to circulate Contractor's Change Proposals to all tenderers

Consideration of the scope allowed to contractors to affect construction

Professional Practice (Quantity Surveyors in the UK)

Consideration of the problems of measuring compliance with the basic parameters of time and quality

To investigate how initiatives towards value, and tendering restrictions affect PBB:

EU rules and requirements

Value for Money (UK Government procurement)

Best Value (England and Wales Local Government Act 1999)

Most Economically Advantageous Tender (MEAT) and other approaches

Other national practices and procedures.

The crucial issue of where PBB turns into prescriptive procurement, where and why?

To investigate how national and legal jurisdictions affect PBB (NB common and civil codes).

To produce a review of national practices and procedures.

To investigate training and education requirements across the domain.

3.2 State of the art

3.2.1 Contextual Statement

The term state of the art produces special problems in this domain since it is also used as a legal term in some jurisdictions. The issue concerns the liability for non-negligent errors and may arise where a designer or a design and build contractor has a duty to achieve a result (for example because of a "fitness for purpose" obligation). Professional Indemnity insurance cover (at least in the UK) is often restricted to claims arising from negligence on the part of the insured i.e. non-negligent errors are excluded. This point is often used by designers in seeking the restriction of their liability for design errors to those involving negligence. They seek the ability to use a "state of the art" defence if they have one.

The definition of quality in terms of performance criteria raises problems for construction procurement, and legal issues. The establishment of pragmatic performance criteria is fraught with problems; and the legal framework may lay down liabilities in differing ways depending on whether the building is prescribed by result or by performance. In the UK for example the duty on a designer may vary between a duty of care (design only) and a duty to provide a building fit for the purpose intended (design and construct).

Simply put under a duty of care a defence may be available that the designer used the knowledge that was available at the time i.e. the state of the art. Under a duty of result no such state of the art defence is available.

Of course this is an issue that Domain 6 sought to investigate over the life of the project; the position as to the state of the art defences in the member countries.

3.2.2 State of the Art

There is no current state of the art which could be applied across the EU; rather a collection of national practices. The work of the domain was to review these practices and procedures with a view to collecting best practice and producing guidelines. .

The definition of quality in terms of performance criteria raises problems for construction procurement and legal issues. The establishment of pragmatic performance criteria is fraught with problems; and the legal framework may lay down liabilities in differing ways depending on whether the building is prescribed by result or by performance.

The term state-of-the-art produces special problems in this domain, since it is also used as a legal term in some jurisdictions. In the UK for example the duty on a designer may vary between a duty of care (design only) and a duty to provide a building fit for the purpose intended (design and construct). Simply put under a duty of care a defence may be available that the designer used the knowledge that was available at the time i.e. the state of the art. Under a duty of result no such state of the art defence is available. Professional Indemnity insurance cover (at least in the UK) is often restricted to claims arising from negligence on the part of the insured i.e. non-negligent errors are excluded. This point is often used by designers in seeking to restrict their liability for design errors to those involving negligence. They seek the ability to use a "state of the art" defence if they have one.

Factors may be driving shifts in procurement towards PBB might be considered under three headings: International competition, government policies and European policies. Influence from international competition has arisen from experiences of multi-national companies around the world and a desire to

replicate best practice in other countries. Significantly better results were experienced in design and build procurement leading to an increase in the use of this procurement, see e.g. Royal Institution for Chartered Surveyors (2001) for a UK analysis. Similar results are reported elsewhere e.g. the USA (Haviland, 1998).

Since the early 1980's government influences have been founded on two things. That governments are responsible for the large part of construction output described above; and that governments need to maintain or increase output, particularly on infra-structure whilst at the same time reducing public sector expenditure. In order to reconcile these two opposing forces governments have increasingly turned to methods that involve private finance in projects. These methods include Design and Build (D&B); Design Build Fund Operate (DBFO); Build Operate Transfer (BOT); Build Operate Own Transfer (BOOT); Private Finance Initiatives (PFIs); and Public Private Partnership (PPP). Currently it is reported that in excess of 100 countries are procuring construction and engineering works under the generic heading of PFI (Merna & Smith, 1999). Private activity in infrastructure grew dramatically between 1990 and 1997, from about US\$16 billion to US\$120 billion (Roger, 1999).

In future years the Commission of the European Communities, as part of its role as promoter of legislative and operational initiatives, may consider defining the general lines of policy across the EU. The collection of best practice and producing guidelines will allow the views expressed to contribute to that definition of general lines of policy. Analogies could be made with other EU initiatives; specifically with the current Green Paper on Alternative Dispute Resolution in Civil and Commercial Law (European Commission, 2002).

Both international competition and government policies have resulted in moves towards PBB since performance specification lies at the heart of both D&B and PFI philosophy.

3.3 State of the Art in Member Countries: Country Reports

3.3.1 Belgium

The full report that has been produced by the member for Belgium, Johan Parthoens, is in Appendix 2. A brief synopsis of the report is given below.

Performance Based Building has been introduced in Belgium in various sectors, including;

- Code for safety: the welfare of the workers during the execution of their work.
- Fire Safety
- Thermal Insulation and heating requirements
- Energy performance of dwellings
- Energy performance of office buildings, schools (in preparation)
- Ventilation of non-residential buildings (in preparation)
- Accessibility for disabled persons

A general PBB approach has been developed in the Flemish region of the country, and the report contains a case study of this. The use of Performance Based Building is different between the private and the public sector, with the private sector having greater freedom than the public sector. In Belgium Performance based Technical Specifications are used for Social Dwellings for the building as a whole and for the different functional building parts.

Tendering rules act as a restriction on the use of PBB in Belgium. This is particularly the case in the public sector where lowest-price is always the selection criteria. This is not always the case in private sector work, although it continues to be the most commonly used deciding factor.

3.3.2 Denmark

The full report that has been produced by the member for Denmark, Kim Haugbølle, is in Appendix 3. A brief synopsis of the report is given below.

In Denmark there are three separate but interlinked markets constitute the building and housing cluster; the property market, the building market, and the product market. In each of these markets, different actors will procure and produce various products and services.

The Danish building legislation is largely performance based, but examples of direct prescriptions of solutions can be found in the Danish building legislation. Although Danish building projects are procured within a largely performance based legislation, there are strong elements of the prescriptive approach present in Danish building projects too. However even a largely performance based design will have to be turned into a prescriptive design at the end of the day. Thus, the issue of prescriptive versus performance based building is not an either-or issue, but rather a time-dependent continuum stretching from performance based to prescriptive building.

The paper suggests that the performance concept may not be the best way of procuring buildings and constructions in all cases and contexts. The paper concludes that the following question is the key one that needs to be addressed:

Under what circumstances is the performance approach more appropriate than the prescriptive approach?

3.3.3 Ireland

The full report that has been produced by the member for Ireland, Louis Gunnigan, is in Appendix 4. A brief synopsis of the report is given below.

Performance Based Building (PBB) is not common in Ireland. However, on some Public Private Partnerships (PPP) projects, the economic drivers are highlighting the need for whole life cycle costing, leading towards an acceptance of PBB principles in early project design. This is increasingly evident on projects using a Design, Build, Finance and Operate (DBFO) approach, e.g. the National Aquatic Centre project. As yet however, Ireland does not have construction standards that relate specifically to PBB, nor are there any plans to introduce such standards in the foreseeable future.

One of the major limitations to innovation in Ireland is professional indemnity insurance (PII). The cost of this has risen considerably in the period 2000 – 2004. As new technology is perceived as a risk, new innovative techniques result in higher PII premiums. Existing tendering rules are also a limitation to the use of PBB as cost is still the final selection criteria for public works. However other factors are considered at earlier stages of the selection process.

3.3.4 Israel

The full report that has been produced by the member for Israel, Igal Shotet, is in Appendix 5. A brief synopsis of the report is given below.

The implementation of the performance-based concept into the building market in Israel started in the 1970's with the preparation of a comprehensive document of Performance Specifications for Residential Buildings, low-rise as well as high-rise. The guidelines were adopted in 1978 by the Ministry of Housing and Construction as part of their formal guidelines for new construction systems in the public building sector.

The construction industry relies on conventional in-situ concrete structures. Building methods are based on heavy-weight reinforced concrete structures (either cast in-situ or prefabricated). The finishing tasks are industrialized with the use of prefabricated units and components such as curtain-walls, windows, etc, and the use of industrialized methods for partitioning, tiling, rendering, cladding etc.

Research in most specific areas of PeBBU is carried out at the National Building Research Institute, NBRI, (known until 1988 as the Building Research Station) <http://www.technion.ac.il/~nbri/>, in the Faculty of Civil Engineering <http://www.technion.ac.il/technion/civil/>, and in the Faculty of Architecture and Urban planning <http://architecture.technion.ac.il/>, all at the Technion - Israel Institute of Technology (please visit these sites for detailed description of the relevant laboratories and lists of publications). Building Standards, many of them with a performance-based underlining philosophy, are developed and issued nationally and uniquely by the Israel Standardization Institution. Building Regulation, undergoing now a shift to performance-based regulations, are issued and mandated by the Ministry of Interiors.

The procurement and legal practices developed first in the establishment of basic knowledge of physical performance and development of the standards that enables performance specifications. The procurement practices follows 4 typical protocols: (1) Traditional procurement (general contractor); (2) Design-Build procurement protocol; (3) Construction Management; and (4) Build-Operate-Transfer (BOT). The following paragraphs review the procurement protocols and the implementation of Performance Based specifications in the procurement protocols.

3.3.5 Netherlands

A synopsis of the position in the Netherlands is given below.

Performance based building is based on functional requirements and performance criteria (= performance specifications), which are not prescriptive.

The Dutch building decree for instance is principally based on performance criteria.

The building process is normally a chain of phases (see diagram). Each phase has his own specifications, which do not specify fully the object normally, requirements etc.. The problem of performance based building may be that the specifications of the different phases are not attuned to each other:

client's demands to clients experiences
specifications 1 to specifications 2
specifications 2 to building decree, and so on

Diagram global (traditional) way of realisation

phase	topic	specifications
☐	client's demands	ideas, wishes
1	initiative (choice of location, global functional requirements, budget)	specifications 1
2	design (definitive design, tender documents/drawings, definitive budget)	specifications 2
3	national laws, by-laws, municipal rules, etc.	building decree
	among others: building permit	
4	(public) procurement	EG-directives
	contract (principal-contractor)	
5	construction	specifications 5
6	exploitation (maintenance up to demolition)	specifications 6
☐	client's experiences	satisfaction

For legal and procurement practices there is the problem of specifications and the requirements of the European directives (and also national rules) that are based on a fair competition of the (possible) contractors.

In practice problem(s) of the possible incompatible or incomplete phase-specifications could be solved by deliberation with the parties concerned, innovative contracting and so on. Deliberation, however, might be at daggers with the rules of fair competition.

Therefore the European directives has been discussed for a competitive dialogue in future.

Provided a fair competition between contractors a public procurement of performance based building is possible, but asks in most of the cases a single solution.

Concerning the domain Legal and Procurement Practices the major issue is try to solve the possible incompatibility of specifications first (principal-contractor: chances/profits-threats/risks) before to describe the properties of specific solutions (a stream of new named innovative solutions are published frequently).

3.3.6 United Kingdom

A synopsis of the position in the UK is given below.

UK practice and procedure vary widely e.g. Scottish procedure is different than English. The construction industries also vary; it might help to think of engineering and building sectors. Engineering can also be split between Civil; Process; Mechanical and Electrical. Some sectors e.g. Chemical Process, Water and Sewage, have a long standing performance based specification practice, if not PBB. The industry as a whole has seen a move towards design and build (see Table I) and with that a concomitant move towards performance based specification, again if not a move to PBB.

3.3.7 Spain

A synopsis of the position in Spain is given below.

PBB is at the research stage and very few implemented. Even in research it is only at the initial stages of the development and there are only few research works related to this topic. The performance based design is in the limited scope exercised by service engineering and clients. The term is conceptually related to the use of building rather than to whole buildings life cycle.

At the moment one of the most important problem of the Spanish construction industry are delays, which may also affect the actual implementation of performance based design. Another important drawback is the lack of communication between the parties involved (designer, contractor, client). This also may affect PBD due to lack of communication regarding the use of the buildings, constructability etc. The national research agenda has been recently finalised.

The building regulations have been modified recently by the Building Act (LOE) enacted as Act 38/1999, of 5 November.

The Act's "express aim" is to regulate basic aspects of the construction process, setting out the obligations and responsibilities of the all those involved in the process, as well as the necessary guarantees for it proper implementation

The Building Act establishes the following basic requirements which must be satisfied in order to guarantee the safety of people, the welfare of society, and the protection of the environment

those relating to **functionality** (use, accessibility and access to telecommunication, audio-visual and information services)

those relating to **safety** (structural, in case of fire, and of use)

those relating to **habitability** (hygiene, health and protection of the environment, protection from noise, energy conservation heat insulation and other functional aspects).

In its Second Final Provision the LOE authorises the government to approve a Technical Building Code, setting the mandatory standards required to ensure safety and habitability.

The Technical Building Code

The Draft of TBC is being developed under the *Ministerio de Fomento* authority

Information on the draft is available to public in www.codigotecnico.org-Documents of the draft can be available to experts prior Electronic identification

The draft is actually under a first overview of the professional and Industrial sectors

Performance Based Code

Insurances and financial guarantees (art 19, LOE)

A decenal insurance or a financial guarantee is mandatory for structural works signed by owners.

A year post construction insurance or financial guarantee is mandatory to the work contractor having as object the faults and imperfection of work ending elements.

A three year no mandatory insurance or financial guarantee for damages for faults of habitability conditions

Insurances and financial guarantees (art 19, LOE)

A decenal insurance or a financial guarantee is mandatory for structural works signed by owners.

A year post construction insurance or financial guarantee is mandatory to the work contractor having as object the faults and imperfection of work ending elements.

A three year no mandatory insurance or financial guarantee for damages for faults of habitability conditions

3.3.8 Greece

A synopsis of the position in Greece is given below.

PBB is mainly restricted to research and regulations/legislations. The information on the status of performance-based design in Greece is generally insufficient. It seems that towards this approach the authorities and the designers have made only few attempts. However, some can be found in some building construction projects, especially in those cases where no specific prescriptive codes and regulations exist.

Finland

A synopsis of the position in Finland is given below.

The performance approach has been implemented e.g. using a performance based requirements management tool: the EcoProP tool. For further details see Domain 8.

3.3.9 Canada

A synopsis of the position in Canada is given below.

The International Centre for Facilities (ICF, Françoise Szigeti / Gerald Davis) developed the 'ST&M-approach' over the last 10 years. For further details see Domain 8.

The Drivers to PBB; Barriers and Incentives

CHAPTER 4



4 THE DRIVERS TO PBB; BARRIERS & INCENTIVES

4.1 The Drivers to PBB: Incentives & Triggers

Legal and Procurement practices in construction are varied; practice and procedure has developed independently in many countries. The major influences are:

Jurisdiction
Civil Code
Common Law
Government Influence
Professional Institutional Strength

The issue of incentives and barriers to PBB implementation implies that PBB is per se a more appropriate approach than the prescriptive approach. The work of Domain 6 has not primarily been driven by a concern of implementation but rather of a concern to understand the characteristics of performance base procurement.

The incentives and triggers for PBB are well documented but need greater clarity and dissemination. For example the claim in PebbU Newsletter Nr 1 ./ 02 that PBB is a strong stimulus for product and process innovation and enhances consumer-orientation, cost optimisation and trade possibilities in construction requires detailed back-up and analysis. The claims that PBB is therefore expected to reduce total construction costs by as much as 25% must similarly be defended and justified.

It is apparent that clients and in particular government clients who are such an important part of construction demand are receptive to change.

In all cases the process of construction is separated, to a larger or smaller degree, between Design and Production. As a comparative example England might be compared with the USA.

The contemporary traditional approach in English (not necessarily the United Kingdom) Construction, but not some engineering processes, was for entirely separate design by, for example, an Architect. Production was by a main contractor responsible only for the design of any temporary works necessary to complete the designed permanent works. This has been greatly eroded (see table I).

Table 1 Trends in Procurement - by percentage value of all contracts

	1984	1985	1987	1989	1991	1993	1995	1998	2001
Procurement Method	%	%	%	%	%	%	%	%	
Lump Sum	72	70	70	62	55	50	56	38	40
Measure and Value	7	5	3	4	3	4	2	2	3
Cost Plus	4	3	5	1	0	0	1	<1	<1
Design and Build	5	8	12	11	15	36	30	41	43
Management Type	12	14	10	22	27	10	11	18	12
Totals	100	100	100	100	100	100	100	100	

The US approach was for lesser separation, designers carried out outline or scheme design only and contractors completed this design to shop or working drawings.

Other practices varied between complete separation as the English Model and limited separation as the US model; there were few, if any, examples of true combined systems. This has changed with the advent of 'new' procurement practices where clients sought single point responsibility e.g. 'package deal', 'turnkey' and more recently Build Operate Own Transfer, Private Finance Initiatives and Public Private partnerships.

It must be noted that the influence of Governments on construction is important and goes some way to explaining practice and procedure. In every country the client for a large part of the output of the industry is government, or a semi-government organisation Hillebrandt (2000). This influence also affected building legislation and regulation; early measures to deal with planning and standards of construction were based on a prescriptive approach where a single or very few solutions are able to satisfy.

It is apparent that clients and in particular government clients who are such an important part of construction demand are receptive to change. As an example the UK government recently confirmed its desire to move away from lowest cost bidding:

Least cost doesn't necessarily mean best value

The Deputy Prime Minister Launching *Re-Thinking Construction*

4.2 Barriers

Besides the well-known barriers to any kind of innovation and change in the building and construction industry like the low level of R&D investments and the segregation and fragmentation of design, engineering and construction, the delphi study and the national case studies have hinted at some of the more specific barriers related to procurement. These barriers include:

- The uncertainty about risk and liability, not least the issue of duty of care versus a duty of result;
- The suspicion of designers and other advisors that the application of PBB will further undermine professional status;

- The wish of clients to exercise extensive control of the end product;
- The dominant position of consultants in the building process in some countries like UK and Denmark;
- The administrative practices of municipalities requiring very detailed project description before granting various approvals in some countries;
- The elaborate involvement of the end-users requiring specific solutions.



Research Priorities; Dissemination; Conclusion

CHAPTER 5



5 RESEARCH PRIORITIES; DISSEMINATION; CONCLUSION

5.1 Research priorities

Domain 6 proposes three research objectives to be addressed in future work on performance-based procurement:

A detailed and case-based analysis of the processes of interpretation, negotiation and translation of requirements (whether performance-based or prescriptive) between the various actors and through the various phases of a building project.

Although some tentative conclusions have been suggested and discussed in the domain meetings, a more substantial analysis on the reasons of clients for procuring in different ways is clearly needed. These analyses should use both interest-based and resource-based approaches in order to address both the issue of willingness and the issue of ability of clients to procure in new ways.

A better understanding and characteristics of the negotiation space (see figure 4) available for the actors in the building process is needed in order to analyze and evaluate under which circumstances various procurement methods, requirements etc. are most appropriate.

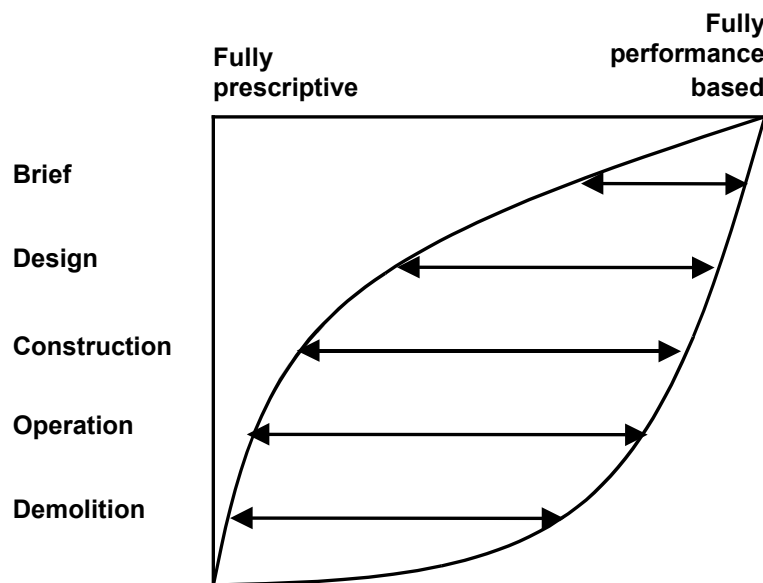


Figure 4. The negotiation space available to the actors.

5.2 Dissemination

5.2.1 Planned methods of dissemination

At the outset of the project a number of tools for dissemination were considered. It was decided that a combination of various tools/methods/activities can lead to the most effective knowledge dissemination into general practice. Among these proposed activities were:

- dissemination through website
- the national user platforms and regional platforms
- publications
- national/international events (such as conferences, workshops etc.)
- contribution of members/participants through organizing of workshops/seminars in conjunction with other events for the target groups
- education modules
- training of professionals
- guidelines for performance-based building
- influence local governments and clients with best practices
- providing clients/designers with decision-making/assessment tools
- in general, designers demonstrate reasonable scepticism and have equally reasonable fears that PBB can have a negative influence on, and further undermine, their profession. Therefore it is needed to address the fear of the designers by providing best practice examples demonstrating it is possible to achieve, for example, design quality and PBB at the same time
- the appropriate best-practice examples must be directed to the appropriate target group
- dissemination of knowledge through best practice examples
- provide clients with case studies which indicate the benefits of PBB

5.2.2 Actual methods of dissemination and implementation

The issue of dissemination and implementation inherently requires a normative stance of favouring PBB as the solution. However, Domain 6 has not been fully convinced of the superiority of the performance approach in all cases and under all conditions. Rather, it has exactly been the attempt of the domain to explore the conditions under which the performance approach may be appropriate. Thus, the issue of dissemination and implementation should instead be viewed as a matter of how the domain has contributed to a continuous debate on the performance approach. Viewed in this light, the dissemination and implementation activities of Domain 6 has included:

Setting up a website at UMIST and contributing to the website of PeBBu;

- Participation in the regional platforms;
- Production of various publications including the domain reports and conference papers e.g. for the conference Combining Forces;
- Participation in national and international events such as conferences, workshops etc. like Combining Forces.

5.3 Conclusion

Domain 6 has been frustrated by the dearth [total lack] of empirical data. The benefits, incentives and triggers for PBB are well documented but in a journalistic manner. Thus, PBB need greater clarity and rigour. It is clear that PBB poses many challenges for legal and procurement practices in building and

construction but because of the unstructured nature of the field [discipline] it is not clear how these can be approached [overcome]. The CIB PeBBu Thematic Network has been an invaluable first step in approaching the challenges.



References



CHAPTER 6



6 REFERENCES

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Annexes





7 ANNEXES

7.1 Annex 1: domain members

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7.2 Annex 2: Country Report: Belgium

7.2.1 Situation in Belgium

The rule is still prescriptive tenders, but more and more regulations are performance based (fire safety, thermal comfort, ventilation, protection against noise, integral energy performance, ...)
Generally common law system neither encourages nor discourages PBB.

In Belgium **building permits** are required for all construction works.

The municipality is responsible for the delivery of the permit, after advice, where needed, from the regional authority.

The municipality and the regional authority have sometimes problems with innovation in the outlook of the building. So they limit, in a certain way, innovative construction practices, new technologies, and modern practices.

Construction works must be designed and built under the responsibility of an *registered* **architect** and executed by *registered* and *recognised* **contractors**.

Following our legislation the architect promotes /manages / handles the client's interests and takes the client's interests to heart in an independent way from the contractor(s).

The architect or the team of architects is responsible for the result in the first place; the contractor(s) can participate more or less in the responsibility.

The architect or architects association is the pivot of the whole construction process.

They design the building, make the dossier for the building permits, supervise the construction process, ...

Normally there is one architectural design ... and this is made for all the contractors who want to submit a tender for a contract. They have only to follow the dossier made by the architect or architects association. The study is made only one time. The system(s)/components/materials are prescribed.

For the contractors (tenderers) it is clear what is expected of them.

When the system(s)/components/materials are given in performance based approach, the contractors (tenderers) each of them has to submit a study.

For a **tender competition** each contractor's architect or architects association has to make a dossier, with a prescriptive answer to the performance based building, to prove they meet the requirements. Each of them makes a lot of costs.

To check out everything about a new approach / material etc. of all the dossiers, would take time to make a full assessment. The correctly **assessing** of innovative approaches is not evident.

To use a tried and trusted approach would be better?

7.2.2 Limitations for PBB

7.2.2.1 Regulations, traditions, ...

The existing technologies can already result in major improvements in the overall performance of buildings. They are well-known and you know what you can expect, which difficulties it gives, ...

Theoretically new concepts and technologies may allow further improvements and/or constitute more cost-effective ways for achieving the same improvement.

Traditionally thinking and the fact not to know what you can expect during erection of the construction, which difficulties you may expect, result in higher cost, at least initially.

For practical reasons, it is not possible that standard assessment procedures include all such new concepts. Therefore, **alternative methods for assessing the performances** of these concepts and technologies must be available.

An assessment method should be available which allows to correctly comparing various innovative systems with a consistent treatment of various technologies.

New building regulations force you to look out for new solutions.

New regulations, new standards, new ETAG's can oblige to analyse the product, to optimise, to perfect the product to have a better quality.

It could be very helpful to have a **database** with all the construction products with technical specifications, to decrease the incertitude about the performances of the products and so also the responsibility. The CE marking (and the Keymark) will play an important role therefore.

See also "Compendium of Building Performance Models" (<http://www.auspebbu.com/page.cfm?cid=3>)

"This Compendium is being developed as an on-line database of building performance models or tools to facilitate the use of the performance approach in building and construction.

It is intended as a "one-stop shop" for the building and construction industry worldwide, so that building professionals, product manufacturers, building officials and researchers can find in one place all of the building performance tools that are needed to support, implement and further develop performance based building."

7.2.2.2 *Tendering rules and requirements,*

In Belgium there is a great difference between the private and the public approach.

In the **private** sphere there is much more liberty than in the public sphere. It's almost always possible to make change proposals, between the limits of the policies regarding building_construction, the built environment, environmental issues, energy use, etc.

For large constructions mostly the client initially "selects tenderers based on capital cost only, innovations which demonstrate significant in-use cost savings and/or other improvements to performance tend to get dropped to win on capital cost.

This tends to affect performance aspects such as flexibility, productivity, reduction of environmental impact etc."

Afterwards the cost is often not lower, quite the contrary, the innovation cause a higher cost by an assurance incertitude

The public tenders have that they are not permitted to let on other than a lowest capital cost basis. When the winning tenderer has a cost much higher than the estimate, it can be the works are not awarded and a new call for tenders is needed.

Performance based regulations can make it difficult to assess the proposals of the contractors and to compare one with another. It is not always clear what you can expect from the contractor.

An assessment method should be available which allows to correctly comparing various innovative systems with a consistent treatment of various technologies.

In the public sector procurement, almost only the PPP (Public Private Partnership) is performance based.

By asking for a **building permits** the municipality and the regional authority have sometimes problems with innovation in the outlook of the building. So they limit, in a certain way, innovative construction practices, new technologies, and modern practices.

7.2.2.3 Professional indemnity insurance

The architect and the contractor have to insure their professional responsibility.

In general everyone looks for an assurance that a new design / material etc. will perform adequately.

This can limit the innovativeness of the designers (architects), as they, or a lot of them, usually would prefer to work with well-known products instead to experiment with new technologies.

A solution can be the use of standards and technical approvals: in Europe the **European Standards** (EN's) and the **European Technical Approvals** (ETA's).

The products which are manufactured according to a standard, are supposed to have a certain life time. Standards are made for 'traditional' construction products which have already proved to have a certain life time.

The European technical approvals give an assessment of the fitness for use for new products and systems. So, when in performance based approach, new materials and new uses for traditional materials are encouraged, technical approvals can often give the answer.

The European technical approvals are based on performance based guidelines.

Also the standards are more and more performance based.

We have now a transition period in Europe: more and more harmonised European standards and European Technical Approvals are being adopted which are the basis for the CE marking.

Products with a CE marking must be accepted in all the EU member states.

The professional indemnity insurance must not limit so much innovativeness of designers generally, since there are the technical approvals, with which you can play the ball shorter.

See also Commission W087 - Post-Construction Liability and Insurance

Producers' Liability under Regimes with performance-based contractual Obligations and Building Regulations. ("producer" is any person with a contract with the client, i.e. a designer (architect, consulting engineer, ...), a contractor, a supervisor etc.)

The period or phase W87 is interested in is the one starting at hand-over or delivery ("reception" in a number of countries), meaning the moment the Client takes over the premises.

The issue of "performance-based liability", and the concomitant liability and property insurance arrangements, is, in some members' view, linked to the way of looking upon "producers' duty" i.e. either as a "Duty of Result" (= obtain the result the client expresses + what the building regulations require) in contrast to the "Duty of Care" (= do as well as any reasonably skilled designer/craftsman would do in your situation)...

7.2.3 Public Private Partnership (PPP)

The Performance Based Buildings can stimulate **new products and components** to satisfy known needs, but also to allow **new architecture**.

The problem is often the professional **responsibility**. In general everyone looks for an assurance that a new design / material etc. will perform adequately.

To promote new materials, components and systems technical approvals can help to break through.

When the PBB-approach allows using your own system and materials, lower prices should be possible.

More recently the **Public Private Partnership** (PPP) is a newly allowed scheme of mixed public and private sectors for the procurement, for example, of social housing projects (930 dwellings).

The PPP involves a consortium consisting of financing bodies, designers, the builder and those who will manage the built facility in use for a period of 27 years.

In the first period projects will be realised on public land (450 dwellings)

In the second period also private land will be concerned (480 dwellings).

The best of the public and private sectors will be combined, with an emphasis on value for money and delivering quality public services.

The private builder secures the investment, the realisation and the maintenance; they are the owners during 27 years.

The dwellings are let by a local housing society, which will let the dwellings out to those as decided in the rent act. The Flemish Region will ensure the difference between the normal rent of the house and the price the tenants can pay.

The performance based approach gives the private investor the opportunity within the proposed technical requirements, to use his own solutions and materials.

The private partner prepares his tender according to the new issue of the “Technical Specifications for Social Dwellings” (performance-based specifications for the building as a whole and for the different functional building parts)

Since he is the owner during 27 years it is in his interest to build durable construction, to have not too much cost for the maintenance and repair.

The Flemish Confederation of the Construction Industry was convinced that creativity concerning design and concerning realisation of the building project, will lead to lower cost and at the same time to a quality of the same high level as normally expected.

The first call for tenders was in autumn of 2003.

In fact, in springtime of 2004, it became clear that the cost of the tenders are too high ... and the projects were blocked.

What is the reason?

- The fact the tenderer remains the owner during 27 years, with all the uncertainty about the pre-financing?
- 3 months preparation was not enough for submitting a complete dossier.
- The cost for the tender was not paid; that cost was not to recuperate in case of no allocation for the works. (For a tender competition, for each tenderer a own tender with a complete dossier is to make up)

There was (still?) no direct indication the performance based approach itself was the reason for higher cost.

The Flemish government, in the meantime, has provided for a guarantee fund.

More time for preparing was given.

Article 17 §2 of the law of 24 december 1993 about the governmental orders gave the opportunity to **negotiate** directly about 7 tenders for about 163 dwellings. These negotiations were secret and are reported to the Inspection of Finances and the government.

The criterions were fixed in a study of Ernst & Young (2002 – 2003)

The public allocation was foreseen for end 2004.

The points of the negotiations were:

- to reduce the costs by a better description of the different costs: build cost, management cost, financial cost, maintenance cost, ...
- the volume of the projects, the costs, to spread up over a great number of dwellings

During the negotiations technical advice was given by the ‘Service flats Invest NV’.

The Flemish government has planned a steering committee to take lessons from this experiment.

The conclusions end 2004:

- finance unknowns: economic climate; deductible VAT expenses and other fiscal cost; interest risk between tender time and late completion (till 3 years);
- the cost of the preparing of the dossier, when you don't have the commission: 'no cure, no pay'
- in spite of the website for FAQ, a lot of interested people stay with questions.
- more than the half of the tenderers had already worked with the Flemish Society for Social Housing
- the expected life cycle of the building components was given: this was crucial for the Flemish Parliament and the Inspection of Finances to start with the PPP formula and the performance based tender.

At the beginning of 2005 for 3 areas (Gent and Aalst; Tienen en Dilbeek; Wilrijk, Lommel and Izegem) with different locations were selected. (137 + 193 + 109 = 439 dwellings)

For the selection 4 criteria were used: price (45%), quality of the building project (40%), quality of the maintenance (10%) and the erection time (5%)

Per area a different advisory committee gave for the building project (40%) and their maintenance (10%) a qualitative appreciation, apart from the other locations.

Ponderation for these 2 criteria:

- Architecture: 12
- Functionality, comfort and materials: 12
- Technical dossier and materials: 10
- Ecology, sustainable building and lifetime dwelling: 6

Because of the budget limits only 238 dwellings, spread over 2 of the 3 areas are contracted out to one private partner (association of a contractor and a bank).

All the dwellings are so committed to one tenderer in the light of cost (to spread up over a great number of dwellings).

The architecture was "sacrificed". Since these contractor worked with different architects and because of the "must" of the total volume of the projects, the good and the not so good projects are selected of one tenderer....

The government is happy with the result:

- an extra of 238 social dwellings can be built in addition to the regular building projects of the government
- the total cost is spread over a long time.

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7.2.4 BACKGROUND

In Belgium **building permits** are required for all construction works.

Construction works must be designed and built under the responsibility of a *registered* **architect** and executed by *registered* and *recognised* **contractors**.

Following our legislation the architect promotes /manages / handles the client's interests and takes the client's interests to heart in an independent way from the contractor(s).

The architect or the team of architects is responsible for the result in the first place; the contractor(s) can participate more or less in the responsibility.

The architect ensure, based on building regulations, the performance of the building with regard to:

- The functionality (the design of the building must ensure the better conditions necessary for use according to its purpose);
- The safety (the building must be designed in order to guarantee structural stability, fire resistance, safe in use, etc.);
- The health (the design and the materials should ensure a good hygiene, a minimal acoustic comfort, a good thermal insulation, etc.);
- The durability (there are requirements for a guarantee of minimum 10 years for the structural elements, the water tightness, ... of buildings)

Performance Based Building has been introduced in Belgium for the following domains:

- Code for safety: the welfare of the workers during the execution of their work.
- Fire Safety
- Thermal Insulation and heating requirements
- Energy performance of dwellings
- Energy performance of office buildings, schools (in preparation) ...
- Ventilation of non-residential buildings (in preparation)
- Accessibility for disabled persons

A general PBB approach has been developed in the Flemish Region for Vlabo (see further) in its demonstration housing sites and partly applied for new social housing projects (see PPP further).

However, for the other issues, the traditional approach has prevailed as only the larger organisations have the required resource and personnel to adopt its practice.

7.2.4.1 Economic

Trends

The level of activities in the Belgian building sector is cyclical and depends on the whole economic situation in the country, but because of the great importance of the building industry it influences also the whole economic situation.

7.2.4.2 Use of Performance Based Building

There is a great difference between the private and the public approach.

In the private sphere there is much more liberty than in the public sphere.

In Belgium Performance based Technical Specifications are used for Social Dwellings for the building as a whole and for the different functional building parts.

Vlabo

The organisation “**Vla**anderen **B**ouwt” or “**Vlabo**” (= Flanders build) uses the “Performance based Technical Specifications for Social Dwellings”, performance-based specifications for the building as a whole and for all the different functional building parts (see later).

Vlabo stimulates the **construction of solid and distinctive dwellings for a reasonably price** with an eye for non-material qualitative elements as good design, organisation of the plans, proportions and orientation.

Vlabo encourages the **collaboration between architect and builder** from the design stage, to become an optimal combining of technique and creativity, with an eye to quality improvement and price controls at the same time.

There is a need for good **urban planning** to use the scarce building lots and expensive infrastructure optimally and to increase the life quality of the individual dwellings by the higher environmental quality.

The intention is to have show houses / flats in each region of the Flemish country....

During 6 months people can visit each type of dwelling of the show houses / flats.

Vlabo makes promotion of new materials, new techniques, “domotica” houses, “ecologic” houses, “new architecture”

Vlabo organizes and co-ordinates projects mostly consisting of a group of houses / apartments / homes from about 10 to 100 dwellings.

A planner, often with an architect, develops a new “estate” (streets, different areas)

Contractors (builder), in association with the architects, work out the proposals for the dwellings. Already at least 36 contractors give their collaboration.

“Vlabo” realised more than 50 projects of 10 to 100 dwellings till now.

See Case study 1

Domus Flandria

“**Domus Flandria**” used these specifications in the period of 1993 to 1996 to build about 10,000 dwellings via the Flemish Society for Social Housing (Vlaamse HuisvestingsMaatschappij).

See Case study 2

Public Private Partnership

More recently the Public Private Partnership (PPP) involves a consortium consisting of financing bodies, designers, the builder and those who will manage the built facility in use for a period of 27 years.

PPP (Public Private Partnership) is a newly allowed scheme of mixed public and private sectors for the procurement of social housing projects. These projects must be developed using the Performance based Technical Specifications for Social Dwellings (performance-based specifications for the building as a whole and for the different functional building parts)

See Case study 3

Whole Life Costing. It's an exception that the brief for projects asks for WLC, which defines building life, durability standards, value engineering etc.,

7.2.4.3 Use of Construction Products Directives

The CPD has not only impact in respect of necessitating harmonised tests to Euronorms.

The CPD is more and more important, because the CPD gives the performance based approach to establish European Standards (EN) and **European Technical Approvals (ETA)**.

The EN's and the ETA's are the basis of the CE marking which becomes from year to year more important.

The number of the **European Technical Approvals** increases more and more each year.

Guidelines for ETA's are based on the performance based “Essential Requirements”.

The EN's and the ETA's will be very important to avoid that all the construction products must be tested again and again for each project.

Council Directive of 21 December 1988 on the approximation of laws, regulations and administrative provisions of the Member States relating to **construction products** (89/106/EEC) as amended by COUNCIL DIRECTIVE 93/68/EEC of 22 July 1993

(<http://europa.eu.int/comm/enterprise/construction/internal/cpd/cpd.htm>)

Belgian implementation of CPD according to the law of 25 March 1996, coming into force on 11 September 1998.

Objectives of the CPD:

- European Internal Market for construction products by technical harmonisation.
- Construction products are fit for their intended use.
- Free circulation of goods in the European Internal Market.
- Competitiveness of European enterprises.

7.2.5 Limitations on innovation

Regulations, traditions, ... should not be a barrier for innovative concepts.

The existing technologies can already result in major improvements in the overall performance of buildings. They are well-known and you know what you can expect, which difficulties it gives, ...

Theoretically new concepts and technologies may allow further improvements and/or constitute more cost-effective ways for achieving the same improvement. Traditionally thinking and the fact not to know what you can expect during erection of the construction, which difficulties you may expect, result in higher cost, at least initially.

For practical reasons, it is not possible that standard assessment procedures include all such new concepts. Therefore, **alternative methods for assessing the performances** of these concepts and technologies must be available.

An assessment method should be available which allows to correctly comparing various innovative systems with a consistent treatment of various technologies.

The application of the principle of equivalence (as used in the Netherlands for the EPN) as a measure for correctly assessing innovative approaches, must be covered by a legal framework for proof of compliance. It is intended to set up such system also for the Flemish energy performance regulation.

New building regulations force you to look out for new solutions.

New regulations, new standards, new ETAG's can oblige to analyse the product, to optimise, to perfect the product to have a better quality.

It could be very helpful to have a database with all the construction products with technical specifications, to decrease the incertitude about the performances of the products and so also the responsibility. The CE marking (and the Keymark) will play an important role therefore.

See also "Compendium of Building Performance Models" (<http://www.auspebbu.com/page.cfm?cid=3>)

"This Compendium is being developed as an on-line database of building performance models or tools to facilitate the use of the performance approach in building and construction.

It is intended as a "one-stop shop" for the building and construction industry worldwide, so that building professionals, product manufacturers, building officials and researchers can find in one place all of the building performance tools that are needed to support, implement and further develop performance based building."

Describe the limitations placed on innovation by the following:

Professional indemnity insurance.

The architect and the contractor have to insure their professional responsibility.

In general everyone looks for an assurance that a new design / material etc. will perform adequately.

This can limit the innovativeness of the designers (architects), as they usually would prefer to work with well-known products instead to experiment with new technologies.

A solution can be the use of the **European Standards** (EN's) and the **European Technical Approvals** (ETA's).

The products which are manufactured according to a standard, are supposed to have a certain life time. Standards are made for 'traditional' construction products which have already proved to have a certain life time.

The European technical approvals give an assessment of the fitness for use for new products and systems. So, when in performance based approach, new materials and new uses for traditional materials are encouraged, technical approvals can often give the answer.

The European technical approvals are based on performance based guidelines.

Also the standards are more and more performance based.

We have now a transition period in Europe: more and more harmonised European standards and European Technical Approvals are being adopted which are the basis for the CE marking.

The professional indemnity insurance must not limit so much innovativeness of designers generally, since there are the technical approvals, with which you can play the ball shorter.

See also Commission W087 - Post-Construction Liability and Insurance

Producers' Liability under Regimes with performance-based contractual Obligations and Building Regulations. ("producer" is any person with a contract with the client, i.e. a designer (architect, consulting engineer, ...), a contractor, a supervisor etc.)

The period or phase W87 is interested in is the one starting at hand-over or delivery ("reception" in a number of countries), meaning the moment the Client takes over the premises.

The issue of "performance-based liability", and the concomitant liability and property insurance arrangements, is, in some members' view, linked to the way of looking upon "producers' duty" i.e. either as a "Duty of Result" (= obtain the result the client expresses + what the building regulations require) in contrast to the "Duty of Care" (= do as well as any reasonably skilled designer/craftsman would do in your situation)...

Tendering rules and requirements,

There is a great difference between the private and the public approach.

In the private sphere there is much more liberty than in the public sphere. It's almost always possible to make change proposals, between the limits of the policies regarding building construction, the built environment, environmental issues, energy use, etc.

For large constructions mostly the client initially "selects tenderers based on capital cost only, innovations which demonstrate significant in-use cost savings and/or other improvements to performance tend to get dropped to win on capital cost. This tends to affect performance aspects such as flexibility, productivity, reduction of environmental impact etc." Afterwards the cost is often not lower, quite the contrary, the innovation cause a higher cost by an assurance incertitude

The public tenders have that they are not permitted to let on other than a lowest capital cost basis. When the winning tenderer has a cost much higher than the estimate, it can be the works are not awarded and a new call for tenders is needed.

Professional practice

In Belgium **building permits** are required for all construction work.

The municipality is responsible for the delivery of the permit, after advice, where needed, from the regional authority.

The municipality and the regional authority have sometimes problems with innovation in the outlook of the building. So they limit, in a certain way, innovative construction practices, new technologies, and modern practices.

In Belgium construction works must be designed and built under the responsibility of a *registered architect* and executed by *registered and recognised contractors*.

The architect or architects association is the pivot of the whole construction process.

This professional practice should not affect the implementation of performance based building criteria in Belgium directly, in so far the architect is not a limitation to the implementation.

The architect or architects association designs the building, makes the dossier for the building permits, supervises the construction process, ...

There is one architectural design ... and this is made for all the contractors who wants to submit a tender for a contract. They have only to follow the dossier made by the architect or architects association. The study is made only one time. The system(s) / components / materials are prescribed.

For the contractors (tenderers) it is clear what is expected of him.

When the system(s) / components / materials are given in performance based approach, the contractor (tenderer) each of them has to make the study.

For a tender competition each contractor's architect or architects association has to make a dossier, with a prescriptive answer to the performance based building, to prove they meet the requirements.

That's surely only not to do for small-scale projects (mostly dwelling sector).

7.2.6 The Effect on Performance Based Building of Value and Tendering restrictions.

Most public tenders have that they are not permitted to let on other than a lowest capital cost basis. In the public sector procurement, almost only the PPP is performance based, but not without political resistance.

Performance based regulations can make it difficult to assess the proposals of the contractors and to compare one with another. It is not always clear what you can expect from the contractor.

An assessment method should be available which allows to correctly comparing various innovative systems with a consistent treatment of various technologies.

7.2.7 The Effect of Legal and National Jurisdictions upon Performance Based Building.

The rule is still prescriptive tenders, but more and more regulations are performance based (fire safety, thermal comfort, ventilation, protection against noise, integral energy performance, ...)

Generally common law system neither encourages nor discourages PBB.

It's impossible to check out everything about a new approach / material etc., and it would take a very long time to make a full assessment. Under those circumstances the tendency will be to use a tried and trusted approach.

The application of the principle of equivalence (as used in the Netherlands for the EPN) as a measure for correctly assessing innovative approaches, must be covered by a legal framework for proof of compliance. It is intended to set up such system also for the Flemish energy performance regulation.

7.2.8 CASE STUDIES

7.2.8.1 Case Study 1 - Building and construction process of Vlabo - BELGIUM

The method of the Flemish organisation "Vlaanderen Bouwt" (Vlabo) promotes a new building and construction process, a process of designing and producing social dwellings.

It generates and implements a new idea, which enhances overall organisational performance.

Not only the contractor, or the client but also all stakeholders are involved.

Therefore Vlabo uses technical specifications, putted together in a performance-based approach.

Vlaanderen Bouwt vzw

"**V**laanderen **B**ouwt" or "**V**labo": Dutch for 'Flanders builds'. www.vlaanderenbouwt.be

The organisation Vlabo uses these performance-based specifications for the building as a whole and for all the different functional building parts.

Vlabo stimulate the **construction of solid and distinctive dwellings for a reasonably price** with an eye for non-material qualitative elements as good design, organisation of the plans, proportions and orientation.

Vlabo encourages the **collaboration between architect and builder** from the design stage, to become an optimal combining of technique and creativity, with an eye to quality improvement and price controls at the same time.

The scarce building lots need a good **district plan** to use these scarce building lots and expensive infrastructure optimal and to increase the live quality of the individual dwellings due to the higher quality of the environment.

A. Organisation / members

Vlabo is established in 1989.

The members are:

- BBRI,
- Flemish Confederation of the Construction Industry,
- Flemish Federation of the SME's of the Construction Industry,
- Flemish Housing Society,
- Flemish Dwelling Fund,
- Belgian Federation of contractors of wood industry.

B. Functioning

A technical board makes the selection. It exists of expert of Vlabo, the owner, an engineer of BBRI, a sociologist, a representative of the Building Department and a professor of Architecture and Urban development.

The intention is to have 'show houses / flats' in each region of the Flemish country....

During 6 months people can visit each type of dwelling of the show houses / flats.

C. Products

Promotion of new materials

Promotion of new techniques

Promotion of "domotica" houses

Promotion of "ecologic" houses

Promotion of "new architecture"

Vlabo organizes and co-ordinates project mostly consisting of a group of houses / apartments / homes from about 10 to 100 dwellings.

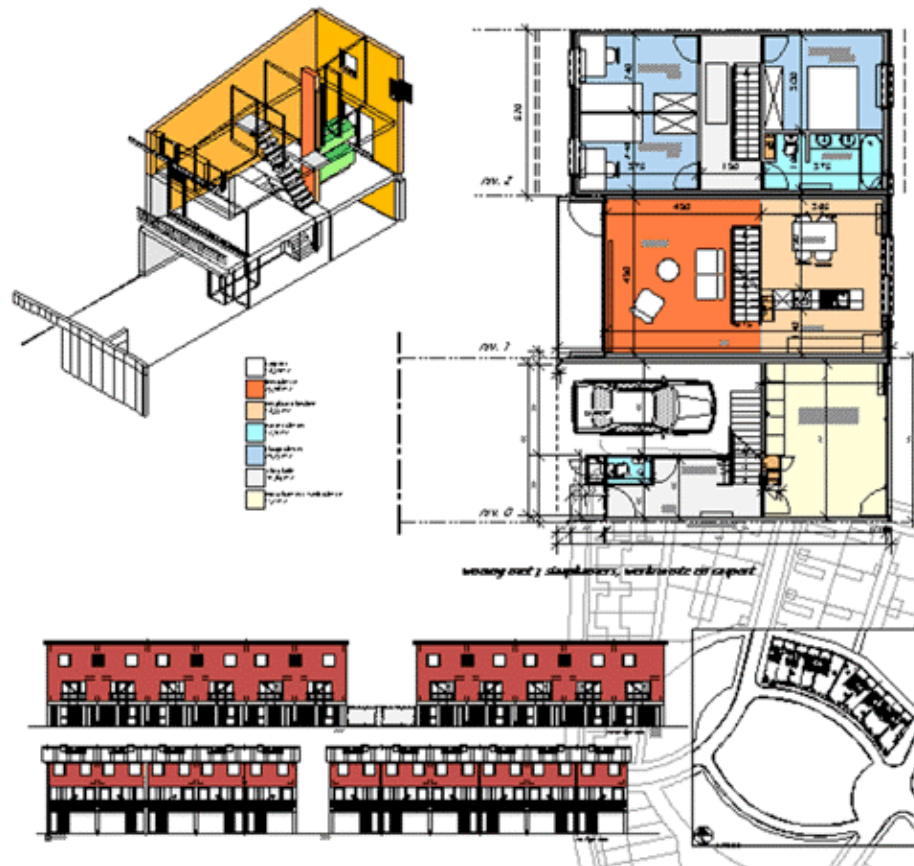
A planner, often with an architect, develops a new "estate" (streets, different area's)

Contractors (builder), in association with his architects, work out the proposals for the dwellings. For the moment 36 contractors give their collaboration.

More than 50 projects are realised. Of these, 6 project concern show houses / flats.

(Most of) the contractors who know the procedures of Vlabo want to collaborate again the next time.

For the project in Londerzeel (92 dwellings) 12 different types of dwellings are chosen from the about 40 submitted proposals.



Stipulation of collaboration between the different partners

1. The owner (proprietor) contact Vlabo for the organisation of the construction of dwellings on his terrain. The co-ordination contract arranges the collaboration.
2. Vlabo provides the district plan (town planning) with roads, infrastructure and building zones. The owner gives building and planting rights to Vlabo.
3. During the realisation of these plan Vlabo informs the collaborating contractors. When they ask for the file, Vlabo send them the file with all the stipulations and modalities of the collaboration.
4. The contractors and their architects send their documents (plans, specifications, tender) in 2 or 3 months to Vlabo.
5. The technical board makes the selection.
6. The owner, the contractor and Vlabo sign a contract taking into account that:
 - The owner gives building and planting rights to the contractor (i.e. during 3 year) to build the dwellings on his terrain
 - The owner commits himself to sell the parcel on the buyer of the dwelling from the contractor
 - The contractor commits himself to build the dwellings in accordance with the file and to sell it for the price of his tender, and to accept the control of Vlabo to the work on the building project
 - Vlabo co-ordinates the initiative and organizes the building technical and legal constructions.
7. The contractor sells their dwellings on their clients. One month before the end of the period of the time of the building and planting rights, the contractor himself buy the parcels for the provided price, when the parcel is not sold.
8. The commissions for Vlabo will be paid by the contractors who received the permission to build.
9. Timing:
 - Design and execution of the roads and infrastructure: 6 month
 - Erection and selling of the dwellings: from 6 month to 1 year.

Selection criteria for dwellings

1. Live quality of the dwellings
 - 1.1. Internal live quality
 - Available space
 - Disposition and division of the plan
 - Functionality and serviceability
 - Orientation in relation to the wind direction, incidence of light, view outside
 - Meet the psychological needs, security, privacy, cheerfulness, and variation.
 - 1.2. External live quality
 - Conception of the environment: terrace, garden
 - Area: street, square, district
 - Relation between interior and environment
 - Relation between dwelling and area
2. Technical quality according to the performance based “Technical Specifications for Social Dwellings” (old version)
 - Sustainable construction
 - Withstand weather conditions
 - Value of the used materials
 - Finishing, workmanship
 - Maintenance facilities (i.e. accessibility to conduits for control and repair; possibility for the occupant to do the maintenance)
 - Maintenance needs
 - Insulation (thermal and acoustic)
 - Use of simply and new technical systems (i.e. recycling materials, means to reduce energy consumption)
3. The price
 - Price as objective fact
 - Relation between price and quality: get a chance at the end of the evaluation.
4. Urban view
 - Implantation in the parcel in relation to the district plan

- Interpretation of the district plan
- Be interwoven with environment and area.

5. Architecture

- Designing (style) as expression of the function
- Designing (style) as expression of construction
- Originality concerning designing
- Simplicity
- Choice of the materials
- Scale
- Good proportions
- General elegant and appeal able appearance
- General stable construction
- Contribution to the overall picture
- Recognizable in homogeneity (variation against monotony and uniformity)
- Degree of realisation of objectives of Vlabo in general
- Use of common sense.

Criteria for the district plan

1. The price

- Estimated price of infrastructure works and environmental works, taking into account that rough draft plans are concerned
- Price control and economical use of means.

2. The live quality

- Orientation in relation to the wind direction, incidence of light, view outside
- Meet the psychological needs, security, privacy, cheerfulness and variation
- Possibilities of communication with the environment
- Conception of the public green and the private green: simplicity and austerity
- Optimal use of the terrain: remain free from characteristic features like different levels, trees, water.

3. Accessibility

- Local traffic concept: right of way to the pedestrians over the mechanical traffic
- Enough parking spaces
- Road / traffic safety

4. Integration in the environment

- Filling-in or connection with the existing buildings
- Street scene
- Construction volumes in relation to the environment
- For social dwellings: integration into varied community life.

Technical Specifications for Social Dwellings in a performance based approach

These specifications are elaborated by BBRI by order of the Ministry of the Flemish community, Housing Department, followed by a technical commission. (December 1987 and revision of November 1989).

The revision and the extension of this document for a project of about 1000 social dwellings is recently finalised. Now we have integrated the 6 essential requirements, given by the EC

(<http://europa.eu.int/comm/enterprise/construction/internal/essreq.htm>)

1. General and specific administrative requirements

For all the requirements the contractor has to prove the requirements are fulfilled.

There are 3 categories:

- Category A: verification in the tender (all the tenderers)
Type solutions, practical guidelines, calculations, technical approval, or reports of tests
- Category B: verification only by the tenderer (tendering firm) who has the job
Type solutions, practical guidelines, calculations, technical approval, reports of tests, prototypes, references in existing buildings, ...

- Category C: verification on request
Type solutions, practical guidelines, calculations, technical approval, reports of tests, prototypes, references in existing buildings, ..., technical documentation.

2. General technical requirements for the building as a whole.

1. Mechanical Resistance and Stability
(Cat. A)
2. Safety in case of Fire:
Fire reaction and fire resistance (Cat. A)
3. Hygiene, Health and the Environment
Dangerous substances and water and damp tightness of the building: (Cat. A)
Air tightness, avoiding of condensation, mould, cold bridges (Cat. B)
4. Safety in Use
Resistance against impacts (Cat. A)
Protection against undesirable access (Cat.B)
5. Protection against Noise
Acoustic qualities: Sound from the outside of the building, sound between rooms of neighbouring buildings, impact sound, noise from installations (Cat B)
6. Energy Economy and Heat Retention
Global level for the thermal insulation (Cat A), temperature factor (Cat B), inner condensation (Cat B)
6. Visual aspects: Appearance of the surfaces (Cat C) [Toc512998358](#)
7. Fitness for use: Ventilation of the rooms (Cat B), ventilation ducts (Cat A), hygiene (Cat B), security against undesirable access (Cat C), incidence of light and view (Cat C)
8. Durability (Cat B)
9. Economy (Cat A)

3. Specific technical requirements for the different functional building parts.

0. Prescriptions for studies, preparatory works and design of the site of the building
1. Substructure
2. Superstructure – primary elements: Walls, floors, stairs, inclined plane, roofs, skeleton
3. Superstructure – secondary elements: Openings in the façades, openings in the inner walls, breastworks and stair handrails, roof lights
4. Superstructure – finishing: For external walls, internal walls, floors and stairs, ceilings, roofs
5. Equipment – drains, conduits, gas distribution
6. Electrical equipment
7. Design / interior (fixed) of a building
8. Design / interior (loose) of a building
9. Construction of the environment

Where relevant the 9 performances (stability, fire safety, tightness, ...) are studied for each of these 9 items. For the classification the first 2 numbers of the Sfb classification is followed.

7.2.8.2 Case Study 2. Domus Flandria - BELGIUM

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...

7.2.8.3 Case Study 3. Public Private Partnership - BELGIUM

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In the second period also private land will be concerned (480 dwellings).

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Since he is the owner during 27 years it is in his interest to build durable construction, to have not too much cost for the maintenance and repair.

The Flemish Confederation of the Construction Industry was convinced that creativity concerning design and concerning realisation of the building project, will lead to lower cost and at the same time to a quality of the same high level as normally expected.

The first call for tenders was in autumn of 2003.

In fact, in springtime of 2004, it became clear that the cost of the tenders are too high ... and the projects were blocked.

What is the reason?

- The fact the tenderer remains the owner during 27 years, with all the uncertainty about the pre-financing?
- 3 months preparation was not enough for submitting a complete dossier.
- The cost for the tender was not paid; that cost was not to recuperate in case of no allocation for the works. (For a tender competition, for each tenderer a own tender with a complete dossier is to make up)

There was (still?) no direct indication the performance based approach itself was the reason for higher cost.

The Flemish gouvernement, in the meantime, has provided for a guarantee fund.
More time for preparing was given.

Article 17 §2 of the law of 24 december 1993 about the governmental orders gave the opportunity to **negotiate** directly about 7 tenders for about 163 dwellings. These negotiations were secret and are reported to the Inspection of Finances and the government.

The criteria were fixed in a study of Ernst & Young (2002 – 2003)

The public allocation was foreseen for end 2004.

The points of the negotiations were:

- to reduce the costs by a better description of the different costs: build cost, management cost, financial cost, maintenance cost, ...
- the volume of the projects, the costs, to spread up over a great number of dwellings

During the negotiations technical advice was given by the 'Service flats Invest NV'.

The Flemish government has planned a steering committee to take lessons from this experiment.

The conclusions end 2004:

- finance unknowns: economic climate; deductible VAT expenses and other fiscal cost; interest risk between tender time and late completion (till 3 years);
- the cost of the preparing of the dossier, when you don't have the commission: 'no cure, no pay'
- in spite of the website for FAQ, a lot of interested people stay with questions.
- more than the half of the tenderers had already worked with the Flemish Society for Social Housing
- the expected life cycle of the building components was given: this was crucial for the Flemish Parliament and the Inspection of Finances to start with the PPP formula and the performance based tender.

At the beginning of 2005 for 3 areas (Gent and Aalst; Tienen en Dilbeek; Wilrijk, Lommel and Izegem) with different locations were selected. (137 + 193 + 109 = 439 dwellings)

For the selection 4 criteria were used: price (45%), quality of the building project (40%), quality of the maintenance (10%) and the erection time (5%)

Per area a different advisory committee gave for the building project (40%) and their maintenance (10%) a qualitative appreciation, apart from the other locations.

Ponderation for these 2 criteria:

- Architecture: 12
- Functionality, comfort and materials: 12
- Technical dossier and materials: 10
- Ecology, sustainable building and lifetime dwelling: 6

Because of the budget limits only 238 dwellings, spread over 2 of the 3 areas are contracted out to one private partner (association of a contractor and a bank).

All the dwellings are so committed to one tenderer in the light of cost (to spread up over a great number of dwellings).

The architecture was "sacrificed". Since these contractor worked with different architects and because of the "must" of the total volume of the projects, the good and the not so good projects are selected of one tenderer....

The government is happy with the result:

- an extra of 238 social dwellings can be built in addition to the regular building projects of the government

- the total cost is spread over a long time.

7.2.8.4 Case Study 4. Flemish Society for Social Housing

7.2.8.5 (Vlaamse HuisvestingsMaatschappij).

7.2.8.6 LIST OF TERMS

7.3 Annex 3: Country Report: Denmark

7.3.1 Procurement in the Danish Building and Housing Cluster

Kim Haugbølle

Title Procurement in the Danish Building and Housing Cluster

Subtitle

Serial title

Edition First edition

Year 2005

Author Kim Haugbølle

Editor

Language English

Pages

References

Key words Performance approach, building/housing cluster, building regulation, contracting, liability

ISBN

ISSN

Price

Word processing

Drawings Kim Haugbølle

Photos Kim Haugbølle

Cover

Printer

Publisher SBi, Statens Byggeforskningsinstitut

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Extracts may be reproduced but only with reference to source: Haugbølle, K. (2005). Procurement in the Danish Building and Housing Cluster. In: Fenn, P., Haugbølle, K. & Morse, T. (2005, eds.). Legal and Procurement Practices – PeBBu Domain 6. Final Domain Report. Rotterdam: CIB. www.cibworld.nl

7.3.2 Preface

This paper has been prepared for the network of excellence “PeBBu” (Performance Based Building). The network is partly funded by the European Commission. The paper is part of the domain report to be published from Domain 6 on “Legal and Procurement Practices in Building and Construction”.

The author wishes to thank the members of the PeBBu Domain 6 network for valuable discussions and especially the domain leaders Timothy Morse and Peter Fenn, University of Manchester (UMIST) for their encouragement and enthusiasm.

Hørsholm, August 2005

Kim Haugbølle
Head of Department for Process and Innovation

7.3.2.1 Introduction

The built environment plays an important role for both quality of life and competitiveness. Buildings and constructions shape the built environment in numerous ways. The way buildings and services are procured during planning, construction and operation may significantly influence the end result. Thus, it is paramount to collect and exchange experiences on procurement across different contexts. In this paper, Danish experiences with procurement will be addressed.

7.3.2.2 The building stock

Denmark is a densely populated country with a population of about 5.4 million people scattered over 43,000 km². The country is highly urbanised with more than 80 % of the population living in urban areas. Every Dane from infancy to old age can make use of about 115 m² on average, 55 m² of which is residential area only.

Table 2 shows the distribution of different building types in Denmark in m² excluding cellars, which account for another 10 % (59 million m² in 2004). Residential buildings account for far the largest share of the building stock closely followed by production facilities. The majority of production facilities (around 130 million m²) is however non-residential farm buildings mostly used for animal husbandry, especially pig breeding.

Table 2. The building stock in Denmark, 1989-2004. 1,000 m² excluding cellars.

	1989	1994	1999	2004
Residential buildings	258,697	268,958	279,317	292,261
Production facilities	173,396	182,480	185,830	191,345
Transport and trade	52,813	58,701	62,121	67,201
Welfare institutions	28,560	30,191	32,242	34,102
Recreational purposes	21,397	22,964	24,496	25,819
Unknown	21	0	0	0
Sum	534,884	563,294	584,006	610,728

Source: www.statbank.dk.

The building stock grows by roughly 1 % annually. The growth is however unevenly distributed. The largest increase in percentage can be found within transport and trade, recreational purposes, and welfare institutions. The largest increase in m² can be found within residential buildings and production facilities.

7.3.2.3 Procurement in a changing environment

The changes of the building process are reflected in and reflect changes in the procurement of buildings and constructions. Looking at the building process in a longer time perspective may illuminate some of the changes that have occurred in the past decades and the challenges facing the procurement of buildings. The building process has undergone significant changes along four lines:

- Process: The conventional picture of the building process as a sequence of phases (brief, design and construction) is being challenged. Increasingly, a value-chain perspective is applied thereby introducing other processes like the client's business processes, the planning process, operation, maintenance and demolition.
- Actors: New actors like facilities managers have entered the building process. Others have had their roles redefined. Today, contractors or manufacturers often carry out much of the detailed design.
- Issues: A number of new issues like accessibility and sustainability have emerged or are emerging as new requirements.
- Products: Manufacturers have constantly introduced a wide range of new products. Furthermore the Construction Products Directive is likely to impact on the quality and availability of products.

Procurement of buildings and constructions is basically a complex task and an uncertain endeavour for the client. There is an inherent and often large uncertainty linked to planning, production and operation of buildings. Contrary to many other industries, the customer is usually not just purchasing or buying an end-product but is more or less actively involved in designing the end-product. This process of procurement may be more or less prescriptive or performance-based.

7.3.2.4 Performance-based building

The issue of performance-based building is not new in Denmark or internationally (CIB, 1975 & 1976). Largely on the initiative of the managing directors of the four Nordic building research institutes, the CIB Working Commission W60 was established in 1970. The CIB Working Commission W60 defined the performance approach in building as follows:

"The performance approach is, first and foremost, the practice of thinking and working in terms of ends rather than means. It is concerned with what a building or building product is required to do, and not with prescribing how it is to be constructed." (Gibson ed., 1982: 4).

In the following years, a number of articles on the performance concept was published. In 1974, the Danish Building Research Institute issued the SBI Directions 94 on the why's and how's of the performance concept including the first performance-based specifications of requirements for non load-bearing internal walls and windows (Blach & Christensen, 1974). Under the leadership of E. J. Gibson, the CIB Working Commission W60 published a number of reports on the performance concept and its terminology (CIB, 1975), application (Gibson ed., 1975), criteria setting (Gibson ed., 1977), test methods (Gibson ed., 1979) and significance of performance requirements (Gibson ed., 1981).

It was expected that prescriptive specifications would largely be replaced by performance-based specifications when the necessary fund of scientific knowledge was available (see e.g. Gibson ed., 1982). Thus, performance-based building has in many respects been asserted to be the seventh wonder to improve innovation, achieve good quality and reduce cost in building. But progress has not been as fast and pervasive as hoped for. Thus, CIB initiated a European network of excellence on performance-based building in 2001.

7.3.2.5 Setting the context

7.3.2.6 Actors and markets in the building/housing cluster

A number of policy studies have analysed the challenges facing the Danish building/housing cluster. These studies include e.g. the resource area analyses (Danish Agency for Trade and Industry, 1993 & 2000), the development programme Project House (Bertelsen, 2000) and a number of governmental policy reports e.g. the Building Policy Task Force (Byggepolitisk Task Force, 2000). Most of these studies have been shaped more or less directly by the pioneering work of Michael E. Porter on the competitive advantage of nations and regions (see e.g. Porter, 1990). Although Porter's original diamond model of determinants of competitive advantage has been partly abandoned, the focus on clusters has prevailed. Instead, the Danish analyses of the building/housing cluster have turned towards more actor-oriented analyses focusing on the value chain. Figure 5 synthesises the analytical framework employed in a number of Danish studies of the building/housing cluster.

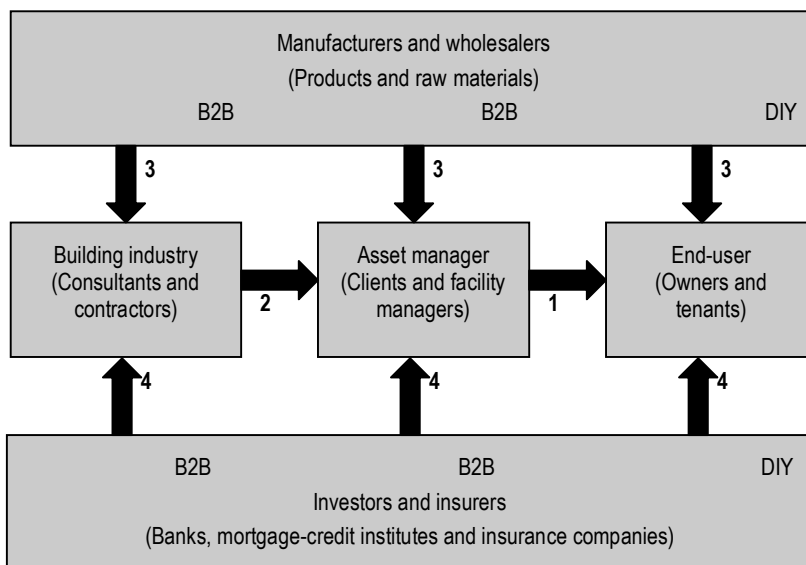


Figure 5. Overview of the context.

Note: B2B = Business-to-Business (professional). DIY = Do-It-Yourself (non-professional).

The framework provides us with an overview of the *context* in which the actors of the building process have to operate. Framed by governmental regulation and the knowledge system, the building/housing cluster can be divided into five subcategories of actors linked through four separate markets. The five groups of actors are:

- The end-users consisting of e.g. tenants in the social housing sector, office employees, and owners of single-family houses.
- The asset managers of private, public and semi-public organisations like social housing associations running existing facilities and acting as clients of new buildings and refurbishment.
- The building industry consisting of consultants like planners, engineers, architects etc. and contractors.
- The manufacturers including wholesalers of construction products and raw materials.
- The investors and insurers consisting of banks, credit-mortgage institutes and insurance companies.

Each of the subcategories of actors is in principle linked through four separate markets of services and products. The four markets are:

- 1. A property market between end-users and asset managers.
- 2. A building market between asset managers and the building industry.
- 3. A product market between manufacturers and the building industry, asset managers and end-users.

- 4. A capital and insurance market between investors and insurers on the one hand and the end-users, asset managers and building industry on the other hand.

7.3.2.7 Economic importance

A cluster or resource area is defined as all the branches (both public and private) that participate in the production of closely related end-products. The building and housing cluster¹ in Denmark is predominantly a home-based industry except for manufacturers of building products especially and consultants. In 2001, the resource area employed about 314,000 people in around 64,000 firms. The total turnover of the cluster was ca. 409 billion DKK (55 billion EUR), 46 billion DKK (6.5 billion EUR) of which were exported primarily to close-by neighbouring countries like Germany and Sweden (Statistics Denmark, 2003). Thus, the building and housing cluster is one of the largest clusters in Denmark (see Table 3).

Table 3. Overview over clusters in Denmark, 2001.

Cluster	Firms	Full-time employees	Turnover (million DKK)	Export (million DKK)
Food	63,951	202,711	533,866	101,360
Furniture/clothing	11,366	61,623	100,992	33,375
Tourism	10,768	35,534	26,317	86
Building/housing	64,036	31,067	408,573	46,163
IT/communication	19,780	181,003	330,256	60,257
Transport	25,360	207,121	387,818	123,744
Energy/environment	1,968	40,601	146,903	54,278
Medico/health	13,958	56,260	101,590	40,199
Others	49,831	221,651	320,600	60,090
Sum	261,018	1,319,571	2,356,914	519,551

Source: (Statistics Denmark, 2003).

Note: The statistics are not complete, since a number of firms are not obliged to publish turnover and export.

7.3.2.8 A cluster in flux

The building and housing cluster is generally characterised by many small firms with a few large companies, but the industrial structure is under considerable change in present years (Bonke & Kristiansen, 2001):

- Clients are spread widely on numerous decentralised and autonomous actors.
- Since the late 1980s, consulting engineers have undergone a strong polarisation between three (also internationally speaking) large companies and a number of small local or specialised firms.
- Architects are at present undergoing the same transformation although company size is more limited compared with that of engineers.
- Contractors are at present being concentrated on a few large Nordic contractors through mergers and acquisitions.

¹ The resource area is statistically defined as the sum of four main groups: Primary industries (NACE 0201, 1411-1413, 1421-22 and 1450), manufacturing industries (NACE 1753, 2010, 2030, 2051, 2124, 2416, 2430 2462, 2521, 2523, 2611-12, 2614-15, 2622-24, 2626, 2630, 2640, 2651-53, 2661-65, 2670, 2681-82, 2721, 2744, 2811-12, 2822, 2862-63, 2873-74, 2913, 2921, 2923, 3120 and 3613), supporting industries (NACE 2952, 4550 and 7132), and service industries (NACE 0202, 4511-12, 4521-22, 4525, 4531-33, 4541-45, 5113, 5153-54, 5162, 5246, 7011-12, 7020, 7031-32, 7420 and 7470).

- To a smaller extent technical contractors (electricians and plumbers) are also concentrating.
- For a number of construction products like cement and installations, one or very few companies dominate manufacturing and wholesale of construction products.
- Trade unions and trade associations are also being restructured through mergers.
- In the past 10 years, banks have grown considerably through mergers and acquisitions on a Nordic scale. Lately, a second trend has emerged with the widespread mergers of banks, mortgage-credit institutes and insurance companies.

Despite the current changes taking place, the building process in Denmark is still dominated mostly by professionals, notably architects and consulting engineers. Thus, the Danish building process has more in common with the British building process with its emphasis on consultants and cost-control than with the French building process with its emphasis on contractors and cost-reduction. To echo Winch & Campagnac (1995) and Winch (2000), the Danish building and housing cluster can be characterised more as a professional system than as an industrialised system.

7.3.2.9 Regulatory framework

The cornerstone of the Danish regulatory framework governing building is a performance-based building legislation divided into three layers:

- The Building Act.
- Building Regulations (BR 95) and Building Regulations for Small Dwellings (BR-S 98).
- SBi Directions describing various ways of complying with the regulation. The Danish Building Research Institute issues these directions.

However, several other types of legislation are relevant when building in Denmark e.g. the Planning Act, the Act on the Preservation of Ancient Buildings, and the Working Environment Act.

7.3.2.10 The Building Act

The Building Act (Order no. 452 of 24 June 1998) with subsequent amendments (Act no. 228 of 31 March 2001) is fully performance-based. The Building Act delegates authority to the Minister for Economic and Business Affairs to issue building regulations dealing with more detailed administrative and technical provisions (see below).

The Building Act covers new buildings, extensions to buildings, conversion of and other alterations to buildings and any changes in the use of buildings that are significant, and demolition. The purpose of the Building Act is to:

- Ensure that a building is built and furnished in such a way that it provides sufficient security with respect to fire, safety and health.
- Ensure that buildings and surroundings are given a reasonable quality with respect to their intended use and are maintained properly.
- Advance accessibility.
- Advance architectural quality.
- Promote actions to increase productivity.
- Promote actions to avoid unnecessary resource consumption in buildings.
- Promote actions to prevent unnecessary consumption of raw materials in buildings.

The Building Act contains a number of administrative provisions. One of the most important provisions states under which circumstances a building permit is needed in order to commence building work. The building legislation distinguishes between three separate situations:

- Building works for which permission and notifications are not required e.g. buildings smaller than 10 m².

- Notification of building works e.g. garages with a maximum area of 50 m². If the local authority has not reacted within four weeks of receiving the notification, the building works may commence.
- In all other cases, a building permit is needed.

The Building Act stipulates that the local authority may demand any information and drawings it may need in order to grant a building permit. A building permit may be divided into sub-permits. A permit will usually lapse if the work is not commenced within one year of the date of issue of the permit.

The Building Act also stipulates that buildings for which a building permit is required must not be taken into use without a building use permit from the local authority. The local authority makes sure that the Building Act and other regulations drawn up in pursuance of this Act are observed.

The Building Act stipulates that penalty by fining shall be imposed on any person who:

- Commences building works, takes building works into use or otherwise initiates measures without obtaining permission as prescribed or who carries out building works or other measures for which prior permission is required in other manner than permitted by the authority in question.
- Disregards conditions laid down in the permit.
- Fails to comply with an injunction or prohibition.
- Fails to carry out maintenance works that are needed to avoid danger to a building's occupants or others.

7.3.2.11 Building Regulations

The building regulations are divided into two set of regulations. One set covers small buildings or dwellings BR-S 98 (Danish Ministry of Housing and Urban Affairs, 1998), while the other covers all other types of buildings including multi-storey residential buildings BR 95 (Danish Housing and Building Agency, 1995). In the following, reference will be made only to BR 95.

The first national building regulations (except for Copenhagen and Frederiksberg) came into existence in 1961. The building regulations have successively been revised every 5-10 years. Thus, new building regulations for all types of buildings were issued in 1966, 1972, 1977, 1982 and 1995. New building regulations are to be issued in 2007. Until then a number of additional provisions have been issued.

The current Building Regulations BR 95 contain administrative and technical requirements on the following subjects:

- Administrative provisions.
- Utilisation of the site.
- Heights and distances.
- Arrangements of buildings.
- Design and construction.
- Fire safety.
- Resistance to moisture.
- Thermal insulation.
- Resistance to the passage of sound.
- Heat producing appliances and chimneys.
- Indoor climate.
- Services.
- Farm buildings and similar, and wind turbines.

Furthermore, the existing BR 95 contains four appendices:

- Approval scheme for graduate engineers.
- Order on design and arrangement of permanent workplaces issued by the Ministry of Labour (Order no. 1163 of 16 December 1992).
- Fire safety examples.
- Measurement of sound insulation in buildings and of building elements.

In order to give an impression of the way the Building Regulations are worked out, the following will use “Part 4: Arrangement of buildings” as an example. Each chapter in the Building Regulations will begin by stating the targets to be met:

“4.1. (1) Buildings shall be designed and arranged so that, having regard to their use, satisfactory conditions are achieved for everyone with respect to safety, health, accessibility and use, and for cleaning and maintenance.” (Danish Housing and Building Agency, 1995: 41).

In many cases, the commentary of the Building Regulations will point to various sources of information for recommendations of approved ways to comply with them. The commentary will for example refer to SBi Directions, recommendations or standards set by Danish Standard or circulars from the National Building and Housing Agency. It may also refer to Orders from other ministries especially the Ministry of Labour.

The Building Regulations stipulate minimum requirements. In some cases, the minimum requirements are optional if no other regulation takes precedence for example with regard to heights and distances in a local plan or town planning by-law. The minimum requirements may be both very detailed and quantitative indeed. For example regarding access conditions:

“4.2.1(2) At entrance doors there must be level access to units on the ground floor of buildings and to any lifts. Immediately outside the entrance door there must be a horizontal landing level with the floor inside. The landing shall be at least 1.5 m x 1.5 m measured from the hinged side of the door. If the door opens outwards, the width shall be increased by 0.2 m along the facade of the building. Any differences in level between landing and ground shall be adjusted in the access area or by means of a ramp.” (Danish Housing and Building Agency, 1995: 42).

In general, the Building Regulations are primarily performance-based and do not specify solutions (except, until recently, with regard to fire regulations). However, you can find a few examples of provisions that directly specify concrete solutions. Below is a provision that directly specifies the use of lifts in multi-storey buildings:

“4.2.1(3) In buildings with 2 or more floors (buildings with 2 floors above ground level) at least one lift that can serve every floor shall be installed. This provision goes into effect on 1 April 1996.” (Danish Housing and Building Agency, 1995: 42).

In the Building Regulations you may also find examples of solutions not to be used. For example no pipes are allowed through the floor in the wet part of wet rooms due to poor performance of known practices.

The Building Regulations also contain a number of definitions of measurement for example of horizontal distances, sound etc.

In conclusion, the Building Regulations are generally speaking performance-based but may also set out very detailed minimum requirements to be met. The Building Regulations also exhibit a very limited number of examples of specific solutions or non-solutions.

7.3.2.12 SBi Directions

The third element in the performance concept in Denmark is the SBi Directions along with other codified knowledge sources like the BYG-ERFA Data Sheets. The SBi Directions are not mandatory, but clients, consultants, contractors etc. will in most cases follow the directions.

The SBi Directions can be grouped into four main groupings. The first group of SBi Directions describes specifications and solutions that are recognised as complying with the requirements stipulated in the Building Regulations. The specifications and solutions are based on extensive laboratory testing and experiences from among others the two Building Defects Funds. An example is SBi Direction 200 on wet rooms (Brandt, 2001).

The second group of SBi Directions describes various testing methods for verifying if buildings satisfy the requirements stipulated in the Danish Building Regulations. The testing methods may describe

various procedures, instruments and inspections for example regarding measurement of sound or moisture. An example is SBi Direction 204 on investigation and assessment of moisture and mould growth in buildings (Valbjørn, 2003).

The third group of SBi Directions describes various methods for calculation and simulation. The SBi Directions will often include paper-based forms to do the calculations by hand, but in some cases the Danish Building Research Institute has also developed software like BSim and BEAT to do the calculations or simulations as well. An example is SBi Direction 210 on calculation and design of timber structures (Larsen & Riberholt, 2005).

The fourth group of SBi Directions contains handbooks or guidelines. This group of SBi Directions may describe procedures, checklists etc. to be used for planning and executing building works. An example is the SBi Direction 191 on building logistics (Clausen et al., 1996).

7.3.2.13 Procurement

This chapter will deal with the procurement methods in Denmark and the liabilities of consultants and contractors according to the agreed documents on general conditions customarily used for contracting in Denmark.

7.3.2.14 Procurement methods

Procurement can take place along different paths and include different forms of contractual and functional relations:

- Traditional/separate trades contracting.
- Main/general contracting.
- Design-build contracting.
- Partnering.

7.3.2.15 Traditional/separate trades contracting

Up till the beginning of the 1960s, traditional or separate trades contracting was the dominating organisational set-up of building projects². In traditional contracting the client or his representative (often an architect or a consulting engineer) is responsible for coordinating each of the individual trades. Each contractor as well as each consultant holds a contract directly with the client (see Figure 6). Each contractor and each consultant may in turn have separate contracts with subcontractors or subconsultants.

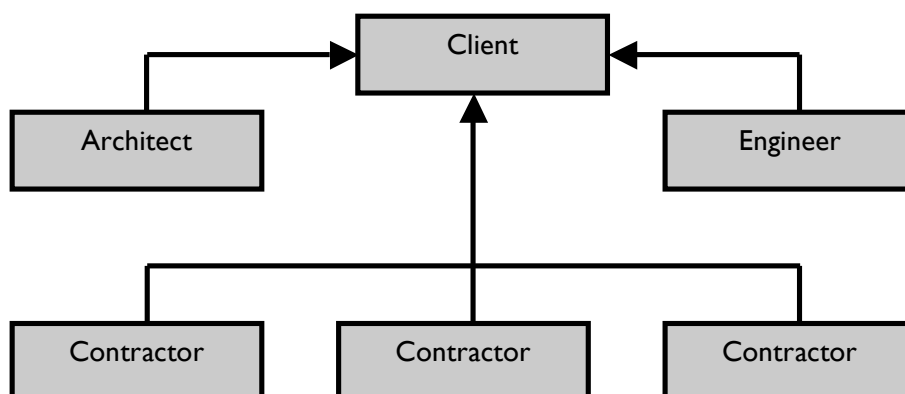


Figure 6. Traditional/separate trades contracting.

² This chapter is based primarily on Levring & Bonke (1996).

Traditional contracting allows the client to have significant and direct influence on the outcome, because the client is involved in most decisions regarding design and materials. However, the traditional contract is also very demanding because it requires the most detailed planning and project design. Thus, in many cases the client will delegate responsibility to his consultants to deal with issues related to design and management. Functionally, contractors will therefore communicate with the consultants and not directly with the client.

7.3.2.16 Main/general contracting

From around 1960 and onwards, main or general contracting became a prominent procurement method³. General contracting was a response to an increasing need for clearer communication and division of responsibility between client and contractors. Furthermore, industrialisation expanded the role of general contractors at the expense of certain trades like bricklayers.

In general contracting, the client is responsible for the design and overall planning, while the main or general contractor is responsible for coordinating each of the subcontractors or individual trades. Only the consultants and the main contractor hold a contract directly with the client. The main contractor carries all responsibility for the work done by subcontractors. Thus, the main contractor must formally deal with all legal, technical and managerial issues (see Figure 7). Each subcontractor and each consultant may in turn have separate contracts with subcontractors or subconsultants.

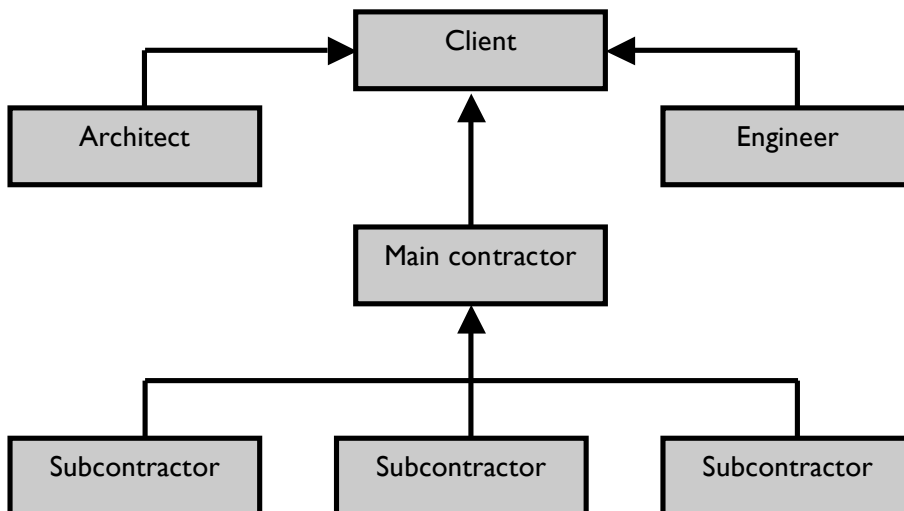


Figure7. Main / General Contracting

General contracting allows the client to exercise quite a strong influence because the client is involved in the major decisions regarding design and materials. However, general contracting is also very demanding because it requires quite detailed planning and a detailed project design before tendering. Thus, in many cases the client will delegate responsibility to his consultants to deal with issues related to design and supervision during execution. Functionally, the main contractor will therefore in many cases communicate with the consultants acting on behalf of the client.

7.3.2.17 Design-build contracting

With design-build contracting the client leaves maximum responsibility to the design-build contractor⁴. In design-build contracting the contractor carries all responsibility for design, construction and management.

³ This chapter is based primarily on Levring & Bonke (1996).

⁴ This chapter is based primarily on Levring & Bonke (1996).

The design-build contractor will often hire consultants like architects and consulting engineers to do the design, but the design will be strongly influenced by the contractor's experience of buildability. Each subcontractor and each consultant may in turn have separate contracts with subcontractors or subconsultants (see Figure 8).

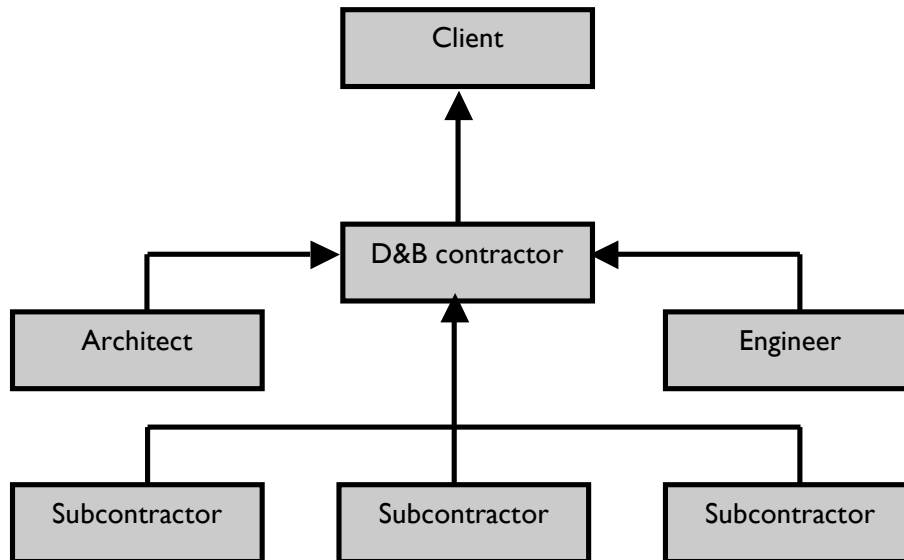


Figure 8. Design-build contracting.

Design-build contracting is the least demanding procurement method for the client. The client will only have to specify the overall functionality, level of quality, milestones for the project etc. However, the client must be able to analyse the tender proposals. Thus, clients may have to hire consultants or advisors to analyse the proposals and see to it that the requirements are being met during construction.

Seen from the perspective of a client, design-build contracting is the simplest procurement method since the client has only one contractual relation to attend to. But design-build contracting gives the client only minimum influence on the project. In order to maintain some sort of control over the project while at the same time harvesting the benefits of design-build contracting, some clients have in recent years introduced “controlled design-build contracting”. That is, the client specifies in the tender documents that the consultants initially hired by the client to prepare the tender have to be taken over by the design-build contractor for the detailed design.

7.3.2.18 Partnering as a new trend

Since the beginning of the 1990s, a number of development initiatives have aimed at improving productivity and quality in building through process development. The shortcomings of the conventional methods for procurement had highlighted the need for an integrated approach towards design and construction of buildings. In the past 10 years, a number of different partnering schemes have appeared along the conventional methods of procurement. Although the term partnering did not enter the vocabulary until the late 1990s, it was especially the public development programme Process and Product Development in Building running from 1994 to 2002 that increased focus on process development and functional integration of design and construction. The programme along with other experiments during the 1990s included a wide range of new production concepts and forms of cooperation like lean construction, partnering, value management and workshop design. Despite their differences in scope etc. the experiments share an ambition of integrating the value chain across professional boundaries including closer and more substantial collaboration with the client.

These experiments and initiatives marked the start of the hybrid practice of design-build contracting. The client hires an architect and engineer for the overall design, and at an early stage of the project it is tendered. The intention has been to integrate designers and contractors in the design team in order to maintain the client's direct influence on the project through his consultants as well as utilise the experiences of the contractor. A number of architects and engineers from e.g. the PPB consortia have however complained that the vertical/horizontal integration is just design-build contracting in disguise and favours large contractors. Thus, the Danish one-liner "partnering eller partering" (translates into partnering or cannibalism) became a widespread epitome for the early discussions on integrated teams. In response, the trade associations for architects, consulting engineers, and small contractors together issued a guideline on an alternative procurement method: Early tendering in traditional contracting (BYG, F.R.I & PAR, 2000). Shortly after, the five major trade associations for small and large contractors, consulting engineers, architects and clients issued a common guideline on partnering in 2001 (BYG, BiD, the Danish Contractors' Association, FRI & PAR, 2001).

On 1 January 2004, a new amendment came into force (Order no. 1135 of 15 December 2003). The amendment makes it mandatory for governmental building agencies to systematically analyse and assess if partnering is an appropriate procurement method for a building project. The amendment has been followed by a guideline on partnering (National Agency for Enterprise and Housing, 2004). The guideline defines partnering:

"The term "partnering" is used regarding cooperation in a building or construction project, that is based on dialogue, trust, openness and early involvement of all parties. The project is carried out with collective goals formulated through joint activities and based on shared economic objectives."
(National Agency for Enterprise and Housing, 2004: 9).

The guideline differentiates between two forms of partnering "early partnering" or "late partnering". In early partnering, contractors will be involved before the client and his consultants have drafted a proposal. In late partnering, the client and his consultants have drafted a preliminary project.

According to the guidelines, experience suggests that the client will gain from partnering. Procurement by partnering may:

- Optimise the end-result regarding architecture, cost etc.
- Provide better management of cost, time and quality.
- Identify and reduce risk.
- Create better understanding of the project by all participants.
- Reduce conflicts and solve disagreements via dialogue.

Some of the disadvantages for the client are higher cost due to more active involvement, uncertainty regarding the competitiveness of the tenders, and contractors' possible lack of expertise in specialised technical fields.

In all known examples of partnering in Denmark, the partnering agreement is drafted on top of the conventional methods of procurement. Although the conventional methods of procurement are used, contracts following the general conditions ABR 89 (consulting services), AB 92 (provision of works and supplies within building and engineering) and ABT 93 (turnkey contracts) may need some adjustments. It is therefore more appropriate to address partnering as a new way of cooperation and coordination of building works rather than label partnering as a new procurement method.

7.3.2.19 Tendering, contracts and liabilities

Although practice differs, tendering will normally include five types of documents:

- General conditions describing the legal conditions for the work. Usually the general conditions will refer to the agreed documents described below.
- Special conditions describe various exemptions from the agreed documents, but may also hold certain special technical specifications.

- Technical descriptions and specifications of the end-result and work to be done.
- Drawings.
- Appendices like time plans etc.

The documents will be held together by a general document referring to all the relevant documents. The documents will be referred to in prioritised order. That is important in case different conditions conflict.

Like the rest of the member states of the European Union, the European Directive on Procurement of Public Service, Public Supply and Public Works has been adopted as national legislation (Directive 2004/18/EF).

In Denmark, contracts and agreements are generally drafted according to the general conditions described in ABR 89 (consulting services), AB 92 (provision of works and supplies), and ABT 93 (turnkey contracts). ABR 89, AB 92 and ABT 93 are agreed documents acceded to by the government, the local authorities, the regional authorities and all relevant parties of the building process. Any client (or employer) within the private sector is free to make whatever agreement he wishes, but public clients are obliged to follow the agreed documents and only diverge from the agreed documents in extraordinary circumstances. It should be noted that the agreed documents do not only treat liabilities but also set out provisions regarding rights and duties, securities, conflict resolution procedures etc.

7.3.2.20 *Liability of consultants*

Regarding consultants, ABR 89 (National Building Agency & Danish Association of Consulting Engineers, 1989) outlines the general conditions governing consulting services and in the following references will be made only to ABR 89 which deals with two types of liabilities:

- Liability for exceeding time limits.
- Liability for errors and negligence.

If the consultant exceeds time limits without a justifiable claim for extension of the time limit, the contract can stipulate a penalty that the consultant shall pay to the client. Similarly, the client is bound to cover losses of the consultant in the event that the client exceeds time limits. In case a penalty has been agreed upon, the client shall forward a claim in writing for payment of the penalty within 30 days of the date on which the work should have been performed.

The provisions on liabilities due to errors or negligence are more complicated. Generally, the consultant is liable under the provisions of Danish law concerning compensation for errors and negligence in the performance of the assignment. The exact interpretation is left to arbitration-court and the law-courts. In the commentary, it is stressed:

“– that the consultant shall be liable for damage occurring in connection with work assumed by him when such damage is the result of a lack of the necessary professional skill or care on the part of the consultant or his employees, and

– that the consultant cannot thus be held liable for damage arising from conditions which cannot be considered generally known in professional circles, for accidental damages, or for errors committed by the client or by others engaged by the latter.” (National Building Agency & Danish Association of Consulting Engineers, 1989: 19).

The amount of consultant's liability and the insurance coverage for the liability is left to be agreed upon between the client and the consultant. The liability of the consultant ceases 5 years after the handing-over of the building or the works in which the error or the negligence occurs. If the client fails to submit a complaint in writing to the consultant as soon as he becomes, or ought to have become, aware of the possible liability, the client shall forfeit his right to raise a claim against the consultant.

Where the consultant shares liability with one or more other parties, the consultant shall be liable only for that part of the client's loss that corresponds to the share of the total guilt attributable to the consultant. Thus, contrary to general practice in Danish law governing joint and several liability for the

losses of the injured party, ABR 89 introduces a pro rata liability. This provision does however not apply where total-consultancy is concerned.

If a consultant has agreed to supervise work on behalf of the client, the consultant is only liable for the loss that the client may incur as a result of the consultant's not raising a complaint at the proper time. Unless otherwise stated, the liability of the consultant is limited to DKK 2.5 million. The same provision applies for inspections like e.g. energy audits carried out by a consultant.

According to ABR 89, a greater degree of liability can not be brought against the employees of the consultant than that which can be brought against the consultant.

7.3.2.21 Liability of contractors

Regarding contractors, AB 92 (Danish Ministry of Housing, 1992) outlines the general conditions governing the provision of works and supplies within building and engineering. In the following reference will be made only to AB 92 which deals with two types of liabilities:

- Liability for exceeding time limits.
- Liability for defects.

The contractor's liability in case of delays is stated in § 25:

"§ 25. Delays which do not entitle the contractor to an extension of time limits shall be considered the liability of the contractor.

Subs. 2. Where provisions have been made for liquidated damages or other special penalties, no additional claims arising out of delays can be made in excess thereof.

Subs. 3. Where no provisions have been made for liquidated damages or other special penalties, the loss suffered by the employer shall be assessed in accordance with the general provisions of Danish legislation on compensation." (Danish Ministry of Housing, 1992: 7).

According to AB 92 the contractor is entitled to extensions of time limits in case of delays of work caused by:

- Alterations of the work ordered by the employer.
- Circumstances relating to the employer or delay on the part of another contractor.
- Circumstances for which the contractor can not be blamed and which are outside his control (force majeure).
- Weather conditions that prevent or delay the work because they are heavier than usual for the season and region concerned.
- Public orders or bans which were not issued because of the contractor's own situation.

Regarding liability for defects, AB 92 states on the concept of defects:

"§ 30. If the work has not been performed in accordance with the contract, with due professional care and skill or in accordance with any instructions given by the employer under § 15, it shall be deemed to be defective. The same shall apply whenever the contractor has failed to provide other services agreed upon in relation to the work.

Subs. 2. If the materials are not the agreed materials or are not of a general, good quality, cf. § 10, subs. 1, they shall be taken to be defective. However, this provision shall not apply

(1) where, in case of a free choice of materials, the contractors substantiates that the materials stipulated in the contract do not exist or are not procurable because of war, import bans, etc., or,

(2) where, in case the employer has ordered the use of specific materials, the contractor substantiates that it is impossible to procure such materials in the stipulated condition due to circumstances which, at the conclusion of the contract, the contractor ought not to have foreseen.

In case of (1) and (2), the contractor must as soon as possible notify the employer of the actual or possible occurrence of obstacles, cf. § 15.

Subs. 3. The work must in any case possess such properties as are guaranteed by the contract.

Subs. 4. The time of handing-over shall be decisive for the establishment of defective work, whether the defects can be established at this point or are hidden." (Danish Ministry of Housing, 1992: 9).

The contractor has an obligation and a right to rectify any defects discovered during handing-over. This obligation and right stands for 5 years. The employer has a right to have the work rectified by another contractor if the rectification does not take place in due time, or the employer may have the contract sum reduced.

The contractor's liability for consequential damage is determined in § 35:

"§ 35. The contractor shall be liable for compensation for losses suffered due to defects in the work, where such defects are caused by errors or negligence on the part of the contractor, or where they relate to properties the presence of which has been guaranteed in the contract.

Subs. 2. The contractor shall not be liable for operational losses, loss of profit or other indirect losses. (Danish Ministry of Housing, 1992: 10).

In opposition to the general Danish legislation, which stipulates a 20-year liability, cessation of the liability for defects takes place 5 years after the handing-over for building works and attendant engineering works. Exceptions are if the contractor has extended the period of his liability, it is established during handing-over that the agreed quality assurance measures have failed materially, or the contractor has acted in gross recklessness.

The provisions on turnkey contracts or design-build set out in ABT 93 (Danish Ministry of Housing, 1993) largely follows the general conditions for the provision of works and supplies within building and engineering (AB 92).

7.3.3 Axel Heides Gård – a case study

7.3.3.1 Integration in the Øresund region

In 1991, the Danish and Swedish parliaments signed an agreement to establish a bridge between Malmö in Sweden and Copenhagen in Denmark. As the Øresund Bridge was opened on 1 July 2000, an important precondition for an increased integration of the Øresund Region was put in place. On behalf of the Danish and Swedish governments two parallel and similar building projects in Copenhagen and Malmö were studied by a joint Danish/Swedish research team in order to identify differences and similarities of building in the two countries. Here only the Danish case Axel Heides Gård in the planning and design phases will be presented.

7.3.3.2 Unique location – attractive but understated estate

Axel Heides Gård has a unique location in Havnestaden in the heart of Copenhagen and with immediate proximity to both the harbour and the huge recreational area of Amager Fælled – a preserved area. Havnestaden used to be a heavy industrial facility, but the facility closed down and Havnestaden is now under complete regeneration as a new uptown area of mixed use for light services and dwellings.

The building project Axel Heides Gård was developed by Kuben, which is one of the largest and most experienced private developers in Denmark. Kuben employs around 160 people and its services include development of building projects, client services and facility management. The company has more than 30 years' experience of building homes for people. Kuben is a non-profit organisation owned by two non-profit foundations, but it is not a social housing association.

The ambitions of Kuben for Axel Heides Gård was to develop dwellings for young newly established families and senior citizens at an affordable rent. The estate is sold under a multi-ownership

scheme to the tenants forming a tenant-owner association. The dwellings are publicly supported dwellings meaning that there is a fixed maximum price for the dwellings. The project includes 84 dwellings with an average size of 98 m² distributed on 16 different types of dwellings of varying size. Axel Heides Gård is a genuine and undemonstrative residential area. In this respect Axel Heides Gård is a clear representative of good Danish building practice.

7.3.3.3 “Controlled” design-build contracting

After Kuben acquired the site, a team of consultants was assembled. Kuben employed a small architect's office and a medium-sized consulting engineering company to develop a project proposal. Both companies including the specific employees involved had been working together with Kuben time and again. Thus, mutual trust had been built up over time and an informal partnership had been formed. Consequently, the consultants had developed a fine sense of the developer's usual requirements and good working relations with Kuben.

The contract with the consultants followed the agreed document on consulting services ABR 89 with two notable differences. First, the building project was going to be tendered as a design-build contract but the winning contractor was obliged to take over the consultants hired by Kuben with no possibility of changing the contract with the consultants unless sanctioned by Kuben. This way Kuben could avoid the typical problem of design-build contracting where the consultants are “squeezed” and the project “massaged” by the contractor to cut costs at the expense of the quality of the project. Thus, Kuben as client could maintain its right – and if necessary exercise that right – to decide in every detail the concrete solutions in order to ensure best value and at the same time include the experience of the contractor on buildability. Second, the contract sum was lower than usual as a consequence, because part of the typical services of the consulting engineer was to be delivered by the contractor.

7.3.3.4 Search-and-learn processes

Over a three-month period, Kuben and the consultants developed the project proposal. As is common practice, the project proposal was rather detailed. Geotechnical surveys had been carried out, the overall design of the residential area was in place, floor plans were ready, facades including choice of materials and glazing were decided on. Since the proposal called for exemptions from the urban planning, negotiations with the municipality had to be undertaken and a hearing among the neighbours carried out. Eventually, Kuben could send in the so-called Scheme A – an application for public financial support for the project.

When the application was granted, Kuben started to market the dwellings. In order to start building this type of project, at least 75 % of the dwellings need to be sold and a tenants-owners association has to be established. Due to the inherent lack of affordable accommodation in the metropolitan area, the dwellings were quickly sold out. When the tenants-owners association was established, the association took over the role of client and thus the risk of the project. Bringing the future tenants-owners into the building process also brings in new requirements that should be dealt with. Since Danish customers are very demanding with regard to their homes, a number of options for individual choices in the dwellings have to be available. Thus, in accordance with usual practice (at least outside the social housing sector) the design-build contractor offered a fixed and prescriptive catalogue of possible individual choices on kitchen interiors, bathroom equipment, surfaces, floors etc.

Meanwhile, Kuben tendered the project and commenced the detailed design of the project together with the design-build contractor. In another six-month period, the detailed design was carried out in close collaboration between the developer, the consultants and the contractor. During this period, a number of detailed requirements were fixed regarding for example windows so that the contractor could order these windows from the manufacturer. Bringing in the expertise of the contractor on buildability, other more complicated issues like the exact design of the terraces of the penthouse dwellings as part of the roof of the building were resolved as well. In this problem-solving activity, more or less explicitly formulated performance requirements were debated against perceived problems and specific solutions in a continuous search-and-learn process.

7.3.3.5 Lessons learned

As a paradigmatic example of the professional practice within Danish building, Axel Heides Gård illustrates two notable observations. First, although Danish building projects are procured within a largely performance-based legislation, there are strong elements of the prescriptive approach present in Danish building projects too. This is due to the wish of clients to exercise control of the end-product, the dominant position of consultants in the Danish building process, the administrative practices of municipalities requiring very detailed project description for approvals, and the elaborate involvement of the end-users.

Second, in many Danish building projects the consultant will set out relatively detailed descriptions of the end-product, while the contractor will often be responsible for some of the detailed design, construction methods, choice of products etc. But even a largely performance-based design will have to be turned into a prescriptive design at some point in the project. If not before, then at least when the building worker has to decide what materials, colours etc. he is going to use to produce a kitchen, bathroom etc. Thus, the issue of prescriptive versus performance-based building is not an either-or issue, but rather a continuum stretching from performance-based to prescriptive building. Within this continuum, a negotiation space exists which can be exploited by the actors of the building process to be more or less performance-based. As the project proceeds, more and more options will eventually be cut off by a prescriptive decision (see Figure 9).

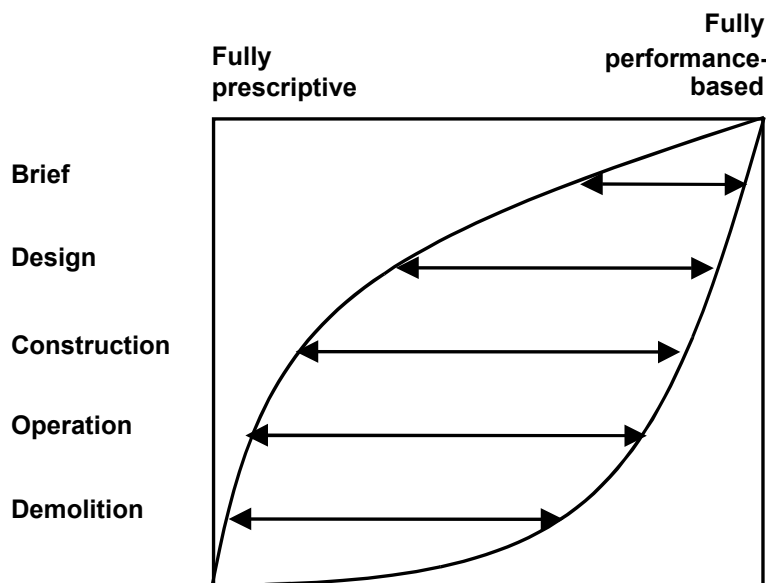


Figure 9. Negotiation space.

7.3.4 Discussion and conclusion

This paper circles around three themes: The context of building, the regulatory framework and procurement. Now, the conclusion will address these three issues in turn before turning to some lessons learned from a case study of the estate Axel Heides Gård in central Copenhagen.

First, the paper pointed out that four separate yet inter-linked markets constitute the building and housing cluster: The property market, the building market, the product market, and the capital market. On each of the four markets, different actors will procure and produce various products and services. A

proper translation or interpretation of one set of performance requirements (e.g. from users to clients) to another set of requirements (e.g. from clients to the building industry) is crucial for satisfying the needs and wishes of the end-users. Consequently, the performance requirements to be met will change character depending on the procurement of various actors on different markets. Thus, this paper suggests that it may prove useful to discuss performance-based procurement in relation to each of these four markets and centre more attention on the interpretations and translations of requirements that are taking place.

Second, the paper has described the regulatory framework in Denmark. The cornerstone in the Danish regulatory framework of building is a largely performance-based building legislation divided into three layers:

- The Building Act.
- Building Regulations (BR 95) and Building Regulations for Small Dwellings (BR-S 98).
- SBI Directions describing various ways of complying with the regulation. The Danish Building Research Institute issues these directions.

Although the Danish building legislation is largely performance-based, a few examples of direct prescriptions of solutions as well as examples of non-solutions can be found in the Danish building legislation.

Third, the paper has described various procurement methods and the liabilities of consultants and contractors. The three procurement methods are:

- Traditional/separate trades contracting.
- Main/general contracting.
- Design-build contracting.

Although e.g. partnering is increasingly gaining ground as a new way of cooperation, it is not in a strict sense a new procurement method. All known examples of partnering in Denmark basically rest on one of the above mentioned procurement methods.

Contracts will usually be drafted in accordance with agreed documents like ABR 89 (consulting services), AB 92 (provisions of works and supplies) or ABT 93 (turnkey contracts). In general, the agreed documents state that consultants and contractors are liable for extension of time limits unless a justifiable claim can be made. Further, consultants and contractors shall be liable for errors, negligence and defects if they do not show due professional skill and care.

Turning from the theoretical perspective towards examining the professional practice in Danish building may raise a cautious question and highlight two notable observations regarding performance-based procurement. It is tempting to advocate that the performance approach will improve value and innovation compared with the prescriptive approach as it has often been argued since the birth of the performance approach in the 1970s. But the performance concept may not be the one superior way of procuring buildings, services etc. in all cases and contexts. Thus, this paper will finish with a more tricky and appropriate question to be dealt with in future research and development. The question is:

Under what circumstances and in what contexts is the performance approach more appropriate than the prescriptive approach in procurement of space, buildings and services, products, and capital goods?

Two notable observations from a case study may hint at some of the answers. First, although Danish building projects are procured within a largely performance-based legislation, strong elements of the prescriptive approach are present in Danish building projects too. This is due to the wish of clients to exercise extensive control of the end-product, the dominant position of consultants in the Danish building process, the administrative practices of municipalities requiring very detailed project description before granting various approvals, and the elaborate involvement of the end-users.

Second, the issue of prescriptive versus performance-based building may not be an either-or issue, but rather a continuum stretching from performance-based to prescriptive building. Within this continuum, a negotiation space exists which can be exploited by the actors of the building process to be more or less performance-based. In many Danish building projects, the consultant will set out relatively detailed

descriptions of the end-product while the contractor will often be responsible for some of the detailed design, selection of construction methods, choice of products etc. But even a performance-based design will have to be turned into prescriptive solutions at the end of the day. If not before, then when the building worker has to decide what materials, colours etc. he is going to use to produce a kitchen, bathroom etc. In conclusion: You can keep the performance-based door open for as long as you like, but you can't keep it open forever!

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7.4 Annex 4: Country Report: Ireland

PeBBu Domain 6

Legal and Procurement Practices in Building and Construction

Country: Ireland

Respondent: DIT, Louis Gunnigan

7.4.1 Background

In Ireland, the architect is responsible to the client for designing a building in according with the building regulations. The responsibility of the contractor is to ensure that the building is built in accordance with the regulations. These regulations (parts A–M) define the requirements of the building in respect of:

Part A - Structure

Part B - Fire Safety

Part C - Site Preparation and Resistance to Moisture

Part D - Materials and Workmanship

Part E - Sound

Part F - Ventilation

Part G - Hygiene

Part H - Drainage and Waste Water Disposal

Part J - Heat Producing Appliances

Part K - Stairways Ladders Ramps and Guards

Part L - Conservation of Fuel and Energy

Part M - Access for People with Disabilities

However, these regulations are quite prescriptive and, with the possible exception of some sections of Part L, could not be described as performance based.

7.4.1.1 Economic

Activity in the Irish construction industry is cyclical. However, the industry has grown significantly since 1994 and now accounts for almost 20% of GDP. It currently employs over 200,000 directly with several thousands employed indirectly. The main areas of activity are in residential construction and in infrastructural development. In 2004 the industry is expected to produce a record high number of 70,000 housing units while the funding provided under the National Development Plan will continue to promote the development of roads, light rail, water/wastewater treatment plants, schools and other public buildings. Large-scale private development such as ongoing the €1 billion Dundrum Town Centre Redevelopment continues to stretch the ability of the industry to continue to deliver increasing numbers of large-scale projects. The increasing use of Public Private Partnerships (PPP) is resulting in large international companies becoming involved in joint ventures with local firms. The larger firms bring with them new technologies and approaches that reduce construction times and costs. Lessons learned on PPP projects are also being applied to traditional projects to achieve similar cost savings.

7.4.1.2 Use of Performance Based Building (PBB)

Performance Based Building (PBB) is not common in Ireland. However, on some of the PPP projects, the economic drivers are highlighting the need for whole life cycle costing, leading towards an acceptance of PBB principles in early project design. This is increasingly evident on projects using a Design, Build, Finance and Operate (DBFO) approach, e.g. the National Aquatic Centre project. As yet however, Ireland does

not have construction standards that relate specifically to PBB, nor is there any plans to introduce such standards in the foreseeable future.

7.4.1.3 Use of Construction Products Directive

The Construction Products Directive (CPD) is a vehicle through the use of performance based building will be promoted as many of the European Standards (EN) and European Technical Approvals (ETA) resulting from the CPD will be performance based. As such standards become the norm in Ireland, it is expected that some aspects of a performance-based approach will develop.

7.4.2 Limitations on innovation

At a technical level, innovation is common in the Irish construction industry. One of the more publicised examples is the recent development in the use of off-site construction where the building is constructed of large sections under factory conditions in a location away from the site. These are then delivered to site and assembled to form the finished structure. Such panels often contain all the electrical, plumbing and heating components built in during the manufacturing process in the factory. The standard of buildings constructed in this manner is very high compared to traditional building.

Interestingly, this approach was not designed for the purpose of greater control of building process or for the achievement of consistently higher standards. It was developed as a result of uncertainty caused during a period of industrial unrest when trades unions for wet trades workers had developed a very strong bargaining position in the industry. The construction firms began to look for ways of reducing the bargaining power of the trades unions by reducing the dependence on wet trades.

Typically, the Irish construction industry uses innovation to react to circumstances as they exist at a point in time, rather than to bring about a change in the performance of the building or the desire to create a competitive advantage. Whilst the Irish industry does not tend to innovate on a large scale in an attempt to deal with a future issue, it has nonetheless shown that it can innovate if the circumstances demand such a course of action. As yet the case in favour of widespread use of PBB in Ireland has not been made, consequently, the industry is not making any significant moves to use PBB.

7.4.3 Describe the limitations placed on innovation by the following:

7.4.3.1 2.1.1 Professional indemnity insurance.

The architect is required to hold professional indemnity insurance and all insurance has risen considerably in price in Ireland in the last four years. The use of new technology is perceived as being more uncertain than use of traditional technology and therefore carries a higher risk. Higher risk results in increased insurance premiums thereby discouraging innovation. However, as PBB becomes wider used, the uncertainty and perceived risk decreases. This will only happen if a number of landmark projects are constructed using PBB. Such projects could be identified in the Government's PPP programme. At the moment, however, there does not appear to be the necessary political will to take this option.

7.4.3.2 2.1.2 Tendering rules and requirements,

In Ireland, final tenders for public works are selected on cost. However, other factors are often used earlier in the selection process to ensure that the works being procured are of the nature and quality required. An example of this is the National Aquatic Centre where PPP was used to design, build and operate the facility. The project was procured using a 3-stage process. Each bidding consortium was given an output specification, clearly identifying, in performance terms, the client's requirements. The first stage

of the bidding process involved the consortium producing an “Expression of Interest”, laying out the strategy on which it would approach the project. Each consortium that successfully concluded the first stage was then invited to produce an “Outline Bid” for the project. This stage included an outline design and an outline project sum. Three consortia successfully progressed to the third stage, which involved a detailed design and financial bid for the project. In such circumstances, the current tendering rules and requirements do not place insurmountable restrictions on the use of PBB in public works.

The rules for private works are not as stringent, with clients using a variety of procurement methods including open tendering, selective tendering and negotiated contracts. Consequently, there are no obvious tendering barriers to the introduction of PBB in private works.

7.4.3.3 Professional practice

In Ireland, a client must obtain planning permission for a project from a local authority (County Council or City Corporation) prior to commencing construction. In order to achieve planning permission, project must be designed with the requirements of the relevant County or City Development plan. Potential new projects identified from strategic studies/plans such as the National Development Plan. The steps in procurement of public works in Ireland are as follows:

- Contracting Authority (CA) carries out an exercise to establish the business case for the project and to establish the means by the project could be delivered;
- CA consults National Development Finance Agency (NDFA) regarding the possible financing options for projects with a potential construction value in excess of €20 million;
- CA employ specialists to prepare:
 - Outline design;
 - Economic evaluation;
 - Cost estimate;
 - Environmental Impact Statement.
- Site is selected and preliminary reports prepared for Department review;
- CA processes the following:
 - Project Design;
 - Compulsory Purchase Orders;
 - Land Acquisition;
 - All necessary statutory consents to build.
- CA advertises the project in the Official Journal of the EU (OJEC) (if over €20 in value), on etenders.ie and in the media;
- Construction companies tender for the project;
- CA establishes tender evaluation criteria, carries out the tender evaluation and chooses the preferred contractor for the project;
- Contractor and CA enter contract under which the project will be constructed;
- CA has a direct role in supervision of work, measurement of quantity of work completed and certification for the purpose of payment to the constructing contractor;
- Contractor plans, manages and undertakes the contract works.

Currently, architects in Ireland are not required to be registered. However, it is proposed that the Building Control Act (currently in draft form and expected to be passed into law in 2005) will require all architects, quantity surveyors and building surveyors to be registered. Similarly, contractors are not required to be registered but those without ISO safety and quality certification are finding it increasingly difficult to get on tender lists for publicly funded construction work. It is expected that a registration system for contractors will be brought into place in Ireland over the next five years.

A variety of professional associations exist in Ireland and are made up of architects (Royal Institute of Architects of Ireland – RIAI), surveyors (Society of Chartered Surveyors), engineers (Institution of Engineers of Ireland – IEI, Institution of Structural Engineers – I Struct E) and other construction professionals (Chartered Institute of Building in Ireland – CIOB, Association of Building Engineers – ABE, Chartered Institute of Building Services Engineers – CIBSE, etc.). Each of these – some to greater extent than others – have representation on a number of policy advisory boards that are used by the government in the development of government policy. Consequently, if PBB were to be promoted in Ireland, one approach would be to target these professional associations.

7.4.3.4 The Effect on Performance Based Building of Value and Tendering restrictions.

As noted in section 2.1.2. above, the tendering process is designed to ensure that the client gets the building appropriate to his/her needs at the lowest cost. However, the client is not always the user of the building – indeed the user of the building is often not known until the construction phase is completed. Consequently, the actual performance requirements of the building from the perspective of the end user cannot be taken on board during the design process where the client is a speculative developer. This situation also occurs where a project may require an environmental impact statement (EIS) as part of the process of receiving planning permission, for example on a road development. In such circumstances a detailed prescriptive design would be required on which to base the EIS. In relation to value, it is somewhat difficult to attribute exact value on the future suitability of the building when the developer is unsure of the precise nature of the future use of the building.

7.4.3.5 The Effect of Legal and National Jurisdictions upon Performance Based Building.

The introduction of PPP has shown that the Irish tendering regulations can be adapted to a new contractual arrangement. However as there is no visible demand for PBB, there is no progress being made at present to progress the legal and contractual issues.

7.4.4 Case Studies

A considerable literature search revealed no case studies of buildings in Ireland that were built using performance based building.

7.5 Annex 5: Country Report: Israel

7.5.1 Introduction

The implementation of the performance-based concept into the building market in Israel started in the 1970's with the preparation of a comprehensive document of Performance Specifications for Residential Buildings, low-rise as well as high-rise. The guidelines were adopted in 1978 by the Ministry of Housing and Construction as part of their formal guidelines for new construction systems in the public building sector. The construction industry relies on conventional in-situ concrete structures. Building methods are based on heavy-weight reinforced concrete structures (either cast in-situ or prefabricated). The finishing tasks are industrialized with the use of prefabricated units and components such as curtain-walls, windows, etc, and the use of industrialized methods for partitioning, tiling, rendering, cladding etc.

Research in most specific areas of PeBBU is carried out at the National Building Research Institute, NBRI, (known until 1988 as the Building Research Station) <http://www.technion.ac.il/~nbri/>, in the Faculty of Civil Engineering <http://www.technion.ac.il/technion/civil/>, and in the Faculty of Architecture and Urban planning <http://architecture.technion.ac.il/>, all at the Technion - Israel Institute of Technology (please visit these sites for detailed description of the relevant laboratories and lists of publications). Building Standards, many of them with a performance-based underlining philosophy, are developed and issued nationally and uniquely by the Israel Standardization Institution. Building Regulation, undergoing now a shift to performance-based regulations, are issued and mandated by the Ministry of Interiors.

The procurement and legal practices developed first in the establishment of basic knowledge of physical performance and development of the standards that enables performance specifications. The procurement practices follows 4 typical protocols: (1) Traditional procurement (general contractor); (2) Design-Build procurement protocol; (3) Construction Management; and (4) Build-Operate-Transfer (BOT). The following paragraphs review the procurement protocols and the implementation of Performance Based specifications in the procurement protocols.

7.5.2 Procurement protocols

7.5.2.1 *Traditional procurement*

The traditional procurement arrangement involves three main participants: owner, design team, and general contractor (Figure 10). In this type of arrangement, a distinct team undertakes the design, and the owner has a direct contractual relationship with most of the participants (except, in most cases, with subcontractors and some of the suppliers). Specialists such as cladding subcontractors, plumbers, electricians, and others act as independent subcontractors, and the design of systems intended to include novel techniques is likewise undertaken through sub-consultants. The design team is led by an architect, or a structural engineer and is joined by consultants specializing in several disciplines such as acoustics, safety, lighting, fire-extinguishing systems, and systems super-position etc. Performance specifications are prepared by the design team, the owner and with the aid of consultants. Some design offices employ already civil engineers with background in Performance Based design. Most of projects implemented with this protocol use descriptive specifications.

7.5.2.2 *Design-Build*

According to this procurement approach, the general contractor undertakes full or partial responsibility for the design, and construction stages. This contractual arrangement differs from the traditional arrangement in the single line of responsibility that exists between the owner and the contractor (Figure

11). The principal advantages of this procurement scheme from an owner point of view are the elimination of any claims by the contractor against the owner due to inadequate design or specifications, and the ability to begin construction of each separate phase of the project as soon as its design is completed, without having to wait for the completion of the overall project design. It was within the framework of the design-build procurement method that fast-track construction was developed. Performance-Based specifications are used for some components in this category.

7.5.2.3 Construction Management

The increasing complexity of projects has led to the development of the Construction Management Procurement method, in which there is no main contractor interposed between the owner and the various specialist subcontractors (Figure 12). The construction manager becomes the principal consultant, coordinating the entire procurement process, from the conceptual design through the commissioning of the project. Construction management firms do not perform any design or construction activities of their own, but rather act as the owner's representative during the life cycle of the project. The function of the construction management firm is to control the flow of information between all parties involved in the project.

This procurement strategy is preferred in large projects that are characterized by high levels of complexity and multi-disciplinarity of their design and construction. Furthermore, professional construction management eliminates some of the risks involved in the fast-tracking of traditional contract; instead of submitting a bid for 80% of the design of the entire project, a trade contractor will bid on 100% of his or her own share of the design (Rubin & Wordes, 1997).

Performance specifications in this procurement are prepared by the Construction Management firm and the owner with the aid of some consultants. In the last years, the industry experienced some success stories in projects that uses construction management firms for partial implementation of performance based procurement.

7.5.2.4 B.O.T. (P.F.I.)

The fast growing needs of increasing populations and the increasing performance expectations coupled with dwindling governmental funds, and surplus in private resources, stimulates the implementation of B.O.T. protocols in Israel. In this procurement protocol, a private sector consortium finances, designs, constructs, and operates an asset for an agreed franchise period. This protocol may be conceived as an extension of the Design-Build contract, expanded by the addition of the finance and operation phases. It enables mobilization of private funds for large public projects that otherwise would not have been realized in traditional financing. However its philosophy of procurement leaps beyond the design-build protocol, as risks such as project risks and global risks are mainly shifted to the franchisee (kumaraswamy and Morris, 2002). This in turn requires a reward such as guaranteed revenue, and causes conflicts of interests between the franchisees and the owners.

The organizational scheme in the implementation of BOT projects in Israel includes a Construction Management firm that manages the tendering and contract phases and carries out the inspection of the construction phase.

The BOT procurement protocol shifts some of the risks previously borne by the owner to the Franchisee, thus the majority of risks borne by the franchisee. This realignment of risks may affect the performance definitions, and the performance criteria by which the optimal solutions are selected. Aspects such as Durability, Maintenance, and Performance Management are amongst those that were found hard to define, and to be agreed upon.

7.5.3 Procedure for the development of Performance Specifications in the tender and the contract documents

The documentations for the tender and the contract allow two forms of specifications (Kaplan, 1999): (1) prescriptive specifications (closed system); and (2) performance based specifications (open system). Performance specifications shift the focus of the quality control to the end of the task or the construction of the component. Rather than carrying the quality measures along the execution (quality assurance), the quality control is focused on the end of execution, and thus requires sophisticated means of tests such as simulations, or laboratory tests.

The paradigm for the definition of performance requirements in a construction project follows the following stages (Becker et al. 1985):

- (a) Site parameters and their effect on performance;
- (b) Legislation – referring to safety, occupational health, and safety regulations, building legislation, and legislations regarding welfare;
- (c) Performance definitions – This procedure is adapted to the designation of the building.

In the following paragraph a brief description of the principal parameters under consideration in the definition of a performance specification:

7.5.4 Site parameters

This phase of the performance planning includes review of various site aspects that affect the performance requirements; location, size, accessibility, existing transportation, infrastructure, obstacles in infrastructures, soil profile, environmental quality, climatic conditions.

7.5.5 Legislation

The legislation review procedure requires following Safety regulations on the building process as well as requirements that focuses on structural safety, Sanitation, health, fire-safety, and security regulations. Legislations include: (1) the “Design and Construction legislation”; (2) Israel Standards Institution (ISI) standards; (3) ISI specifications; and (4) The general specification for building (issue by the Ministry of Defense).

7.5.6 Performance Specifications

Performance Based specifications are implemented in the following:

Thermal comfort, lighting condition, quality of internal air, spatial requirements, fire safety, quality of vertical transportation, seismic resistance, parking, etc.

7.5.7 Future developments

It is anticipated that quality assurance means for construction in PeBBu concept be further developed to allow quality assurance along the procurement and execution processes. It is envisaged that Research and Development effort will be focused on procedures for performance specifications in B.O.T. procurement protocol that addresses the following points: Asset Value management, durability, and quality assurance.

7.5.7.1 Education and training aspects

It has been recognized in Israel that, independent of the local regulatory framework and the obligations of engineers and architects from any legal point of view, building design may be significantly improved if it is based on the rigorous methodology implied by application of the Performance Concept.

The Performance Concept has thus been introduced and incorporated as a basic framework of engineering thought into many courses of the various divisions of the Civil Engineering Faculty at the Technion since the 1970's. The division of Building Materials, Performance, and Technology offers an introductory course "Physical Performance of Buildings", that provides the basic terminology, philosophy, and tools for the integration of human requirements and design of buildings, their components and building details. In addition more specific courses of two kinds are offered: 1) Attribute-related courses - "Building Climatology", "Building Acoustics", "Moisture Problems in Buildings", "Fire Resistance in Buildings", "Durability of Building Materials, Structures and Buildings", and 2) Technology-related courses - "Industrialized Building", "Metal Construction", "Timber Construction". Similar ideas are included in some courses of the Structures Department. The division of Construction Engineering and Management (CEM) offers 7 basic courses at the undergraduate level, amongst them Construction Management, and Construction Methods. The four above-mentioned basic procurement protocols are appraised from various points of view amongst them the definition of performance specifications. Comparison of technological alternatives is taught based on equal performance requirements. The Life Cycle Costs concept is learnt in a maintenance module that introduces LCC and maintainability criteria into the design process.

Most of the courses mentioned above are elective courses. This implies that many civil engineers and architects, who did not select these courses, do not have the knowledge required to follow a comprehensive performance-based procurement process. The introduction of purely performance-based regulations, which do not include a descriptive and/or prescriptive venue, is thus impossible even in the long run, and should not be pursued. Nevertheless, it is envisaged that with the introduction of the new regulations it will become inevitable to turn some of the elective courses into mandatory ones, and ensure that more Civil Engineers and Architects have a sufficient background to cope with the new regulatory framework.

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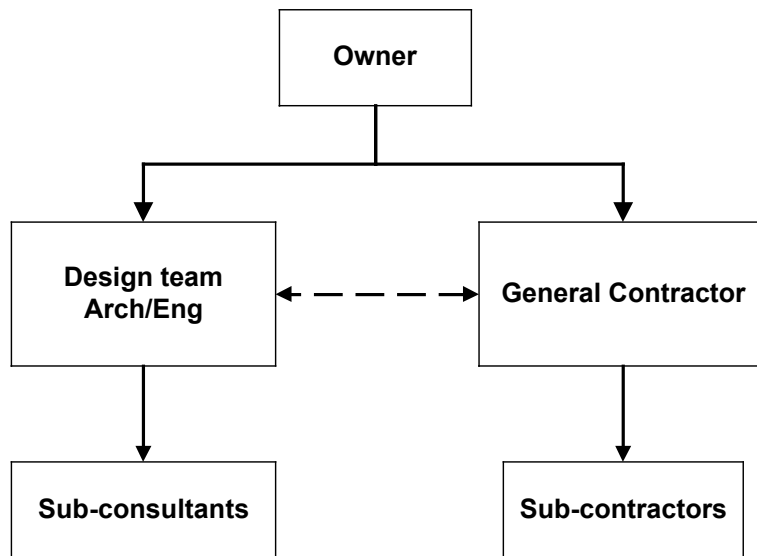


Figure 10 Traditional procurement

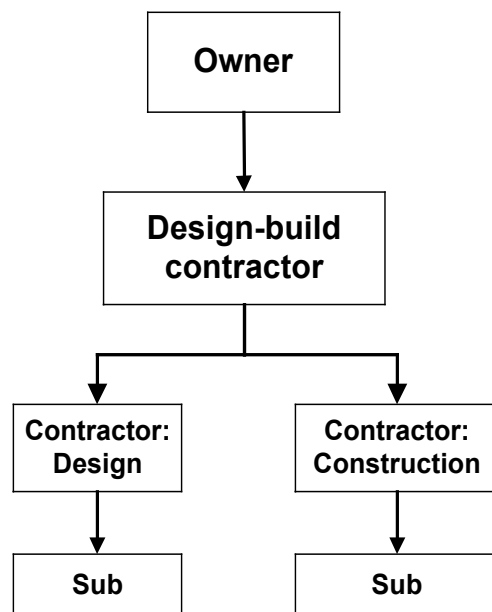


Figure 11 Design-Build procurement

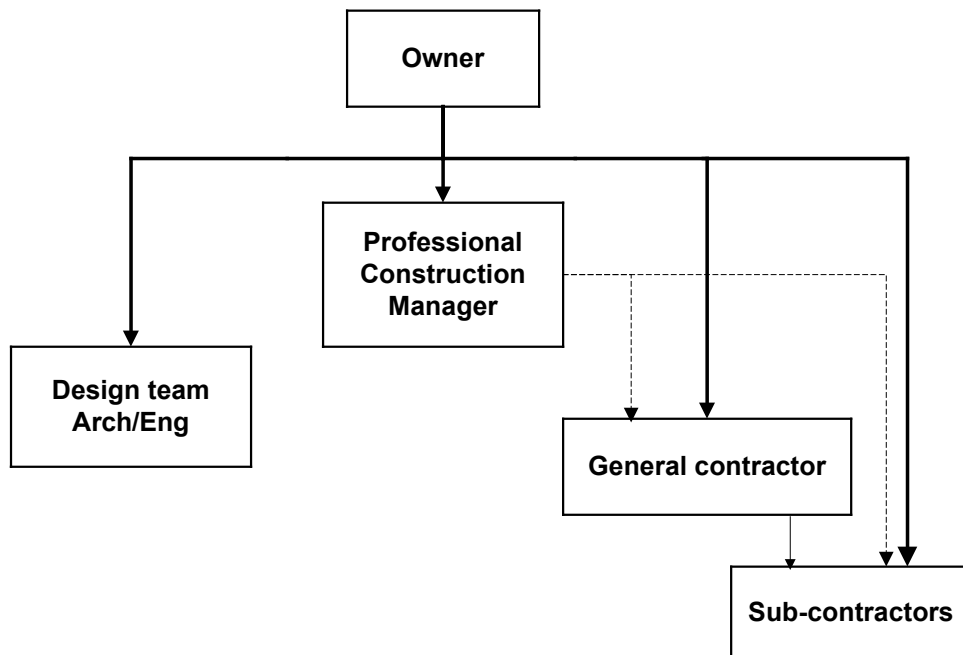


Figure 12 Construction management procurement



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