PERFORMANCE-BASED MAINTENANCE AGREEMENTS BY DUTCH HOUSING ASSOCIATIONS

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ABSTRACT: Dutch housing associations are considering the application of performance-based maintenance agreements. With this they expect to manage maintenance processes efficiently and effectively. A performance-based maintenance agreement is based upon minimal performance criteria of building components. Decisive performance requirements are directly linked to the specific functions of a building component. The contractor has to meet or exceed these criteria by executing the right maintenance activities to the building component at the right time. Based upon existing partnership forms and desires by housing association and contractors three partnership forms for maintenance services are designed. They are especially meant for condition-based maintenance to building components. The partnership forms can be described as price and performance agreements for maintenance activities, long-term cooperation and lump sum performance-based contracting. Long-term cooperation promises the best results in performances and costs.

Keywords – Maintenance, partnering, performance measurement, performance requirements, value.

1. INTRODUCTION

The construction industry faces a need for change and innovation. It has to change from an orientation on costs to value and performance. There is a common view to the need to take a whole-life view of value and to adopt new procurement methods. Procurement methods based upon adding value for clients and the performance concept. This viewpoint is being endorsed by national and international studies, working groups and networks, e.g. Rethinking Construction (Department of the Environment, Transport and the Regions (DETR), 1998), revaluing construction (Courtney, 2005) and performance-based building networks PeBBu (pebbu.nl) and AusPeBB (csiro.au). In many countries national programs for changing industry were being set up. In the Netherlands the Advisory Board on Technology Policy pointed out the need for building process innovation. A group of powerful principals can act as a catalyst by forcing building partners to another or innovative way of co-operation (arTB, 2002). In the Netherlands this virtual group is formed by the Government Buildings Agency and large innovative housing associations.

In 2004, a review of international reforms in building and construction was carried out within the Dutch research program Process and System Innovation in Building and Construction (PSIBouw) in order to learn from international reform practises prior to implementing a Dutch initiative. Ang et al. (2004) point out that procurement practises are of crucial significance in reform of building and construction. Lack of product differentiation and one-dimensional, price-oriented competition are mentioned as imported drivers for collusion (Dorée, 2004). More integrated forms of procurement have been found to provide better value for clients and include other dimensions of competition, such performance, speed and reliability. Partnering is such a form. In the UK the Rethinking Construction report was an overture for change and for the implementation of partnering in construction. The report stated that partnering is not easy: “An essential aspect of partnering is the opportunity for participants to share in the rewards of improved performance”(…) “Partnering is more demanding than conventional tendering, requiting recognition of interdependence between clients and constructors, open relationships, effective measurement of performance and an ongoing commitment to improvement” (DETR, 1998).

The performance-based concept provides a flexible and technically non-prescriptive framework for building design and construction. Its application consists of translating human needs (functionality, comfort, etc) first into functional and then into technical performance requirements, implementing them within a regulatory framework through codes/ standards/ specifications. “Performance-based building is the practice of thinking and working in terms of ‘ends’ rather than ‘means” (PeBBu.nl). There has been considerable prior research into the performance-based concept in new construction. In fact exiting networks and working groups solely focus on new construction. Contrary to the need to take a whole-life of value, the introduction of new procurement methods including maintenance and operation and the big share of maintenance work in the building volume, attention to refurbishment and maintenance is nil.

2. MAINTENANCE PROCUREMENT BY DUTCH HOUSING ASSOCIATIONS

Dutch housing associations are not-for-profit organisations, which are obliged to operate in the interest of housing, in particular by providing decent, affordable housing to lower-income households. In 2003, 527 Dutch housing associations together possessed more than 2,4 millions of rented dwellings (MVROM, 2004). In the 1990s, the national government granted housing associations considerably more freedom of policy but also diminished the financial support. Furthermore, demand for social housing decreased, partly due to a booming economy and changes in housing preferences towards home-ownership. As a consequence housing

associations began to adopt business-like approaches in their housing management. They had to operate more market-driven and client-driven (Gruis and Nieboer, 2004).

The professionalism of housing associations have led to a noticeably greater attention for maintenance processes and partnership forms in the supply chain for maintenance. The growth in the size of the holdings for which an individual housing association is responsible is an important factor in considering the adoption of performance-based maintenance agreements. Some larger associations have as many as 40,000 dwellings under their management, which renders it more or less essential to explore alternative means whereby maintenance processes can be managed efficiently and effectively. An additional factor is that the housing associations have chosen to re-focus on their core business, and a number now regard maintenance as a secondary process for which outsourcing, provided it is organized in a responsible manner, is preferable. Another reason for considering performance-based agreements is the emergence of a strategic housing stock policy. This entails a customer focus, greater differentiation in quality and hence some variation in maintenance performance levels (Straub, 2002a).

The interest shown by housing associations in performance-based agreements is also further to their adoption and development of quality management systems. Many associations have adopted the EFQM Excellence Management Model (EFQM, 1999). Others use the ISO-system (ISO 9000) or systems marketed by the Dutch Quality Centre for Housing Associations (KWH). While still focusing on direct results and processes, the associations wish to shift the emphasis onto continuous learning, innovation and improvement and to seek out value adding partnerships with other organisations.

2.1 New Procurement Methods

Traditionally, housing associations tender maintenance services using a descriptive and detailed specification of work to be performed. The objectives are to achieve the lowest price or best price-quality ratio by means of a competitive tender. By contrast, the performance-based approach centres on a set of desired performances or service levels.

The objectives of housing associations for performance-based partnering are to improve quality, to achieve budget certainty and cost savings, to simplify the maintenance management process and to promote innovation on the part of maintenance contractors. Maintenance contractors no longer act as suppliers of capacity, but become active participants in the overall maintenance process. They advise about maintenance strategies, performances and maintenance activities. They assume certain risks and responsibilities with regard to the quality and costs of maintenance activities, doing so for a long period wherever possible. Contractors underline improvements of performance and service

and innovations in the whole maintenance process by having continuity in orders and sustainable relationships with clients. Maintenance contractors are prepared to assume certain risks, but at a price (Straub, 2002b).

2.2 Research Project

The OTB Research Institute for Housing, Urban and Mobility Studies, which is part of Delft University of Technology in the Netherlands, is doing research into the application of performance-based maintenance agreements by Dutch housing associations. In our research project we have worked out the performance-based concept, using performance requirements and performance criteria for building components, into the maintenance procurement system.

One study involves performance-based maintenance agreements for building components and maintenance services and involves seven large, innovative, housing associations and the Dutch Building Research Foundation (SBR). The first phase of the study involved literature reviews and case studies into housing associations' current procurement and outsourcing methods. First initiatives to performance-based agreements covering the maintenance of central heating systems, lifts, flat roofing and work to exterior surfaces have been examined and compared. Clients and contractors expressed divergent views concerning the content and implementation of performance-based partnering. Despite such differences of opinion, the parties concerned showed a common interest in developing performance-based concepts, process models, maintenance performance requirements and suitable instruments for performance measurement.

OTB has been working at guidelines for effective, efficient and transparent performance-based procurement processes and agreements. Those guidelines consist, among other things, of process models and decisive performance requirements (Straub *et al.*, 2005ab). The process models and performance requirements were tested in expert meetings with housing associations, maintenance contractors and consultants.

3. PERFORMANCE CONCEPT IN MAINTENANCE

The development and use of performance-based agreements depend on the maintenance service involved, the costs as a proportion of overall maintenance expenditure, and the opportunities that exist to measure both performance and the level of risk faced by both parties.

Each type of maintenance service demands for its own procurement method, and contract form. In the case of performance-based agreements for building components, a preventive and condition-based maintenance approach forms the basis of all maintenance activities. However, this does not mean that the agreements should not also cover

breakdown services by comprehensive contracts, applied for e.g. flat roofing and HVAC. Preventive cyclical maintenance and breakdown service lend themselves particularly well to the performance-based approach. In case of preventive cyclical maintenance regular, fixed contact moments between client and contractor already exist. Preventive maintenance activities are carried out to preclude breakdown of the system. Performing breakdown service is not so much a question of performance level of the installation components, but that of service delivery, i.e. response times and active maintenance times. Requirements for service delivery can be derived from the requirements of the client's own quality management systems, put in place to ensure customer satisfaction.

3.1 Performance Requirements for Maintenance Work

For a performance-based approach to maintenance work the Performance System Model of CIB Task Group 37 Performance-Based Building Regulatory Systems (Tubbs, 2004) can be used. This model can be divided into a qualitative component and a quantitative component. Qualitative is where the building owner needs are expressed in general language usually in the form of goals and objectives. Derived from that are functional statements and operative or performance requirements. Quantitative are criteria and standards. Standards contain verification methods.

For maintenance functional statements, performance requirements and performance criteria suffice. Performance requirements, even on the long-term, can be considered as output specifications. In case that the use of the component strongly influences performance, meaning external conditions change, output specifications do not satisfy. These circumstances occur by for instance installation components or highways. Client and contractor need 'output measure' or 'dynamic performance control' (e.g. De Ridder, 2001; U.S. Department of Transportation, 2003).

3.2 Performance of Building Components

The performance of building components can be determined by assessing defects. All components have to contend with performance loss through ageing, use, and external causes. Performance loss is measured in terms of defects ascertained. The defects are registered during a condition assessment or performance measurement. Condition assessment using a six-point condition scale has become popular in the Netherlands. The condition categories are of a chronological order that describe possibly occurring defects without references to remedial work, but just describe occurring defects (Straub, 2002a). In 2006, this method will become a Dutch standard (NEN, 2005).

A performance-based maintenance agreement could be based upon minimal performance criteria of building components. In long-term agreements also the performance at the end of the contract period should be agreed. The contractor has to meet or exceed these criteria by executing the right maintenance activities to the building component at the right time.

3.3 Performance Requirements in Performance Agreements

Not all possibly occurring performance requirements and defects have to be used in performance-based agreements. Decisive performance requirements are directly linked to the specific functions of a building component, for instance jammed movable parts in case of wooden windows and doors. See table 1. For verification methods or performance measurement methods, references to international standards are given. See table 2.

Table 1. Decisive performance requirements of wooden window and door frames, windows and doors (Straub et al., 2005b).

Substrate
Jammed movable parts
Decay of wood/ Rotting
Finishing
Loss of gloss paint
Discoloration paint
Cracking paint

Table 2. Examples of verification or performance measurement methods

Performance requirements	**Verification method**	**Percentage of measurements**	
		Criteria final acceptance control	**Criteria periodic and end control**
Loss of gloss paint	ISO 2813	90% degree 0 10% degree 1	Yearly loss 25% of original
Cracking paint	ISO 4628	100% degree 0	90% degree 0-2

4. PERFORMANCE-BASED MAINTENANCE PARTNERSHIP FORMS

Based upon existing partnership forms and desires by housing associations and contractors we have designed three partnership forms for maintenance services. They are especially meant for condition-based maintenance to building components. The partnership forms can be described as:

- price and performance agreements for maintenance activities,
- long-term co-operation and
- lump sum performance-based contracting.

The appropriate partnership form for a housing association depends on its size, organizational structure, business-like approach, the maintenance service involved and especially its goals for partnering. In performance-based maintenance agreements technical, commercial, organisational and legal arrangements differ from those in traditional maintenance contracts.

The objectives of housing associations for price and performance agreements are improving quality, budget certainty, direct cost savings and the development of sustainable relationships. A housing association cooperates for the maintenance of its housing stock with a selected group of maintenance contractors. Those maintenance contractors contribute to the planning process. They give advise about performances and maintenance activities. Maintenance cycles and maintenance intervals are determined beforehand.

In a long-term co-operation housing associations strive to improve the maintenance process by managing the main outline of the process. They seek cost savings and hope to promote innovation on the part of maintenance contractors. Maintenance contractors are acting as consultants. They are consulted at an early stage of the process, and are therefore able to contribute their ideas concerning the best maintenance strategy within the constraints of the performance requirements, the exploitation period and the financial aspects applying to each housing complex. The housing association and the maintenance contractor jointly specify decisive performance requirements for several housing blocks, concluded in a general agreement. The contractor works out the desired performances, fitting them into the actual technical state of the housing block and the desired exploitation period. The technical solutions are laid down in maintenance scenarios and activity plans. The contract duration is a maintenance scenario covering several maintenance intervals of returning maintenance intervention, eventually lasting the whole, expected, exploitation period of a housing complex. A maintenance interval can be defined as the period between two maintenance activities to the same building component, e.g. the cycle of paintwork (six or seven years). The best maintenance scenario is chosen, based upon net present values and total costs of ownership. The scenario and the performance criteria are laid down in a performance agreement. The contractual pricing

method allows recovering additional costs caused by agreed circumstances.

Performance-based agreements will be most useful and appropriate if they are long-term in nature. Continuity enables the product and services to be offered at the best level of quality. However, this does not necessarily mean that the agreements should be legally binding for long periods. It must remain possible for the parties to "go their separate ways" should this prove necessary. Nevertheless, there must be a letter of intention to continue the partnership throughout the term of the contract. In order to observe and measure the effects of performance-based arrangements, the ideal situation is to have one contractor perform the maintenance on a building complex for the entire exploitation period of the building.

4.1 Process Models

Figure 1 gives a picture of the procurement process model of traditional maintenance tendering, used as a reference model. Figure 2 gives a picture of long-term maintenance co-operation. (Straub et al., 2005a).

4.2 Control and Supervision

Traditionally technical specifications are formulated by the housing association, being the basis of the tendering process. The housing association supervises the maintenance work in detail. A final acceptance control also involves an examination of performance directly related to the quality of the workmanship. Measurement of client satisfaction might be done by the housing association.

In a performance-based partnership form the primary purpose of control and supervision by the housing association is to review the performance achievements and to identify problems with the necessary action. In price and performance agreements performance control is carried out after the execution of initial activities and maintenance intervals (assessment on completion work), at specific intervals (periodic performance control) and at the end of the contract period (end control). The contractors themselves monitor the degradation processes of building components by performing performance measurements.

Contractors also monitor the process and especially the client satisfaction during maintenance interventions and thereafter. They keep responsibilities for laid down performances and client satisfaction during the contract period. Performance control by independent third parties, may take the form of a random check rather than a full inspection of all performance criteria. During the contract period the maintenance scenario might be adapted. The housing association's objectives are likely to change over time, just as external circumstances may change.

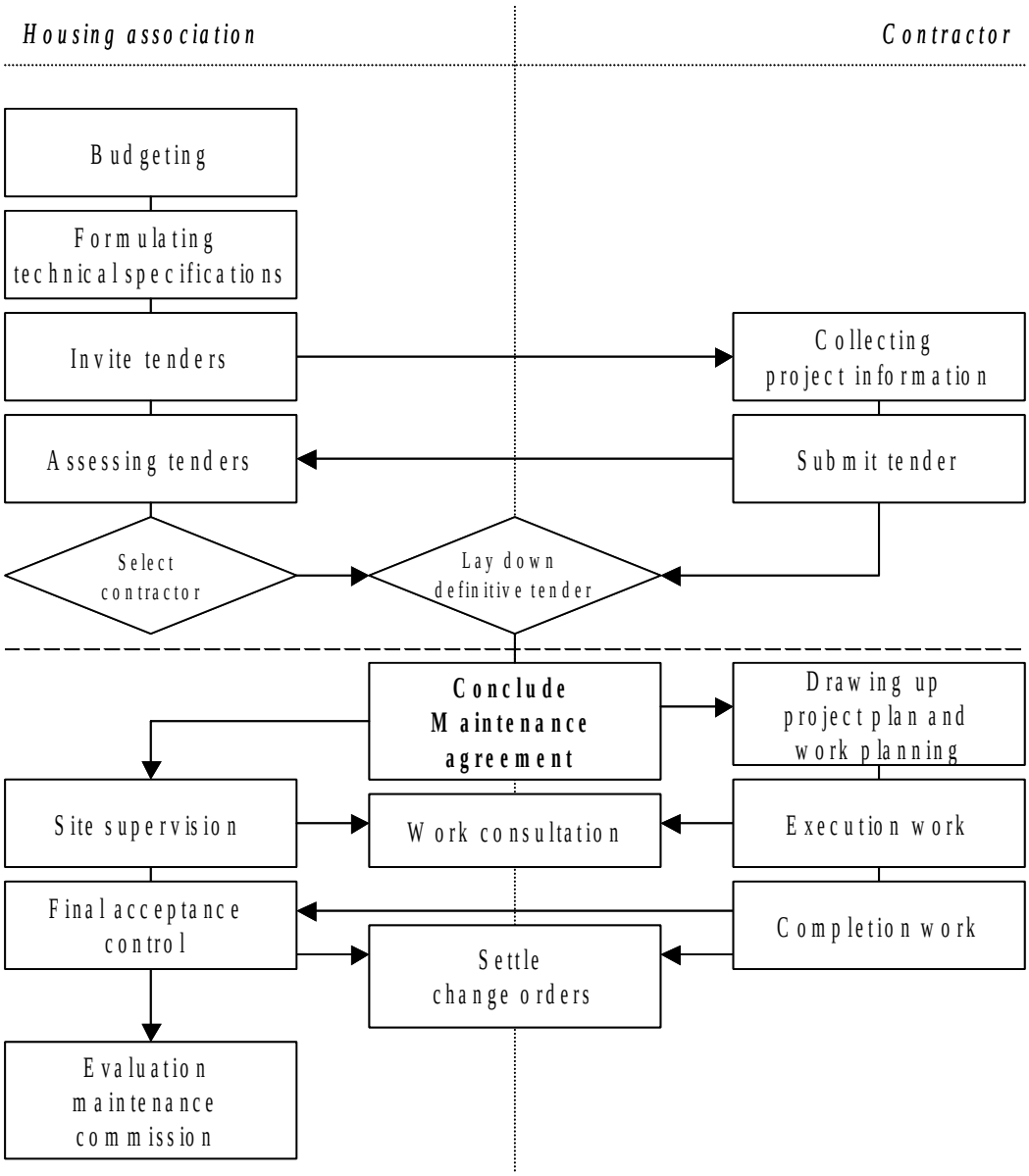

Fig.1. Process model of traditional maintenance tendering

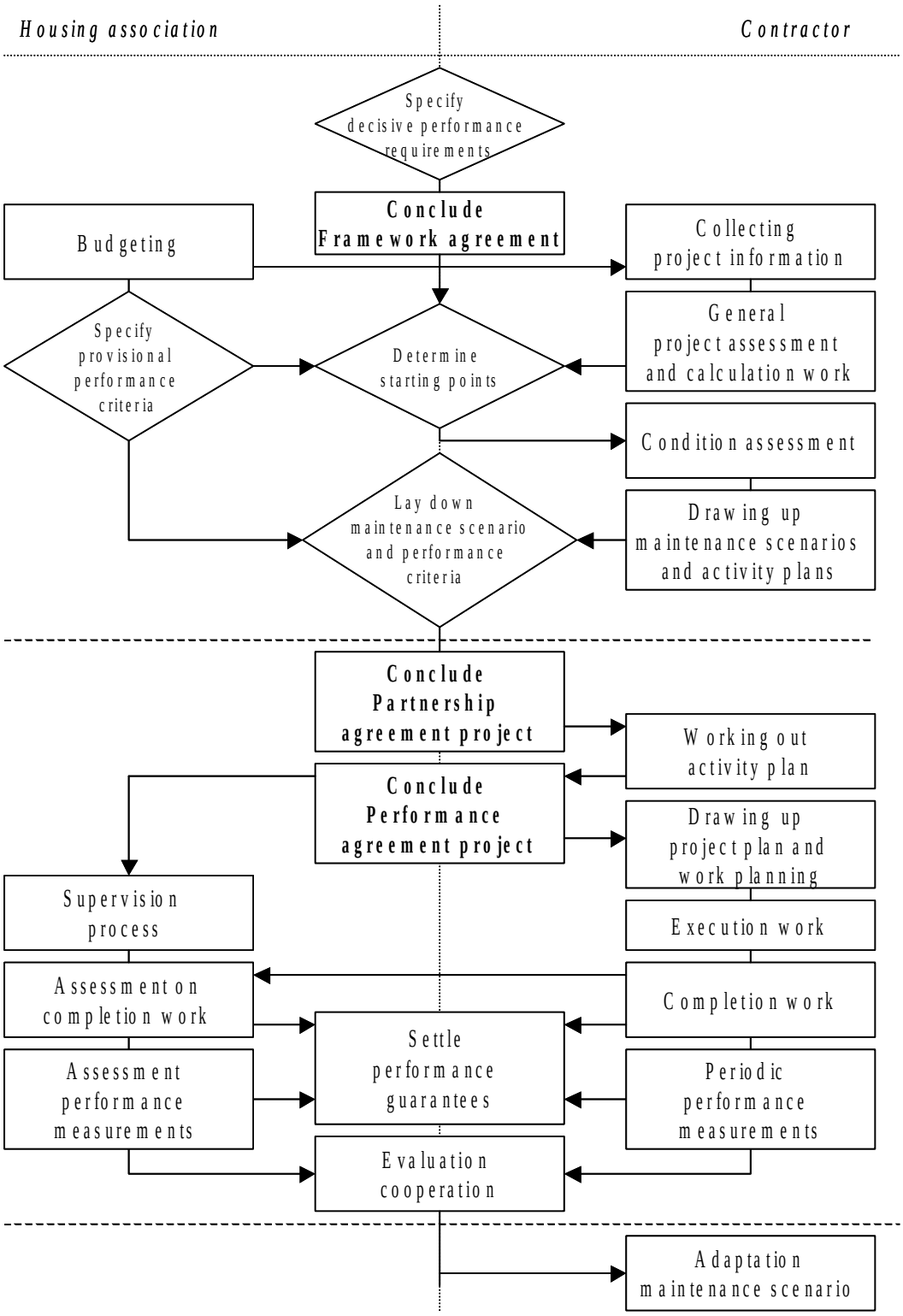

Fig. 2. Process model of long-term co-operation

5. CONCLUSIONS

Dutch housing associations are for many reasons considering the application of performance-based maintenance agreements. With this they expect to manage maintenance processes efficiently and effectively. A breakthrough of performance-based maintenance partnering on a wider scale is obstructed by disbelief in benefits, distrust, lack of knowledge, fear of disturbance of price competition and desired flexibility in decision-making. The client organization's objectives are likely to change over time and external circumstances may change. Therefore any long-term cooperation must incorporate a degree of flexibility. More important is the fact that Dutch housing associations fear a disturbance of price competition using long-term performance-based agreements. Together with their desired flexibility in maintenance policy they restrict the co-operation period to maintenance work intervals. Contrary, they admit that a long-term partnership will enable them to derive the greatest possible advantage from the performance-based maintenance approach. For this reason OTB is studying direct and indirect cost savings by performance-based long-term cooperation between clients and contractors. If a contract is performance-based, the contractor has contract-related incentives to improve its way of working in terms of performance. That will result in direct and indirect cost-savings. Direct project costs represent the expenditure incurred during the actual performance of (long-term) maintenance activities. The indirect project costs are all costs in connection with the organization and performance of the maintenance activities, but which cannot be expressed as direct project costs. In other words, these are the process costs incurred by both client and contractor. Indirect cost reductions can be realized because the long-term performance-based approach enables maintenance contractors to assume responsibility for certain activities which they are better equipped to perform than their clients. In the traditional approach, many activities are duplicated, i.e. conducted by both client and contractor, because information is lost following the once-only tendering process. In the performance-based approach, clear agreements are made with regard to which party is responsible for which activity during the cooperation period. We will compare the costs of long-term performance-based co-operation and traditional maintenance tendering. The first ten projects show that the total indirect costs are lower in the performance-based approach than in the traditional working method.

The development of performance-based maintenance contracts and partnering forms is still in its early stages. First steps are taken into orientation on performance in stead, or besides, costs. Progress varies greatly according to the type of maintenance service involved. Maintenance performance requirements for breakdown services should include requirements for service delivery, e.g. response times. Those performances might be of bigger value for tenants than the technical performance of building components. The need to take a whole-life of

value demands maintenance and refurbishment linked to new construction. This way, performance-based co-operation can add momentum to concepts of lifetime engineering and total costs of ownership.

6. REFERENCES

Adviesraad Technologybeleid Bouwnijverheid (arTB) (2002) *Quick Scan Bouwprocesinnovation [Quick Scan Building process innovation]*, arTB, Den Haag.

Ang, G.K.I., Courtney, R. and Spekkink, D. (2004) *Inventory of international reforms in building and construction*, PSIBouw, Gouda.

Courtney, R. (2005) *Revaluing Construction 2005 – The Challenge of Change, Conference Report*, PSIBouw and CIB, Gouda.

Department of the Environment, Transport and the Regions (DETR) (1998) *Rethinking Construction* (Egan Report), DETR, London.

De Ridder, H.A.J. (2001) *Dynamic performance control of design & construct of complex systems*, Proceedings CIB World Building Congress 2001 Wellington 2001, pp. 299-308.

Dorée, A. (2004) *Collusion in the Dutch construction industry: an industrial organization perspective*, Building Research & Information, 32(2), 146-156.

European Foundation for Quality Management (EFQM) (1999) *Introducing Excellence*, EFQM, Brussels.

Gruis, V. and Nieboer N. (eds) (2004) *Asset Management in the Social Rented Sector*, Policy and Practise in Europe and Australia, Kluwer Academic Publishers, Dordrecht.

Ministerie van VROM (MVROM), 2004, Cijfers over Wonen 2004, MVROM, Den Haag.

NEN (2005) Ontwerp NEN 2767 Conditiemeting van bouw- en installatiedelen, NEN, Delft.

Straub, A. (2002a) *Strategic Technical management of housing stock: lessons from Dutch housing associations,* Building Research & Information 30(5), 372-381.

Straub, A. (2002b) *The application of performance-based maintenance contracts in the Netherlands*, John Hinks, Danny Shiem-Shin Then and Stuart Buchanan (eds), Proceedings CIB W70 Glasgow 2002 Symposium Facilities Management and Maintenance, CABER, Glasgow Caledonian University, Glasgow, 628-641.

Straub, A., Vijverberg, G.A.M. and Van Mossel, J.H. (2005a) *Prestatiegericht samenwerken bij onderhoud, Basisinformatie Bouwkundig Onderhoud*, SBR, Rotterdam.

Straub, A., Vijverberg, G.A.M. and Van Mossel, J.H. (2005b) *Prestatie-eisen kozijnen, ramen, deuren en puien met ondergronden van hout, metaal en kunststof*, SBR, Rotterdam.

Straub, A., Vijverberg, G.A.M. and Van Mossel, J.H. (2005c) *Prestatiegericht samenwerken bij onderhoud, Financiële onderbouwing van resultaatgericht samenwerken bij onderhoud*, SBR, Rotterdam.

Tubbs, B. (2004) CIB TG37 *Final report*, Proceedings CIB World Building Congress 2004 Toronto.

U.S. Department of Transportation (2003) *Asphalt Pavement Warranties – Technology and Practise in Europe U.S.*, Department of Transportation, Washington.

Van Weele, J. (2002) *Purchasing and supply chain managemen*t, Analysis, Planning and Practise, Thomson Learning, London.