

## **Cost Management under Construction Management (CM) Contracts -In the Case of Large Building Projects in Finland**

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### **Abstract**

Frequently, large building projects are started and going on without knowing the actual occupiers or before the decision makers are able to determine their final design requirements. In Finland, construction management (CM) contracts are increasingly used. CM contracts allow the start-up of construction works even when room infill designs have not been finalized. However, the costs of CM projects cannot be controlled by tender prices only, as in traditional general contractor lump sum projects. Herein, a new model is introduced for managing costs in CM projects from programming to handover. The adoption of this model enables (1) to set a target price (cost frame) based on a flexible (modifiable) building program (brief), (2) to check a given overall design by comparing a building element estimate (BEE) against the target price, (3) to break down the BEE into a target budget (cost plan) according to design packages, (3) to check the design solutions of each design package against the target budget by using a detailed bill of quantities and a detailed cost estimate, (4) to break down these cost estimates into procurement packages, and (5) to utilize the expertise of suppliers and subcontractors to develop the design solutions in order to meet the target budget.

### **Keywords**

Building, Construction Management, Cost Management, Finland, Procurement Methods

### **1. Introduction**

Construction management (CM) is characterized as a contract form where a professional CM organization leads a project in close cooperation with an owner (client) using open cost books. A construction manager acts as an owner's representative who sits on the same side of the table. An owner makes all of the final decisions during a project concerning design solutions, procurement packages, trade or work contracts, and suppliers (Kiiras et al., 2005 and Kiiras et al., 2002).

Typically, many owners start their building investments before all the users are known or before the owners are ready to determine their final design requirements. The use of CM contracts makes it possible to start building projects before all the room interiors (infill) are designed. Since the mid-1990s, CM contracting has gained a big share of the building market in Finland. In particular, owners appreciate the savings in time. The construction works are executed by many procurement packages. The primary reason for the high level of satisfaction of most owners lies in the opportunity to make true quality/price choices concerning each procurement package.

So far, no major cost overruns have occurred in large CM building projects in Finland. Nevertheless, the reasons for some actual minor cost overruns are perceived differently among the various project parties. In general CM managers accuse the owners and the designers of making too many design changes too late. In turn, most designers and owners claim that CM managers are not competent enough to identify the complete scope (and all the costs) of works, supplies, and services based on overall design documents (sketches). CM managers are used to estimate costs on a bottom-up basis (i.e. nuts and bolts generate a building).

The normal use of the guaranteed maximum price (GMP) needs to be preceded by the completion of (almost) all of the designs. Thus, the GMP is not applicable in the context of this paper where it is assumed that the owners seek high flexibility throughout the total duration of a given project.

Herein, the construction of large building projects is approached from the CM perspective where an emphasis is given to a new way of managing costs effectively through concurrent project processes. A new model for cost management is introduced. The first pilot tests of the model involve the action research case study. The conclusions concern the future applications of the suggested model in the case of the building market in Finland.

This article presents the modifications needed for an advanced Finnish cost management model in the case of concurrent CM projects. The Finnish cost management model (Haahtela and Kiiras, 2005) consists of a target price, a building element estimate, and detailed cost estimates.

## **2. A Cost-Centered Rationale for Advancing CM Forms in Building in Finland**

### **2.1 Cost Control Based on the Causes of Cost Variance**

The unit spatial cost variance (differences in €/m<sup>2</sup>) among building projects are caused by building programs, local conditions, design solutions, procurement methods, and variable tender prices. The empirical findings have revealed that overall and detailed design solutions play the decisive role (Kiiras, 1999; Haahtela and Kiiras, 2005).

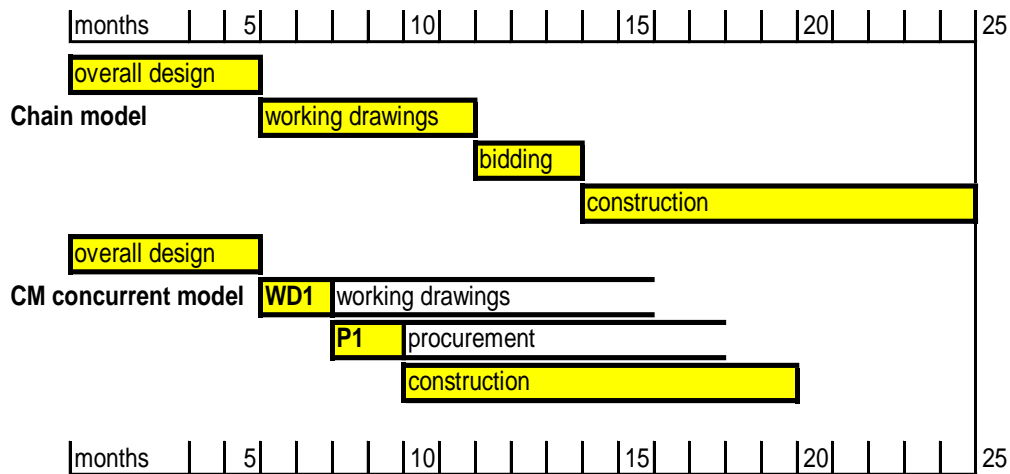
The Finnish cost management system is based on the causes of cost variance. It proceeds through a project's stages as follows. A target price (cost frame) for a project is set based on a building (room) program and local conditions, not on designs. The idea is to make an appropriate budget based on the requirements and on the local conditions. The design team has to produce design documents that are feasible within the cost frame (under the cost limit). The acceptance of the overall design documents is checked against this target price (cost frame) by a building element estimate (BEE). The overall design documents include traditional sketches according to the standard task lists of Finnish designers. An exception involves room layouts which are illustrated only by several different room types. In turn, the acceptance of working drawings is checked by a detailed cost estimate and a general contract lump sum tender price (Haahtela and Kiiras, 2005). This procedure has been used as the basis for this cost management system of concurrent CM projects.

### **2.2 Basic Ideas for Managing Building Costs under CM Contracts**

In the concurrent CM model, the detailed design and engineering (working drawings), procurement, and construction works are overlapping. Both design packages and procurement packages are used as levers for effective project management. The timing of the final working drawings is fairly open toward the end of the construction stage (Kruus and Kiiras, 2005).

The major differences in cost management between the traditional chain model and the concurrent CM model are as follows (Figure 1). Under a CM contract, (1) construction works are started before all the work documents are ready, (2) the full costs of all the works and supplies are estimated based only on these half-

completed design documents, and (3) the detailed design documents are developed jointly by all the project parties, i.e. an owner's representatives, a CM manager, designers, package contractors, and suppliers.



**Figure 1: Main Contract Chain Model versus Construction Management Contract Concurrent Model (in The Case of a 20000 m<sup>3</sup> Office Building).**

In Finland, a new model (FinSUKE) is being developed, where the building design process and its outcomes are managed through a set of design packages, not construction bid packages. In each CM project, design packages are determined early as part of a project plan. A CM team compiles and schedules a set of design packages in cooperation with designers. A design (and engineering) package is defined as a set of convergent solutions concerning a fairly independent part of a building. Together, these design packages cover a building as a whole. Typically, a design package is determined for earth construction, a substructure, a superstructure, a facade, a roof, and different room or space areas. In other words, design packages cannot be formed by construction trades such as tiling works (Kruus and Kiiras, 2005).

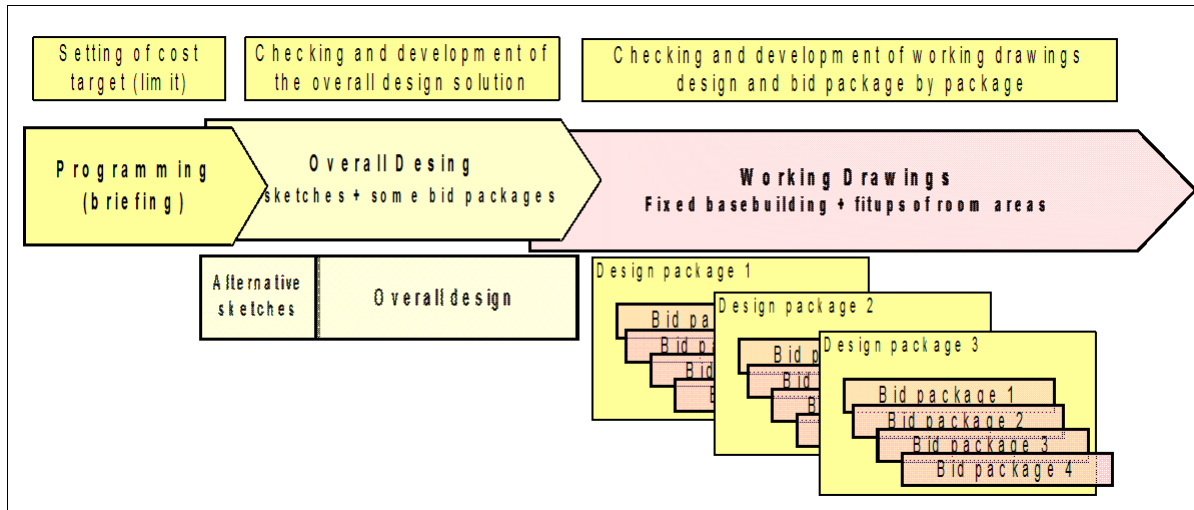
Under CM contracts, a cost management process is divided to two main phases. First, the management system is a top-down (break down) procedure, i.e. a building project is broken down to nuts and bolts, until the completion of each design package. The building element estimate are broken down into the design packages. After the working drawings are ready, package by package, the cost management process proceeds on a bottom-up basis. Herein, the detailed cost estimates of design packages and the procurement package bids are used as the comparative tools.

### 3. New Model for Managing Building Costs under CM Contracts

#### 3.1 Stages in Cost Management

The cost management of a building design process as a whole is illustrated in Figure 2. The three main stages include (1) the setting of a target price (cost frame), (2) the checking and the development of an overall design (solution), and (3) the checking and the development of working drawings, package by package. In essence, building costs are managed seamlessly via a process starting from a project target price (cost frame) through to each procurement bid package.

The cost management model is not used for achieving the cheapest possible building. The purpose of the system is to ensure the best value for an owner within the limits of the first acceptable budget.



**Figure 2: Stages in Cost Management under CM Contracts.**

### 3.2 The Setting of A Target Price (Cost Frame)

The Finnish target price procedure is herein applied to determine a feasible cost frame. This implies that the building needs are determined and expressed in terms of functions or spaces, i.e. a room program is prepared. Nowadays this is a common practice in Finland (Haahtela and Kiiras, 2005).

In many cases, the detailed room requirements of occupiers or users are not known until the construction stage. Typically, many occupiers may leave the project and others come in during a lengthy construction process; room requirements are changed, and tenants (when applicable) are being chosen ex post, i.e. after construction works have been initiated.

So in order to prepare a sound budget for a project, a limit (target or frame) for the construction costs must be set. The limit is determined by including the most expensive modifiable infill in a budget. The budget is broken down into the support part and the infill part. The infill budget is revised as more is learned about the users of the building in question (Saari, 2002).

### 3.3 Checking and Development of Alternative Sketches into an Acceptable Overall Design

The checking of the costs of both the alternative sketches and that of the selected overall design is based on a Finnish building element estimate (BEE), which is compiled especially for a sketching stage (an elemental bill and estimate). If the estimate of the sketches is higher than the project cost frame, the sketches should be developed. The idea is to tackle the actual reason for cost overruns not the consequences of the over-designed documents. After the start of construction, any major change in the overall design becomes costly. In the concurrent CM projects no lump sum tenders of a general contract can be used. Similarly, no real detailed cost estimates can be prepared due to a non-completed design. The BEE serves then as a basis for planning a set of design packages. The BEE acts as a target budget for design development and is broken down into the design packages, not into procurement bid packages. A single procurement package is seldom the most relevant criterion for managing a building design process effectively. A design package is a larger entity containing all the sub-designs that are to be solved together.

### 3.4 Checking and Development of Working Drawings

When a design package is completed, a **detailed bill of quantities and a detailed cost estimate** are prepared for it. The detailed cost estimate is compared with a target budget for this design package. The better solutions of the design packages may be developed in several ways such as (1) revising a design to allow the adoption of more productive ways of construction, (2) decreasing the level and/or the scope of a design, and (3) revising the design to allow the use of alternative materials.

In this model, all the works of each accepted design package are identified and assigned as the targets to the procurement packages. The detailed bills of quantities enable the invitation of better packaged bids and a harmonized comparison of the bids that have actually been submitted.

If a procurement package-specific bid is higher than its target, a CM manager can rely on several ways of developing the designs and/or changing the competitive terms in order to meet the target budget. The design solutions can be developed jointly by an owner, a CM manager, designers, package contractors, and suppliers. In particular, their trade-specific expertise can be called upon for the purpose of meeting the target budget. In turn, the development of acceptable procurement packages involves obtaining various approaches such as (1) breaking the current procurement scope down into a set of smaller procurements, (2) combining several procurement packages into the larger one, (3) procuring the materials and work separately, and (4) altering the bid form into a cost-plus-fee contract.

#### **4. Conclusions**

No model or procedure is available to an owner for the purpose of obtaining simultaneously a flexible design process (resulting into modifiable solutions) and fixed costs for the focal project. An owner has to make a trade-off between one or another project goal.

Under flexible CM contracts, seamless cost planning through all the stages with a set of proper controls is recommended to owners. In addition, an advanced owner or a CM manager may use two kinds of reservations. Contingencies are assigned for changes concerning overall designs and project plans. Allowances are attached to single not-yet-specified items. A reliable total budget must be prepared on a top-down basis.

In comparison with the cost management literature, the suggested new model differs in many ways from the more traditional ones such as (1) a detailed cost estimate is not prepared for a building as a whole or there is no lump sum or GMP bid, (2) design packages serve as the bases for the detailed cost estimation, (3) a target budget for each procurement package is set after the related design package is completed and accepted.

In the case of Finland, several smaller cost management problems have occurred in large building projects carried out under CM contracts. In part, the reasons lie in the traditional practices used. Most cost estimators have dealt only with fixed prices in competitive bidding situations. They estimate the minimum price for the works (scope) based on the completed design documents. Any changes in the designs are compensated later with change orders. Under CM contracts, all the designs are preliminary and each owner expects that the budgeted price allows for the execution of all construction works needed for a finished building. Thus, a target price (cost frame) should be set for the maximum price of a building program. In renovation projects, the existing building should be considered a circumstance.

In our design management (FinSUKK) study (Kruus and Kiiras, 2005), the principles of open building are being adopted in order to decouple the fixed base building from the modifiable room areas. The idea does not differ from the principles presented previously, for example, by Decker and Kendall (1996). In the Finnish pilot projects, this principle has led to new kinds of guide lines, which include (1) the re-phasing of a building design process into three stages so that construction works can be started before all the design packages are completed and (2) the refocusing of a design team's attention on the fixed base building with a long life cycle and on the modifiable room infill with shorter life cycles, respectively.

The results of the initial tests of the suggested model support a hypothesis on the systematic management of costs also in a project where the final uses of spaces are specified later during a construction phase. It is

envisioned that CM forms and, in particular, the choices of the best suppliers on a basis of the life-cycle costs will attract many competent suppliers to productize their offerings (i.e. services, products, and systems) further.

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