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# Introduction

Financial control means control of money changing hands. Since money almost always changes hands in the opposite direction from that in which goods or services are supplied, it can be considered as the control of who provides what and at what price. This thought establishes a priced bill of quantities as the central vehicle for the financial control of a civil engineering contract. The bill of quantities is the agreed statement of the prices that will be paid for work done by the contractor for the client, and it shares with the drawings and the specification the responsibility for defining what has been agreed shall be done.

Control is usually based on a forecast. The difficulty of controlling something is proportional to the difficulty of predicting its behaviour. The points, finer and coarser, of the financial control of civil engineering contracts revolve around the difficulty that the client has in forecasting and defining to a contractor precisely and immutably what the contractor is required to do, and the difficulty the contractor has in forecasting precisely what the work will cost. To achieve effective control it is necessary to limit these difficulties as much as possible within reasonable limits of practicality. This means using as much precision as possible in defining the work to the contractor and in enabling them to forecast their cost as precisely as possible. These are the essential functions of bills of quantities. It is the essential function of a method of measurement to define how bills of quantities should be compiled so that they serve these two essential functions.

It is clear from this consideration that a bill of quantities works best if it is a model in words and numbers of the work in a contract. Such a model could be large, intricately detailed and reproducing the workings of the real thing in an exact representation. Alternatively, it could be as simple as possible while still reproducing accurately those aspects of the behaviour of the original that are relevant to the purposes for which the model is constructed.

The first purpose of a bill of quantities is to facilitate the estimating of the cost of work by a contractor when tendering. Considered as a model, it should therefore comprise a list of carefully described parameters on which the cost of the work to be done can be expected to depend. Clearly, these parameters should include the quantities of the work to be done in the course of the main construction operations. There is no point in listing those parameters whose influence on the total cost of the work is so small as to be masked by uncertainty in the forecasting of the cost of the major operations.

Other points of general application emerge from this principle of cost-significant parameters. The separation of design from construction in civil engineering contracts and the appointment of contractors on the basis of the lowest tender are the two features of the system that make it essential for a good set of parameters to be passed to contractors for pricing, and for a good set of priced parameters to be passed back to designers and employers. Only then can they design and plan with the benefit of realistic knowledge of how their decisions will affect construction costs. The less that contractual pressures cause distortion of the form of the prices exchanged from the form of actual construction costs, the better this object is served. It is very much in the interests of clients of the civil engineering industry, whether they are habitually or only occasionally in that role, that the distortion of actual cost parameters should be minimised in priced bills of quantities.

A client's most important decision is whether to proceed to construction or not. This decision, if it is not to be taken wrongly, must be based on an accurate forecast of contract price. Only if a

# Section 2
# General principles

The general principles in CESMM4 are a small group of rules and statements that set the scene for the detailed rules that follow. Where they are expressed in mandatory terms, they are rules of full significance; where they are expressed in less than mandatory terms, they give background to help interpretation of the rules.

Paragraph 2.1 points out that CESMM4 is intended to be used only in connection with civil engineering works or simple building works incidental to civil engineering works. This paragraph has been amended from that found in CESMM3 by removing reference to CESMM3 being used in conjunction with the ICE Conditions of Contract 6th Edition. In keeping with the stated contract-neutral objective, CESMM4 is now intended to be used in connection with any contract for civil engineering works that requires a bill of quantities: for example, the NEC Engineering and Construction Contract where Main Options B or D are used or the Infrastructure Conditions of Contract Measurement Version.

CESMM2 introduced a new Work Classification Z, setting out rules for measuring simple building works that are incidental to civil engineering works. Paragraph 2.2 explains the circumstances and limitations when using CESMM4 in connection with simple building works that are incidental to the dominant civil engineering works.

There is clearly no point in using CESMM4 if the work in a contract is not principally made up of the things that CESMM4 covers.

Paragraph 2.2 also deals with the problem of identifying and measuring work that is not covered by CESMM4, either because it is work outside the range of work that CESMM4 covers or because it is work not sufficiently common to justify its measurement being standardised in CESMM4. Work that is not covered by CESMM4 includes mechanical or electrical engineering works or building works other than those covered by class Z. No rules are given for itemisation, description or measurement of such work, but principles are given that should be followed. If the work needs to be measured, that is to say a quantity calculated, any special conventions for so doing that it is intended shall be used should be stated in the Preamble to the bill.

The last sentence of paragraph 2.2 says that non-civil engineering work outside the scope of CESMM4 that has to be covered shall be dealt with in the way that the compiler of the bill chooses, governed only by the need to give the itemisation and identification of work in item descriptions in sufficient detail to enable it to be priced adequately.

Paragraph 2.2 does not imply a standard method of measurement, because for this type of work there is no necessity for there to be a standard method. Thus, an entry in the Preamble to the bill that complies with this paragraph might refer to another standard method of measurement, such as the Royal Institution of Chartered Surveyors' NRM 2: Detailed Measurement for Capital Building Works, or it might state a measurement convention adopted for a particular work component. An example of this would be the measurement of large oil tanks associated with oil refinery installations. These are not mentioned in CESMM4 but they might have to be measured within a civil engineering contract. In such a case, the compiler of the bill would probably decide to measure the tanks by their mass of steel and might need to state related measurement conventions in the Preamble to the bill. These conventions might include the rules by which the mass of steel in the oil tank was to be calculated for payment.

## Class A: General items

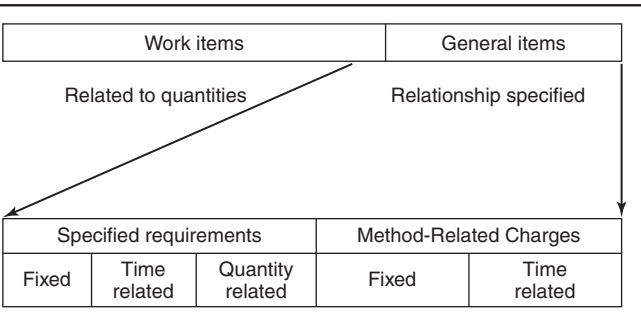
The introduction of the first edition of CESMM made the use of general items more purposeful than it was previously. General items include those items that were sometimes called preliminary items in the terminology of the building industry. They are now a group of prices in the contract that are general in the sense that either they are not related to the permanent works (such as items for services and facilities for the contract administrators) or they can conveniently be grouped under a heading that is general (such as items for Method-Related Charges or Provisional Sums).

CESMM4 defines cost relationships for general items very precisely. This is an example of the closer relationship of prices to construction costs that CESMM4 sets out to achieve. Figure 8.1 shows how the price–cost relationships for general items are arranged.

Bills prepared before the introduction of the first edition of CESMM assumed that all prices for measured work items were proportional to quantities, and that prices for general or preliminary items were not necessarily proportional to quantities. Since conditions of contract rarely if at all make reference to general or preliminary items, no agreement is assumed in the contract for any special interpretation of general or preliminary items as regards when they should be paid or in what circumstances varied. This formerly led to hesitance on the part of tenderers when pricing general items, and to uncertainty and contention in the settlement of accounts. A contractor could have explained that the large sum of money in the general items that was described in very broad terms was mainly for mobilisation costs and could have asked for the sum to be paid in the first certificate accordingly. Later, that contract could have been varied in such a way that the contractor found it helpful to explain that the sum was mainly to cover the continuing time-related cost of major plant and services. Accordingly, it would then have been increased to make it reasonable and applicable to the extended work. Perhaps such a clear-cut case has never happened in real life, but that it could happen demonstrates the problem. A traditional bill discouraged tenderers from pricing mobilisation costs in appropriate general items because of uncertainty about how the contract administrator would include them in certificates. It was safer to allow for such costs against the rates for that measured work that was bound to be done at the beginning of the construction period than to risk that the contract administrator would certify only the amount pro rata to the value of total measured work.

Figure 8.1 shows how CESMM4 overcomes this problem. All the prices for permanent works generated by classes B to Z are either directly related to a measurable quantity of work or are sums related to the extent and nature of a self-contained item. The prices for other work covered by class A are defined as either quantity related, time related or fixed. The relationship for each item is stated in its description, so that the ordinary processes of interim payment and adjustment specified in the conditions of contract can be applied to them rationally and realistically. Prices are controlled more predictably and with a closer relationship to actual cost. The main division of general items is shown in the first-division descriptive features of class A. The bill compiler should give items for all the obligations required by the contract and all the services

**Figure 8.1** All prices against items in Bills of Quantities compiled using CESMM4 have an assumed relationship to cost. This relationship is either to quantities that can be observed in the physical work itself (quantity-proportional unit rates), to time (Time-Related Charges) or to neither quantity nor time (Fixed Charges). This diagram shows where the items that embody these three relationships are to be found in CESMM4



**Schedule of changes in CESMM3**

Class I

**1**. New classification of materials in the first division provided in line with common modern practice.

**2**. Excavation carried out by hand measured separately.

Class J

**3**. New classification of materials in the first division provided in line with common modern practice.

**4**. Rules concerning straight specials now expanded.

**5**. Fittings and valves on relined mains measured separately.

Class K

**6**. Coverage rules for manholes and other chambers revised.

**7**. Excavation carried out by hand measured separately.

**8**. Nominal trench width for piped French and rubble drains defined.

Class L

**9**. Excavation carried out by hand measured separately.

**10**. Rules for beds, haunches and surrounds of the same material amended.

**Schedule of changes in CESMM4**

Class I

**1**. Clarification of the measurement rule where more than one pipe is expressly required to be laid in one trench.

**2**. The requirement to state British Standard specifications no longer required in the description of pipes.

Class J

**3**. The requirement to state British Standard specifications no longer required in the description of pipe fittings.

Class K

None.

Class L

None.

| Number | Item description | Unit | Quantity | Rate | Amount | |
|---|---|---|---|---|---|---|
| | | | | | £ | p |
| | STRUCTURAL METALWORK. | | | | | |
| | Conveyor gantry example C, steel grade 43A. | | | | | |
| | Fabrication of members for frames; straight on plan. | | | | | |
| M311 | Columns. | t | 1.4 | | | |
| M321 | Beams. | t | 0.9 | | | |
| M351 | Roof trusses comprising single 70 × 70 × 8 mm angle rafters and 50 × 50 × 6 mm internal and bottom ties. | t | 0.9 | | | |
| M353 | Built-up side girders cambered comprising two single 150 × 90 × 12 mm angles top boom, two single 150 × 75 × 12 mm angles bottom boom with verticals 70 × 70 × 8 mm angles, diagonals 70 × 70 × 8 mm, 80 × 80 × 8 mm and 90 × 90 × 10 mm angles. | t | 2.6 | | | |
| M361 | Bracings, purlins and cladding rails. | t | 1.7 | | | |
| M370 | Grillages. | t | 0.4 | | | |
| M380 | Anchorages and holding-bolt assemblies comprising 4 nr 450 × 24 bolts with plates 150 × 150 × 10 mm. | nr | 4 | | | |
| | Erection of conveyor gantry. | | | | | |
| M620 | Frame members. | t | 7.9 | | | |
| M632 | Site bolts black diameter 16–20 mm. | nr | 150 | | | |
| M662 | HSFG load-indicating bolts diameter 16–20 mm with washers. | nr | 84 | | | |
| | Conveyor gantry example C, steel grade 43A. | | | | | |
| | Off-site surface treatment. | | | | | |
| M810 | Blast cleaning as specification clause M2/38. | $m^2$ | 241 | | | |
| M870 | Painting one coat zinc epoxy primer. | $m^2$ | 241 | | | |
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