3. FORMAT OF THE BILL OF QUANTITIES

3.1 Introduction

Before 1922, no standard method of measurement to the Bill of Quantities was available. Only some pamphlets setting out the method of measurement in respect of three trades, recommended by the then quantity Surveyors Association in 1909, were available. Bills had been prepared in different ways by different people. This lack of uniformity afforded a just ground of complaint in the part of contractors that the estimator was frequently left in doubt as to the true meaning of items in the Bill of Quantity. It was observed that although there were number of alternatives available (elemental bill, operational bill etc.) only the conventional standard method of measurement is used to prepare and price the bill of quantities. Here B.O.Q. gives the item, description, quantity, unit, rate and amount. This type of B.O.Q. does not give much help to post tender use. As such, there should be a better format of B.O.Q. to be considered before revising the standard method of measurement.

Lot of research work had been carried out by various professionals to improve the use of the estimate, and then to minimise unnecessary repetition and re-work. Some research professionals even have proposed different formats and presentations to the existing type of bill of quantities to have a better document for their tasks. Detailed explanation of elemental bill and operational bill together with other available formats are given below, so that building industry can study these and benefit from the good aspects of the proposals when they revise our SMM.

3.2 Elemental Bill

In the early 1950's the Elemental Bill was introduced (by the Department of Education in the first place) to face the perceived need for planning. In this bill, items are arranged, not in trade order under main headings of the separate trades, but are grouped according to their position in the building elements. Each element comprises an integral part of the building such as external walls, roofs or floors, which each perform a certain design function. This work within each section (element) is still billed in trade order or grouped in building sequence. It was intended that this form of bill would assist in more precise tendering, help on the job by locating the work in the bill and make the operation of cost planning and cost analysis techniques much easier. The article published in Building Bulletin by the Department of Education and Science explained this concept in detail. (Kodikara, 1990)

This proposed that "If the design and cost control procedures have been structured around elements, that is all parts of the building have been designed under elemental headings and allocated sums of money in the initial cost plan, followed later by elemental detail drawings from which approximate quantities have been measured for cost checks - the cycle should be completed by presenting the bills of quantities in element format, instead of in the work section order of the Standard Method of Measurement".
The preparation of an elemental bills of quantities need not involve any change in the taking off procedure from that used in the preparing a work section bill. The only difference being that the dimensions are sorted under elements instead of work sections. Since quantities are usually prepared by taking off the measurement of sections of a building, which in general are similar to element, there is greater scope for billing direct and thus for saving in time. Editing can commence at a much earlier stage that normal and, with related items billed together (for example, surface excavation, site slab) there is a much better chance of detecting any slip which may have been made during the taking off or billing. However, there had not been a standard list of elements to follow. Different bodies had used different lists. (Kodikara, 1990).

In 1956, the Quantity Surveyors Committee appointed a sub-committee to investigate the use of elemental bills. After a comprehensive investigation, the Quantity Surveyors Committee, reported that, "the reaction of builders generally at present is unfavorable to the elemental bill of quantities, chiefly on the grounds that tendering is made more complicated". According to the report, there had been no general demand amongst the architectural profession for the use of elemental bill of quantities, and it had been found that for a very large number of jobs, they would be in appropriate. The committee concluded that, it would be unwise, and unnecessarily confusing to builders, for the quantity surveying profession as a whole to undertake any large-scale change in the lay-out of bills of quantities at that time. (Kodikara, 1990).

In may 1959, the Cost Research Panel established a Working Party to consider the systems and operations for which the bill of quantities may be used. The evidence submitted to the working party had on site work which had to be sub-let. Although by their very nature, elemental bills must involve some repetition of items, the extent to which they do so will depend upon the list of elements chosen. However, as explained earlier, there had been no standard list available. The number of elements chosen had been varied considerably form 15-20 in the Hertfordshire County Council Office to some 30 in the Ministry of Education’s sub division. There had been many other variations resulting inconsistency in elements identification. (Kodikara; 1990).

### 3.3 Sectionalised Trades Bills

To meet the problems of using elemental bill at the estimator, the Hertfordshire country Council developed another form of bill called "Sectionalised Trades Bill". This bill, upon which tenders are invited, is arranged basically in trades with each trade sub divided into functional elements; the items within each trade are arranged in the normal trade order within the sections.
By always commencing the separate elements at the top of a sheet a "Loose leaf" form is obtained allowing the bills to be re-collated for use in contract management as elemental bills. The main headings are then the functional elements divided into such trades as occur within the element. Hence, a bill similar to conventional type of trade order (with elements within trades) is used in tendering while another bill similar to elemental bill (trade order within each element) is given to the successful contractor for his contract management. However, the response from the industry had been very poor in implementation of the bill. Again, the Quantity Surveying Techniques Working Party of the Cost Research Panel, after investigating the possible use, in its report concluded that, neither the Elemental nor the Sectionalised Trades Bill appeared to be amenable to amendment which would enable contractors to relate site costs to bill prices. (Kodikara, 1990).

3.4 Operational Bill

The Building Research Station (BRS)'s development of the operational bill in early 1960's had been considered as a rational attempt to provide the builder with a document, better suited than the conventional bill, to the pricing, planning and control of building work. In this form of bill, the description of the billed work follows the actual building process, with material costs shown separately from labour costs, all described in terms of the operations necessary for the construction of the building. The intention of the bill was to aid estimating and production by having a common basis for cost information in design, estimating and construction. The sequence of operations was often shown in the bill on a precedence diagram, which showed their relations one to

A number of practicability of the resulted confusion, because the contractor's method of working had not matched with the bill operations. The decisions taken by the client's quantity surveyor may not be relevant to the contractor, and hence may differ from his approach. Therefore, the contractor should be consulted when preparing the precedence diagram. However, if more than one contractor bid for the work, there would not be much benefit on this consultation. Operational bills would appear to place more work on the contractor's estimating division. The estimator's price for the labour element of an operation has to be based on the descriptions in the bills, the schedule of materials and the drawings. The estimator must therefore have the bills and drawings beside him all the time and the need to the extensive time required for the preparation of an estimate with operational bills. (Kodikara, 1990).

To solve the problem of the estimator regarding the complexity and too much information in the bill, in one of the live projects two forms of bills had been tried, one with less detail for all the contractors for tendering purpose and the other with all the material schedules for the successful contractor. This had resulted repetition of work at the client himself. Also, the successful contractor received two forms of bills for pricing at two stages.
Estimators working at speed and under pressure must be able to identify the character, scope and location of an operation. It is also important that description should be sufficiently precise to admit only one interpretation - if not confusion and litigation must follow. Therefore, designers and architects should consider operational (production) methods and should give drawings accordingly. To relate the final drawings to the building operations and their sequence, in one live project, at the request of the BRS, the school of architecture had agreed to substitute operation drawings for conventional working drawings whenever this had been possible. It had been decided that a separate drawing should be prepared for each operation illustrating its nature and extent. However, the problem of preparing drawings in away compatible with the operational sequence was emerged. Also, the employment of different draughtsman on similar operations, such as, brick work from ground to first floor and brick work from first to second floor has resulted in several drawings not being consistent. Operational drawings had been prepared after preparing a complete set of general arrangement (conventional) drawings first. Preparation of a complete set of drawings of conventional type as well as operations drawings was an obvious duplication, hence received criticisms from the industry. (Kodikara, 1990).

It had been observed that substantial additional expense incurred in printing the bills where the costs were more than double the amount normally to be expected with traditional bills for comparable project. Use of a non-standard size of paper due to the width, the use of coloured papers to identify different trade, and the large number of papers in the bill (due to printing each operation on a separate sheet) were the main causes of this additional expense. For tendering purpose a bill had to be given to each competitor with this additional expense for each bill. No client would like operations bill became unpopular. (Kodikara, 1990).

There had not been a clear format for identifying operations and sequence. Also, there had been no standard format to group operations so that the bill could be consistently arranged under sectional headings considering the sequence of construction and operation elements under each section. For example in one live project, there had been only five bills in contrast to an earlier live project which had eight bill with a different format in the summary. This means that, there had not been standard set of rules for the preparation of operational bills. (Kodikara, 1990).

Usually, the cost of plant was assessed in a separate bill rather than within each operation, thus had resulted no indication on the use of plant in each operation. However, in one of the live projects a separate section for plant in each operation was included in response to a suggestion by the contractor, but difficulty had been experienced in estimating plant costs in connection with 'Standing time' between operations. The times when various items of plant would be standing idle had been showed up very clearly with the operational presentation of the bills, and therefore the difficulty had not been of assessing the value but of finding a satisfactory position to include this cost in the bills without 'loading' the true cost of any particular operation.
The operations on the network are a representation of what would happen on site. Therefore, the production of components manufactured on or off site are not included within the operations, although the operational descriptions do, of course, include for fixing these components. All these prefabricated components such as precast concrete units, joinery, metal world etc., are collected together in order in a separate bill called "Manufactured Goods Bill". The components in the manufactured goods bill are cross referenced with the operation descriptions in the other bills. According to the experience of Forbes and Skoyles, during the preparation of the bill, the separation of work on site from manufactured goods had required a considerable amount of cross referencing resulting the estimating process rather cumbersome. (Kodikara, 1990).

3.5 Bill of Quantities (Operational format)

It had been observed that during the BRS' development work on the operational bill, that a 'half-way house' might be of more immediate advantage. Therefore, they introduced a new bill, Bill of Quantities (Operational Format) which incorporated the production bias of the operational breakdown, but retained familiar methods of measurement and pricing using unit rates. The bill items, measured in accordance with the standard methods were presented in the order of construction dictated by the design (and shown on a precedence diagram), and those not directly associated with the site construction process were given separately. (Kodikara, 1990).

The basis is similar to the operational bill, but, because of the use of the Standard Method of Measurement forward. The describing the items as indicated in the buildings' erection activities or operations. A separate section for plant material, labour and plant requirements. However, a separate section for 'off site process' is included as the manufactured goods bill in the operational bill. Lear carried out some work on implementation of this approach, and claimed that the new method was feasible. However, although the preparation and obtaining tenders is little easier than the operational bill, this format also had the same drawbacks as in operational bill. Further more, as in Elemental bill, the result was a significant duplication of effort and a very lengthy tender document creating estimating process rather laborious. According to Skinner the Bill of Quantities (Operational Format) had found no more popularity than the Operational Bill. (Kodikara, 1990).

3.6 The BPF System - Schedule of Activities -

In 1983, the British Property Federation introduced a new concept call "BPF system" in order to attempt to dense a more efficient and co-operative method of organising the whole building process.
In 1984, ACA Form of Building Agreement - BPF Edition - which was designed to overcome many of the criticisms of existing agreements and contracts was released to use with the BPF system. The system which divides the design and building process into five stages as; concept, preparation of brief development of design, tender documentation and construction, can be seen as a project management system where one key man called in the manual ‘Client’s Representative’ takes charge of the job. It is similar to the USA system of organising the work. According to the opening statement by Denis Marler, the BPF president at the conference held in February 1984 for the defence of the system, the working party had taken some interest on overseas construction industry when preparing the system. The system defines how the client should work with the design team, how the design leader should work with the consultants, the client and the contractor, and indeed how every aspect of the management of the team is directed. (Kodikara, 1990).

Bill of Quantities are replaced by the Schedule of Activities (SOA), in which the contractor specifies a priced list of activities within his total program.

The contractor would be paid as each activity is completed. The number of activities in the schedule will depend on how the contractor plans his work and wishes to be paid. The successful contractor may be invited to break down into more detail the activities in the outline SOA submitted with his tender so long as he does not change the overall price and schedule. However, if the client wishes to use a B.O.Q. instead of SOA, provision has been made for it. The priced SOA fulfil the roles of a priced B.O.Q. and a program. It is the basis for reporting progress and is of assistance also has the also has the progress during a close relat achieved.

According to Sims, the advantages gained by the SOA are not that much but less than of the B.O.Q. system. Also, the disadvantages of the SOA are much greater than the disadvantages of existing B.O.Q. type bill.

Furthermore, with the use of SOA, the employer may find himself bound to a system of payment which may be manipulated by the contractor. Royal Institute of British Architects (RIBA) also had criticized the BPF as a method which introduce increased delays and errors to an already over burdened building process. However, Sims again pointed out that, the idea might work reasonably well on a very simple project such as a large factory building comprising basically an enclosed shape. (Kodikara, 1990).
3.7 Standard Method of Measurement

As mentioned earlier, the first Standard Method of Measurement was published in 1922 by the Surveyors' Institution mainly to have a greater accuracy of work and uniformity of method of measurement. At that time even a little thought had not been given for post tender use of the estimate. The only consideration considered by the joint committee had been the preparation of a set of standard rules of measurement of building works.

Since 1922, seven editions of the Standard Method of Measurement (SMM) have been published, each edition considering the changing requirements of the then industry. During this period (1922-1988), various professionals and bodies had criticized the conventional B.O.Q. and asked for numerous changes. One such requirement has been the improvement of the post tender use of the estimate. The previously described formats have been proposed during this period as changes and these methods have been practised in U.K. When SMM was revised the committee has considered all these formats, so SMM7 can be considered as a method which is benefited from all these proposals. Therefore when revising Sri Lankan document we can mainly concentrate on SMM7 for necessary inputs.