

Chapter 16

Method of Measurement for Highway Works

16.1 Measurement and billing of proprietary manufactured structures

Each proprietary structure to be designed by the contractor is billed according to Paragraphs 15 and 16 of the MMHW Chapter III: *Preambles to Bill of Quantities* and to Series 2500: *Special Structures* of Chapter IV of the MMHW.

16.1.1 Billing of items

Guidance is provided in the *Notes for Guidance on the Method of Measurement for Highway Works* Series 2500: *Special Structures*. As a consequence, the BQ items for proprietary structures to be designed by the contractor would appear in a separate Bill No. 5 as illustrated in Table 16.1.

16.1.2 Measurement

It can be seen that, within Bill No. 5: *Structures Designed by the Contractor*, a separate ‘sub-BQ’ is provided for each structure (e.g. Bill No. 5.2: Highmore Lane Underbridge).

The take-off for this item would be generated as shown in Figure 16.1 which shows the item description in the upper grid and the ‘base item’ or ‘root narrative’, from which the item description is derived, in the lower grid.

The base item is taken from the *Library of Standard Item Descriptions for Highway Works* (1*2* designed by the Contractor 3*), and this is edited as shown in the upper grid.

The item would appear in the final bill of quantities as illustrated in Table 16.2 pursuant to the requirement of Series 2500: *Special Structures* that contractor-designed structures are to be billed as separate single items, with an associated name or reference.

16.1.3 Tender stage

At tender stage, the contractor prices the item by means of a single lump sum that is deemed to include for design, approvals, submissions and resubmissions and *everything necessary for the completion of the Works within the Designated Outlines, as shown in the relevant item coverages in the Chapters and Series of the Method of Measurement, with the exception of those works scheduled as not to be included.*

Table 16.1 Bill No. 5 – structures designed by the contractor.

Bill no.	Title	Name/reference
1	Preliminaries	
2	Roadworks	
3	Structures	
4	Structures where a choice of designs is offered	
5	Structures designed by the contractor	
5.1		Elton Brook Culvert
5.2		Highmore Lane Underbridge
5.3		Grassington Road Gabion Wall
6	Service areas	
7	Maintenance compounds	
8	Accommodation works	
9	Works for statutory or other bodies	
10	Daywork	
11	PC and provisional sums	

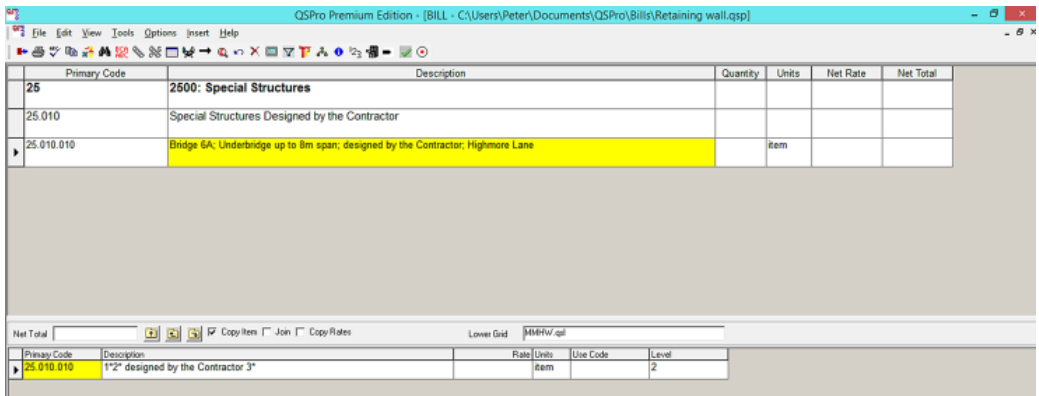


Figure 16.1 Highmore Lane Underbridge – 1.

Table 16.2 Highmore Lane Underbridge – 2.

	Qty	Unit	Rate	£	p
2500: Special Structures					
<u>Special Structures Designed by the Contractor</u>					
A Bridge 6A; Underbridge up to 8m span; designed by the Contractor; Highmore Lane		item			

This means that not only does the item coverage for Series 2500: *Special Structures* apply, but also other item coverages for other relevant Series pertinent to the work involved in constructing the proprietary structure.

The tender documentation must clearly show the extent of work excluded from within the designated outline as this work would be measured in the Roadworks or other Bills by the overseeing organisation. Where this cannot be shown clearly, a schedule of exclusions must be provided.

Risk issue

Tenderers must decide how much effort to put into designing proprietary structures at tender stage. Clearly, designs need to be sufficiently developed so that an accurate price can be derived but not so detailed as to incur design fees disproportionate to the cost of tendering and to the chances of winning the contract.

Exclusions from the contractor's lump sum include common items of work such as drainage, kerbing and safety barriers, etc. Such items will be billed by the overseeing organisation in other Bills, unless impracticable to do so, in which case the contractor's attention must be drawn to the need to price these items into the lump sum price for the proprietary structure. Earthworks within designated outlines are excluded but, if this is not scheduled on the drawings, the contractor could be caught out by the provisions of Series 600: *Earthworks* Paragraph 11 which states that:

- *Earthworks within Designated Outlines shall not be measured in this Series.*

Risk issue

Contractors should be aware that earthworks volumes within designated outlines will not be included in the earthworks schedules prepared by the overseeing organisation and that no claims will be entertained should the contractor not take this work into account in the tender price.

The consequence of this is that tenderers must calculate earthworks volumes within designated outlines for themselves and include these quantities in the pricing of the lump sum items for proprietary structures to be designed by the contractor.

Once the contractor's tender is accepted, detailed design will follow and, once accepted by the overseeing organisation, the contractor must submit a schedule of rates totalling the tendered lump sum. The purpose of the schedule of rates is to provide a means of valuation of work in progress and in order to value variations to the contract. The schedule of rates must be itemised in accordance with the relevant Chapters and Series of the MMHW pursuant to the requirements of Paragraph 16 of the MMHW Chapter III: *Preambles to Bill of Quantities*.

16.2 Measurement and billing of structures where there is a choice of designs

In accordance with MMHW Chapter III: *Preambles to Bill of Quantities*, Paragraph 6, the measurement and billing of structures where there is a choice of designs requires two bills of quantities to be included in the contract documents as part of the main BQ so that the contractor is able to choose which of the options to price.

16.2.1 Billing of items

Where a choice of designs is offered, each bill (e.g. Bill No. 4.1 – Hough Farm Box Culvert) will comprise two bills of quantities as illustrated in Table 16.3:

1. One bill of quantities quantifying the design prepared by the overseeing organisation.
2. A second bill of quantities for the contractor's design.

Table 16.3 Bill No. 4 – structures where a choice of designs is offered.

Bill no	Title	Name/reference
1	Preliminaries	
2	Roadworks	
3	Structures	
4	Structures where a choice of designs is offered	
4.1A	Structure designed by the overseeing organisation	Hough Farm Box Culvert
4.1B	Structure designed by the contractor	
4.2A	Structure designed by the overseeing organisation	Tarrant Road Retaining Wall
4.2B	Structure designed by the contractor	
4.3A	Structure designed by the overseeing organisation	Wavin Lane Footbridge
4.3B	Structure designed by the contractor	
5	Structures designed by the contractor	
6	Service areas	
7	Maintenance compounds	
8	Accommodation works	
9	Works for statutory or other bodies	
10	Daywork	
11	PC and provisional sums	

Each structure must be billed in this way so that:

- The measured work in the engineer-based design is kept separate from other measured work in the contract to avoid confusion.
- The BQ for the engineer-based design may be left unpriced and omitted from the contract where the contractor design option is preferred by the tenderer.
- It is clear that there is no duplication in the eventual tender total.

The structure of the full tender bill of quantities is illustrated in Table 16.3, where it can be seen that there are three structures where a choice of designs is offered.

Table 16.3 shows that:

- **Structures Where a Choice of Designs is Offered** is Bill No. 4.
- Bill No. 4 is quite separate from Bill No. 5 Structures Designed by the Contractor which deals with proprietary structures.
- Bill No. 4 is subdivided as necessary into separate bills for each structure (e.g. Bill No. 4.1, 4.2, etc.).
- Each bill is then subdivided into separate bills according to how they are measured (e.g. Bill No. 4.1A and 4.1B).

16.2.2 Measurement

Taking Bill No. 4.1, Hough Farm Box Culvert, as an example, the work would be measured as follows:

- Bill No. 4.1A is measured in detail, according to the various appropriate Series of the MMHW, because it is based on a design by the overseeing organisation.
- Bill No. 4.1B is measured according to Series 2500 (i.e. a single item) because the design is to be carried out by the contractor.

Bill No. 4.1B would be created as a single item under Series 2500 as illustrated in Figure 16.2 which shows the ‘base’ item or ‘root narrative’ in the lower grid.

The final billed item would appear as illustrated in Table 16.4.

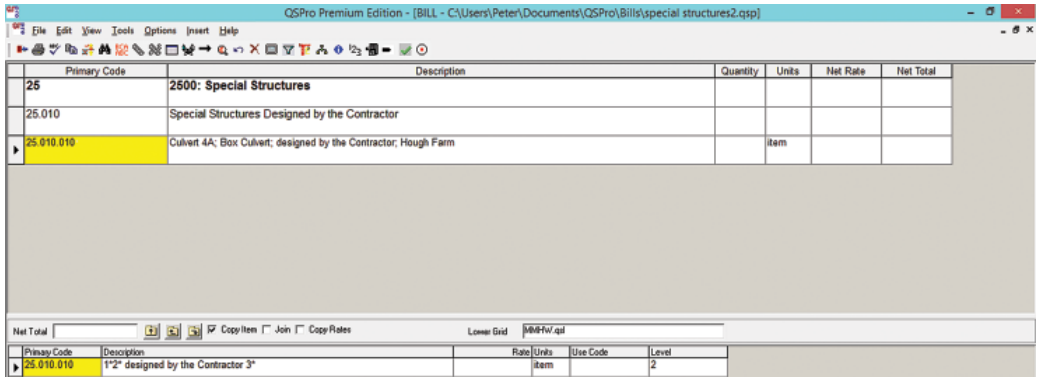


Figure 16.2 Hough Farm Box Culvert – 1.

Table 16.4 Hough Farm Box Culvert – 2.

		Qty	Unit	Rate	£	p
	2500: Special Structures					
	<u>Special Structures Designed by the Contractor</u>					
A	Culvert 4A; Box Culvert; designed by the Contractor; Hough Farm		item			

16.2.3 Tender stage

At tender stage, tenderers have a choice:

1. Price Bill A – The bill of quantities for the engineer-based design:
 - This is measured, in detail, according to the appropriate Chapters and Series of the MMHW.
 - If priced by tenderers, this bill is brought to a distinctly separate total to the remainder of the measured work in the tender bills.
 - The design and quantity risks are retained by the Overseeing Organisation.
2. Price Bill B – The contractor design option:
 - This is again prepared in accordance with the MMHW but this time uniquely under the provisions of Series 2500: *Special Structures*.

- This BQ will comprise only one item and the price, if submitted by the contractor, will be a single lump sum.
- The contractor takes both the design risk and the quantity risk for this item.

Once the tenderer has decided on the appropriate strategy, the tender is finalised by pricing either Bill A or Bill B (but not both) and totalling this with the remaining bills in contract (i.e. Preliminaries, Roadworks, etc.).

16.3 Measurement of proprietary manufactured structural elements

Figures 16.3 and 16.4 illustrate the construction of an engineer-designed railway bridge where the contractor is to be responsible for designing the proprietary structural elements. These consist of bridge bearings and piles.

The bridge is required to carry the railway line over a proposed highway. In order to keep the railway line running, the bridge is to be slid into position during a line possession thereby reducing disruption to a minimum. Piles, capping beams and service ducts can be seen in Figure 16.3 which have been installed in previous possession periods. In a further possession, the railway line embankment, ballast and track have been removed, and the bridge is ready to be slid into position.

A simulation of the process can be seen at <https://www.youtube.com/watch?v=Nw4luhVNjsU>.

16.3.1 Billing of items

In Figure 16.4, the bearings for the central pier can be seen highlighted, and it is this item of work that the contractor is to design as a proprietary structural element, along with the piles.



Figure 16.3 Bridge slide – 1.



Figure 16.4 Bridge slide – 2.

As there are no notes for guidance for measuring these items in the *Notes for Guidance on the Method of Measurement for Highway Works*, the bill compiler is on his/her own when it comes to describing and billing the work.

16.3.2 Measurement

In this particular case study, the number and length of piles and the number of bridge bearings have to be measured. These items are classed as proprietary manufactured structural elements to be designed by the contractor, and the MMHW requires that they be billed in specific units of measurement.

As discussed in Section 8.10.4, however, the bill compiler has a dilemma because these elements have yet to be designed but a quantity is, nonetheless, required to complete the BQ.

After the *Notes for Guidance*, the first place to look for ideas is the root narrative for the item concerned – for example, bridge bearings.

Figure 16.5 illustrates the root narrative for bridge bearings where it can be seen that the type of bearing must be known in order to complete the two descriptions – supply and installation – and a quantity must be known to complete the items.

Primary Code	Description	Quantity	Units	Net Rate	Net Total
21	2100: Bridge Bearings				
21.010	Bearings				
21.010.010	Bearing 1*		no		
21.010.020	Installation of 1* bearing		no		

Figure 16.5 Root narrative – bridge bearings.

However, without knowing what the contractor’s design will be, it is impossible to say what type the bearing is or what the quantities should be, leaving the bill compiler to come up with quantities for items that are unknowns!

Obviously, the method of measurement must be respected but, on the other hand, reality must be faced and a solution found. Therefore, purely as a personal suggestion, a method of billing the bridge bearings is illustrated in Table 16.5.

Table 16.5 Suggested billing of bridge bearings.

Rail Bridge 118A		Qty	Unit	Rate	£	p
2100: Bridge Bearings						
<u>Bearings to be designed by the Contractor</u>						
A	Bearing Type []*; quantity to be inserted by the Contractor * to be completed by the Contractor		no			
B	Installation of bearing Type []* ; quantity to be inserted by the Contractor * to be completed by the Contractor		no			

Once individual bill compilers have decided on their own plan of action, it may be thought appropriate to amend the Method of Measurement. This may be done by including additional pages in the Preambles to the Bill of Quantities and turning to MMHW Chapter III Paragraph 20 for a suitable form of words:

- *For the purposes of the Contract the Method of Measurement for Highway Works is amended in accordance with the pages immediately following.*

16.3.3 Tender stage

Faced with the problem of billing proprietary structural elements, tenderers are in a better position than bill compilers because, at some point, they will have a design from which quantities may be derived, enabling them to come up with a price.

However, faced with uncertainty in the method of measurement, contractors are prone to overprice or load rates or both as a reaction to risk and, therefore, need a clear and unambiguous item to encourage a competitive figure.

This requires not only a suitable item description – notwithstanding the method of measurement – but an appropriate item coverage that deals with the interface between the contractor’s design and that of the engineer.