

Chapter 17

Principles of

Measurement (International)

17.1 Underpinning

Application of the POM(I) measurement rules is considered in this case study in relation to the underpinning of a 1½ brick thick masonry wall as detailed in Figure 17.1.

The underpinning is to be constructed with C25 mass concrete filling using the traditional alternate bay method of construction.

17.1.1 Measurement rules

Underpinning is measured under POM(I) clause B7, which provides five rules for such work:

- B7.1. Underpinning shall be given under an *appropriate heading* that includes the location of the work.
- B7.2. Work *shall be measured in accordance with the appropriate Work Sections*.
- B7.3. Temporary support *shall be given as an item*, and particulars shall be given where the design of the temporary works is not at the discretion of the contractor.
- B7.4. Excavation *shall be measured by volume*.
- B7.5. Cutting away projecting foundations *shall be measured by length*.

17.1.2 Itemisation

Excavation in underpinning is required to be given in two separate items:

1. Excavation in preliminary trenches.
2. Excavation below the base of the existing foundation.

B7.4.1 is clear that the depth of excavation for the preliminary trench is measured to the base of the existing foundation and the depth of the underpinning pit is the depth below that (B7.4.2).

Whilst POM(I) rules require excavation in underpinning to be billed in two items, there is, however, no rule governing the width of the preliminary trench, or the underpinning pit.

B7.4 merely states that *excavation shall ... be taken to the outside line of the projecting foundations or to the outside line of the new foundation (whichever is the greater)*.

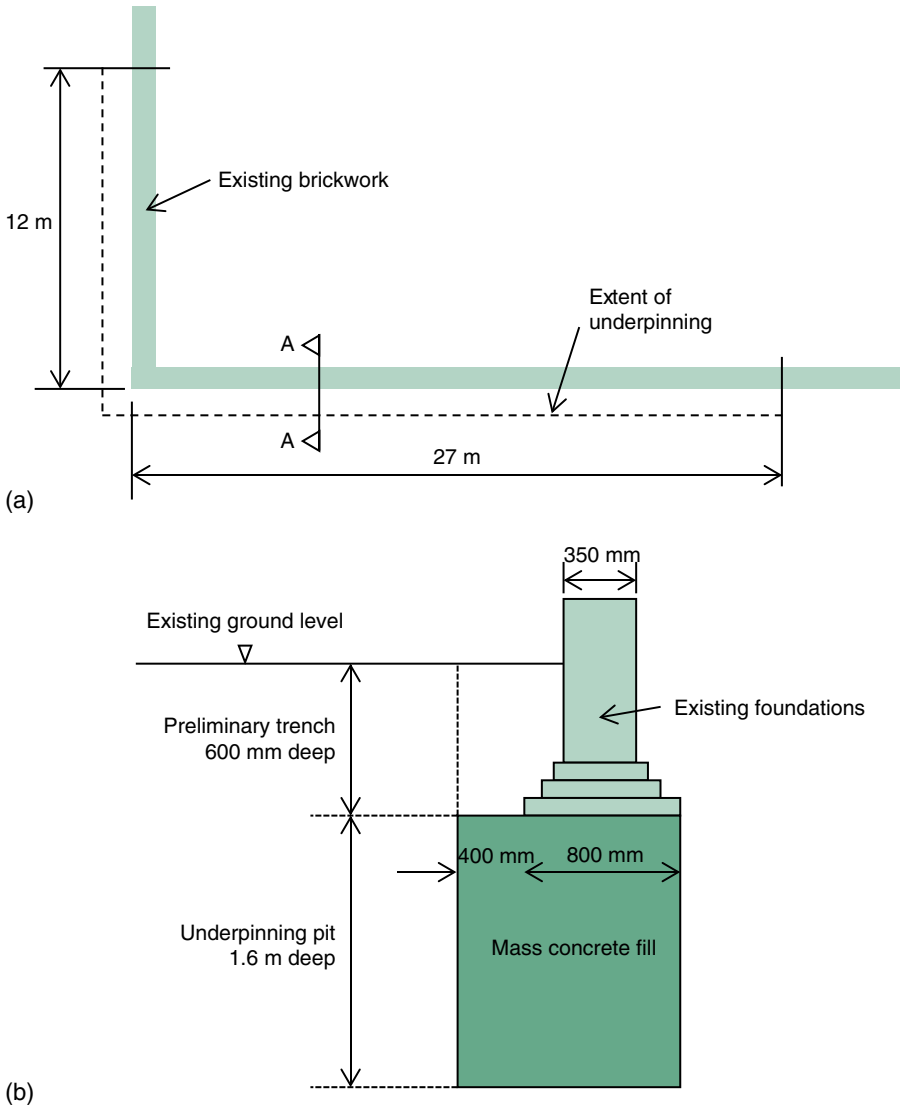


Figure 17.1 Underpinning details. (a) Plan and (b) Section A–A.

17.1.3 Rule B7.4

This rule is illustrated in Figure 17.2 where it can be seen that the width for the measurement of excavation of both the preliminary trench and the underpinning pit is given by the greater of dimensions (a) or (c).

This width shall apply to the volume calculation of both excavations.

The approach taken under POM(I) is to be contrasted with that of SMM7, wherein a *width allowance* is added to the calculation of the width of each excavation as illustrated in Figure 17.3. The width allowance is considerable – a minimum of 1 m – and this reflects the working space required for operatives to work in an underpinning trench which, because of its short length in the alternate bay system, is effectively a confined space from a health and safety standpoint. The consequence of this, for the case study in question, is that a formwork (shuttering) item would be needed for the concrete as well as the obligatory earthwork support item required under SMM7 D50.4.

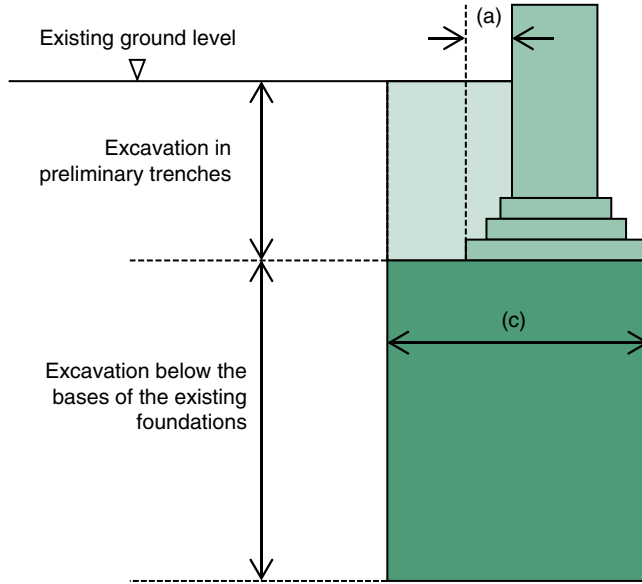


Figure 17.2 POM(I) trench widths.

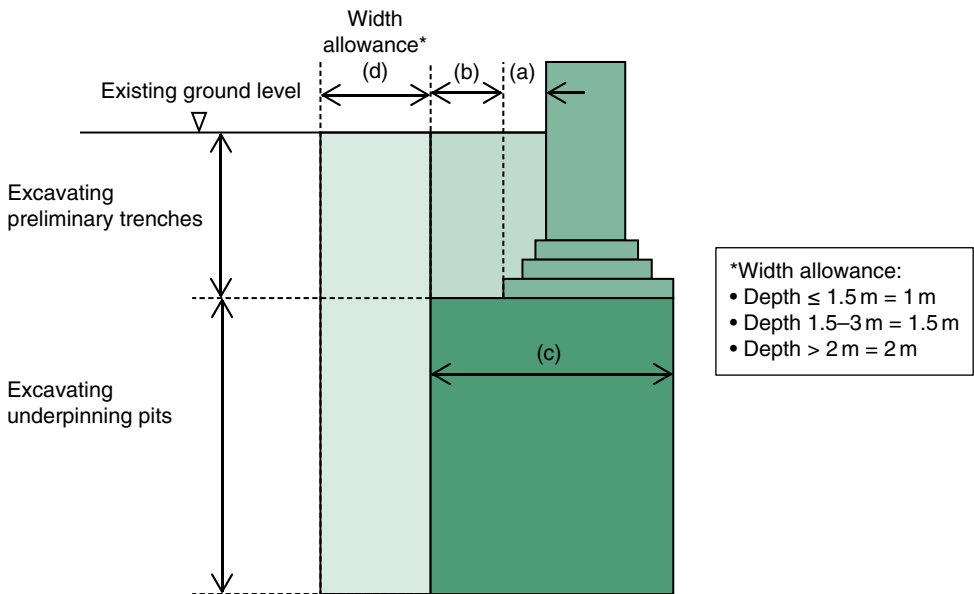


Figure 17.3 SMM7 trench widths.

Risk issue

Following clause B7.4, contractors and subcontractors should be alive to the fact that the volume of excavation measured in the bill of quantities will probably be significantly less than that necessary to carry out the work.

In this event, the rate stated for the work will need to allow for the extra excavation and backfilling required as well as for earthwork support, which is not measured at all.

Consequently, under POM(I) rules, the volume measured is the *net* volume with no allowance for working space or earthwork support.

17.1.4 Working space

Working space is not measured in underpinning, or elsewhere in POM(I), but temporary support for underpinning shall be *given as an item* (refer to B7.3).

Exactly what is meant by the phrase *temporary support* is not clear as this could be taken to mean:

- Temporary support to excavations.
- Temporary support to the wall to be underpinned (e.g. raking shores).
- Temporary support to the foundation prior to concreting (e.g. needles inserted through the wall at ground level).

In common with much of POM(I), the intention here may be to give the bill compiler the latitude to refer to details on drawings or to add additional description to items. The contractor also has the freedom to price the work as seen fit and to price a lump sum (or method-related charge) that can be shown separately from the measured work in the bill of quantities.

In any event, the contractor is obliged to measure his own quantities for the ‘support’ item from the drawings.

17.1.5 Dimensions

Apart from the support item (B7.3), none of the underpinning work is measured under B7. Consequently, reference must be made to other appropriate sections of the method of measurement in order to find suitable items. In this case, Sections B: *Site Work* and C: *Concrete Work* are relevant.

The software used for this case study is CATO Take-off and Bills, which is one of several modules in the Causeway CATO suite.

The basis for measurement in CATO is the dim sheet which is illustrated in Figure 17.4. Here, it can be seen that the first dimension, the trench centre line (39.025 m), is signposted as such and there is a reference {A4} to the side cast for this dimension. Reference to Figure 17.5 shows how the basic side casts have been calculated in the CATO software. The side casts are as follows:

- A1. The existing foundation overhang which is needed to work out the width of the preliminary trench.
- A2. The width of the preliminary trench.
- A3. The centre line of the preliminary trench, allowing for the corner.
- A4. The centre line of the mass filling, again allowing for the change of direction, which serves both the excavation and concrete items.

Tables 17.1 and 17.2, respectively, are the dimension sheets for the excavation and concrete work. The dimensions are presented in the traditional vertical format.

Taking Table 17.2 as an example, it can be seen that the dimensions have been referenced to both the centre line signpost that appears in the corresponding dim sheet (Figure 17.4) and to the side cast {A4} for this dimension. CATO, therefore, provides a clear audit trail for the dimensions and for the side casts used to create those dimensions.

Times	Dimension	Result	Signpost	Side Calc
	39.025		centre line	{A4}
	1.200			
	1.600			
	-----	74.928		

SECTION C - CONCRETE WORK
POURED CONCRETE
Poured concrete; Class C25, unreinforced
Foundations, bases or the like
in mass filling under existing foundations; poured against earth face

Figure 17.4 CATO dim sheet (part).

Figure 17.5 Side casts.

17.1.6 Billing

The dimension sheets in Tables 17.1 and 17.2 can now be related to the quantities billed as illustrated in Table 17.3. In the final BQ, it can be seen that:

- An appropriate heading has been created for the underpinning work which is described under Sections B and C of the method of measurement.
- Items A, D and G contain additional description which has been included pursuant to Paragraph GP1.1 of POM(I).
- All item descriptions have remained faithful to the ‘brevity principle’ of POM(I) which encourages tenderers to pay close scrutiny to the drawings and specification that accompany the bill of quantities.

Table 17.1 Dim sheets – excavation work.

Excavation in preliminary trenches		Unit: m3	Sort: NA	Sheet: 5
Item Code:				
	39.625 0.625 0.600 =====	14.859 ----- 14.859 =====	{A3} centre line	
below the base of the existing foundations		Unit: m3	Sort: NA	Sheet: 6
Item Code:				
	39.025 1.200 1.600 =====	74.928 ----- 74.928 =====	{A4} centre line	
DISPOSAL Disposal of material arising from excavations Generally backfilled into excavations		Unit: m3	Sort: NA	Sheet: 9
Item Code:				
	39.625 0.625 0.600 =====	14.859 ----- 14.859 =====	Anded-on from file UUU sheet 000005 - START - centre line Anded-on from file UUU sheet 000005 - END	
remove from site		Unit: m3	Sort: NA	Sheet: 10
Item Code:				
	39.025 1.200 1.600 =====	74.928 ----- 74.928 =====	Anded-on from file UUU sheet 000006 - START - centre line Anded-on from file UUU sheet 000006 - END	

Table 17.2 Dim sheet – concrete work.

SECTION C - CONCRETE WORK POURED CONCRETE Poured concrete; Class C25, unreinforced Foundations, bases or the like in mass filling under existing foundations; poured against earth face			
Unit: m3		Sort: NA	Sheet: 13
Item Code:			
39.025 1.200 1.600 =====	74.928 ----- 74.928 =====	{A4} centre line	

17.1.7 Footnote

It should be noted that the BQ for the underpinning has been prepared strictly in accordance with POM(I) rules. However, POM(I) allows the bill compiler considerable latitude to not only include additional description but also to amend the rules of measurement as seen fit (clause GP1.2).

In this particular case study, it would seem appropriate to amend the method of measurement for several reasons:

- There is a clear need for a measured item in respect of working space for excavation work under the existing foundation.
- Consequently, an earthwork support item would be appropriate.
- A shuttering item should be measured for the mass concrete fill.

Table 17.3 Bill of quantities – underpinning.

			£	p
<u>SECTION B - SITE WORKS</u>				
<u>UNDERPINNING</u>				
<u>North and east elevation; Howard building</u>				
(NA)				
Temporary support				
A	to sides of excavation	ITEM		
Excavation				
B	in preliminary trenches	15	m ³	
C	below the base of the existing foundations	75	m ³	
Cutting away projecting foundations				
D	cutting away projecting brickwork foundation; one side	39	m	

Excavation items

<u>DISPOSAL</u>				
<u>Disposal of material arising from excavations</u>				
(NA)				
Generally				
E	backfilled into excavations	15	m ³	
F	remove from site	75	m ³	

Disposal items

<u>SECTION C - CONCRETE WORK</u>				
<u>POURED CONCRETE</u>				
<u>Poured concrete; Class C25, unreinforced</u>				
(NA)				
Foundations, bases or the like				
G	in mass filling under existing foundations; poured against earth face	75	m ³	

Concrete item