	£
Brought forward	*0.198*
Labour	
Cutting plug holes, fixing plugs, cutting and fixing grounds.	
0.35 h carpenter at £0.67	*0.235*
	£0.433
Profit and oncost 15%	*0.065*
	£0.498 m²

Cost per m² = £0.50

10. 100 × 50 mm White pine in partitions—m.

	£
Material	
Timber, 10 m at £0.15 per m	*1.50*
Nails, 0.15 kg at £0.12½ per kg	*0.018*
	1.518
Waste 5%	*0.076*
Labour	
0.70 h carpenter at £0.67	*0.469*
	2.063
Profit and oncost 15%	*0.309*
	£2.372 per 10 m

Cost per m = £0.23½

11. Metal joist hangers handed to builder for building in—No.

	£
Material	
Hanger/No.	*0.25*
Waste 2½%	*0.005*
Carried forward	*0.255*

Brought forward	*0.255*
Labourer	
Marking position and attending builder, 30 per h 30 costs £0.67 :1	*0.023*
	0.278
Profit and oncost 15%	*0.041*
	£0.32 No.

CHAPTER XV

JOINERY

Labour Constants

Making Door (based on door 830 × 2 040 mm)	*1 joiner*
50 mm Softwood frame, ledged and braced door	8 h
40 mm Softwood four-panel door	10 h
50 mm Hardwood single-panel glazed door	10 h
Hanging Doors (730 × 2 040 mm)	
40 mm Softwood door	1.2 h
40 mm Hardwood glazed door	2.0 h
Making and Fitting Door Frames (based on 730 × 2 040 mm)	
100 × 50 mm to 150 × 50 mm door frames	2.0 h
100 × 50 mm to 150 × 50 mm door frames plugged to brickwork	2.5 h
Making and Fitting Windows	*per m²*
Double hung sash and case windows	10.75 h
Casement sashes (medium)	8.0 h
	per m
Sillboards, includes bearers not exceeding 300 mm wide	1.0 h
Sillboards, including bearers exceeding 300 mm wide	1.6 h

Per m²	*Nails*	*1 joiner*
Flooring not exceeding 100 mm boards	0.57 kg	0.8 h
Flooring exceeding 100 mm boards	0.42 kg	0.75 h
Per m		
Fascias	0.3 kg	0.35 h
Barge boards	0.3 kg	0.7 h
Soffit boarding (230 mm wide)	0.3 kg	0.35 h
Shelving (230 mm wide)		0.25 h
Bearers		0.5 h

Per 50 m	*Nails*	*1 joiner*
Stops, facings and beltings	1.5 kg	5.75 h
Skirtings, 75 and 100 mm (excluding grounds)	2.4 kg	6.75 h
Skirtings, 150 mm (excluding grounds)	2.4 kg	8.5 h
Grounds, plugged, including cutting holes		6.75 h
Fixing Ironmongery to Softwood		
Night latch		1.0 h
Mortice lock and furniture		2.0 h
Rim lock and furniture		1.0 h
Postal knocker		1.5 h
Casement stays and furniture		0.5 h

Examples

1. 230 × 25 mm Red pine fascia plate fixed to ends of rafters—m.

	£
Material	
Fascia per m	*0.225*
Nails 0.3 kg at £0.12½	*0.038*
	0.263
Waste 5%	*0.013*
Labour	
Joiner 0.35 h at £0.67	*0.235*
	0.511
Profit and oncost 15%	*0.077*
	£0.59 m

2. 25 mm Nominal white pine tongued and grooved board flooring, securely nailed to joists, the byewood neatly flushed off—m².

	£
Material	
Timber per m²	*0.85*
Carried forward	*0.85*

	£
Brought forward	*0.85*
Nails 0.42 kg at £0.12½	*0.053*
	0.903
Waste 2½%	*0.023*

Labour

Laying and flushing byewood	
Joiner, 0.75 h at £0.67	*0.503*
	1.429
Profit and oncost 15%	*0.214*
	£1.643 m²

Cost per m² = £1.64½

Note: *If this rate had to be worked from a m³ basis then an allowance would require to be made for the tongues. This would, of course, depend on the width of the board but an average allowance would be 10% to 12½%.*

3. 130 × 50 mm Red pine door frames—m.

	£	£
Material		
Timber, per m³	*30.00*	
Dressing (allow)	*6.00*	
		36.00
Waste 5%		*1.80*
		£37.80 m³
Material cost per m = $\frac{6\,500}{1\,000.00} \times$ *£37.80*		*0.246*

Labour

Joiner, 2 h at £0.67 = £1.34	
4.8 m costs £1.34:	
1 m costs	*0.278*
Carried forward	*0.524*

	£
Brought forward	*0.524*
Profit and oncost 15%	*0.078*
	£0.602 m

Cost per m = £0.60

4. 130 × 50 mm Red pine door frames plugged to brickwork—m.

	£
Material	
As example 3	*0.246*
6 plugs and nails at £0.01½ = £0.09	
4.8 m costs £0.09:	
1 m costs	*0.019*

Labour

Joiner, 2.5 h at £0.67 = £1.675	
4.8 m costs £1.675:	
1 m costs	*0.349*
	0.614
Profit and oncost 15%	*0.092*
	£0.706 m

Cost per m = £0.70½

5. 40 mm Flush pass door as described, size 730 × 2 040 mm—No.

	£
Material	
Door, per quotation	*3.50*

Labour

Fit and hang	
Joiner, 1.2 h at £0.67	*0.804*
	4.304
Profit and oncost 15%	*0.646*
	£4.95 No.

6. 44 mm Afrormosia bound entrance door size 915 × 2058 mm. consisting of 100 mm stiles and top rail 200 mm bottom rail, all morticed and tenoned, checked and prepared for glazing in one pane—No.

Quote: Hardwood £110.00 m³ delivered site.

Materials required:

2 × 2.058 = 4.116
0.915

5.031 × 0.100 = 0.503

0.915 × 0.200 = 0.183

0.686 × 0.050 = 0.034 m³
Allow 0.036 m³ including waste

	£
Material	
Hardwood, 0.036 m³ at £110.00 m³	*3.96*
Dressing (allow) £10.00 per m³:	
0.036 m³	*0.36*
	4.32
Allow for wedges, nails, glasspaper and glue—5%	*0.216*
Labour	
Making 10 h	
Hanging 2 h	
12	
Joiner, 12 h at £0.67	*8.04*
	12.576
Profit and oncost 15%	*1.886*
	£14.462 No

Cost per door = £14.46

7. 76 × 19 mm Douglas fir double facings fixed to frames—m.

Quote: 76 × 19 mm facings, £0.08 per m delivered site.

	£
Material	
50 m at £0.08 per m	*4.00*
Nails, 1.5 kg at £0.12½ kg	*0.188*
	4.188
Waste 5%	*0.209*
Labour	
Joiner 5.75 h at £0.67	*3.853*
	8.25
Profit and oncost 15%	*1.24*
	£9.49 per 50 m

Cost per m = £0.19

8. Single light sash and case window—m².

Preambles: Sash and case windows to consist of sashes 50 mm thick in one pane for glass, 115 × 38 mm stiles and lintel, outer facing 19 mm thick, parting bead 19 × 10 mm, baton rod 25 × 16 mm fixed with brass screws and sockets, double checked, double weathered and double throated sill 165 × 65 mm, all properly grooved and tongued together complete.

Build up of rate an assumed size of 1.00 × 1.75 m.

	£
Material	
50 × 50 mm sashes	
2 × 2 × 1.00 = 4.000	
2 × 2 × 0.875 = 3.500	
7.500 at £0.125	*0.938*
Carried forward	*0.938*

	£
Brought forward	*0.938*
115 × 38 mm stiles and lintels	
2 × 1.750 = 3.500	
1 × 1.000 = 1.000	
4.500 at £0.18	*0.81*
25 × 19 mm outer facings, 4.500 at £0.05	*0.225*
19 × 10 mm parting bead, 4.500 at £0.04	*0.18*
25 × 16 mm baton rod, 4.500 at £0.05	*0.225*
165 × 65 mm sill, 1.000 at £0.74	*0.74*
	3.118
Waste 10%	*0.312*
Allow for wedges, nails, screws, glue and sandpaper 5%	*0.156*
	£3.586 per 1.750 m²
	£
Material cost per m²	*2.044*
Labour	
Making, fitting and hanging 10.75 h joiner per m²	
Joiner, 10.75 h at £0.67	*7.203*
	9.247
Profit and oncost 15%	*1.387*
	£10.63½ m²

9. Fit and hang sliding sashes with Unique spiral sash balances, including grooving rails complete—No.

JOINERY

Quote: Sash balances £3.00 per pair delivered site

	£
Material	
Sash balances, per pair	*3.00*
Labour	
Fitting and hanging per pair	
Joiner, 1.5 h at £0.67	*1.005*
	4.005
Profit and oncost 15%	*0.601*
	£4.60½ No.

10. 230 × 19 mm Douglas fir sillboards to windows, fixed to and including bearers—m.

	£
Materials	
Sillboard, 1 m at £0.25	*0.25*
Bearers, 1 m at £0.02½	*0.025*
	0.275
Waste 5%	*0.014*
Nails (say)	*0.015*
Labour	
Joiner, 1.0 h at £0.67	*0.67*
	0.974
Profit and oncost 15%	*0.146*
	£1.12 m

11. 25 mm White pine treads with rounded nosing and 19 mm risers, tongued and grooved and blocked together—m².

Assume a measured area of tread and riser of 230 mm and

180 mm respectively and a width of 915 mm, 230 mm + 180mm = 410 × 915 mm = 0.375 m².

	£
Material	
Tread, 915 mm at £0.50 per m	*0.458*
Riser, 915 mm at £0.41 per m	*0.375*
Blocking, 3 at £0.02½	*0.075*
	0.908
Waste 10%	*0.091*
	0.999
Allow for wedges, screws and glue —2½%	*0.025*
Labour	
Making, fitting and erecting	
Joiner, 2.5 h at £0.67	*1.675*
	2.699
Profit and oncost 15%	*0.405*
	£3.104 per 0.375 m²

Cost per m² = £8.28

12. *Ends of treads and risers housed to stringers—No.*

	£
Labour	
Joiner, 0.4 h per step (i.e. two housings)	
0.4 h at £0.67	*0.268*
Profit and oncost 15%	*0.04*
	£0.308 for 2 No.

Cost per housed end = £0.15½

13. *215 × 32 mm White pine stringer, rounded on one arris—m.*

	£
Material	
Stringer, 1 m	*0.575*
Waste 10%	*0.058*
Labour	
Joiner will fix 3.75 m per h £0.67 for 3.75 m: 1 m	*0.179*
	0.812
Profit and oncost 15%	*0.121*
	£0.93½ m

14. *100 × 22 mm Douglas fir rounded skirting with ground plugged to brick wall—m.*

Quote: 100 × 22 mm rounded skirting, £0.08 per m; ground £0.02½ per m.

		£
Material		
Skirting, 50 m at £0.08 m		*4.00*
Ground, 50 m at £0.02½ m		*1.25*
Nails, 2.4 kg at £0.12½		*0.30*
		5.55
Waste 5%		*0.278*
Plugs (600 mm centres) 84 at £0.01½		*1.26*
Labour		
Fixing, grounds, including cutting and fixing plugs	*6.75 h*	
Fixing skirtings	*6.75 h*	
	13.50 h	
Carried forward		*7.088*

	£
Brought forward	*7.088*
Joiner, 13.50 h at £0.67	*9.045*
	16.133
Profit and oncost 15%	*2.42*
	£18.553 per 50 m

Cost per m = £0.37

15. Supply and fit 100 mm steel hinges to pass doors—Pair.

	£
Material	
Hinge and screws, per pair	*0.25*
Labour	
Included with hanging door	—
	0.25
Profit and oncost 15%	*0.038*
	£0.29 Pair

16. Supply, fit and fix 127 mm horizontal mortice lock with furniture and escutcheons (prime cost value £2.50)—No.

	£
Material	
Lock, furniture, etc. and screws	*2.50*
Labour	
Joiner, 2 h at £0.67	*1.34*
	3.84
Profit and oncost 15%	*0.576*
	£4.41½ No.

17. Supply, fit and fix casement stays (prime cost value £0.80)—No.

	£
Material	
Casement stays with screws	*0.80*
Labour	
Joiner, 0.5 h at £0.67	*0.335*
	1.135
Profit and oncost 15%	*0.17*
	£1.30½ No.

CHAPTER XVI

PLUMBING AND ENGINEERING INSTALLATIONS

Labour Constants

Cast Iron

	Plumber and apprentice
Gutters	
100 mm to 150 mm eaves gutters	0.75 h per 2 m length
Fittings	0.25 h each
Rainwater Pipes	
75 mm to 100 mm pipes	0.75 h per 2 m length
Fittings generally	0.25 h each
Soil and Waste Pipes	
50 mm to 75 mm pipes	1.25 h per 2 m length
100 mm pipes	1.5 h per 2 m length
50 mm to 75 mm bends	0.45 h each
100 mm bends	0.75 h each
50 mm to 75 mm branches	0.65 h each
100 mm branches	1.00 h each

Copper Tubing

Pipe size	*Plumber and apprentice fixing tubing with clips*	*Plumber and apprentice fixing bends*	*fixing tees*
10 to 28 mm	0.35 hm	0.15 h	0.2 h
35 to 42 mm	0.45 hm	0.20 h	0.25 h
54 mm	0.55 hm	0.25 h	0.3 h

Examples

1. 114 mm Cast iron half-round eaves gutter fixed with fascia brackets at 1 m centres—m.

Quote: Gutter £0.85 per 2 m length; fascia brackets £0.05 each; red lead £0.15 per kg all delivered site.

	£
Material	
Gutter—2 m length	*0.85*
2 brackets and screws at £0.05	*0.10*
	0.95
Waste 5%	*0.048*
1 joint	
0.1 kg red lead at £0.15	*0.015*
1 bolt and nut	*0.025*
Labour	
0.75 h 1 plumber and 1 apprentice per 2 m length	
0.75 h at £1.21	*0.908*
	1.946
Profit and oncost 15%	*0.292*
	£2.238 per 2 m length

Cost per m = £1.12

2. Extra over 114 mm cast iron gutter for 114 mm cast iron elbow—No.

Quote: Elbow £0.35.

	£
Material	
Elbow	*0.35*
Waste 2½%	*0.001*
1 joint—as last example	*0.04*
Labour	
0.25 h 1 plumber and 1 apprentice	
0.25 h at £1.21	*0.303*
	0.694
Profit and oncost 15%	*0.104*
Carried forward	*0.798*

	£
Brought forward	*0.798*
Deduct	
450 mm length of 114 mm gutter at £1.12 per m	*0.50*
Extra value	*£0.298 No.*

Extra value for elbow = £0.30

3. 100 mm P.V.C. half-round gutter, jointed with gutter unions, fixed with and including fascia brackets at 1 m centres—m.

Quote: Gutter £0.60 per 2 m length; gutter unions £0.15 each; fascia brackets £0.05 each; all delivered site.

	£
Material	
Gutter—2 m length	*0.60*
1 gutter union	*0.15*
2 brackets and screws at £0.05	*0.10*
	0.85
Waste 5%	*0.041*
Labour	
0.5 h 1 plumber and 1 apprentice per 2 m length	
0.5 h at £1.21	*0.60*
	1.491
Profit and oncost 15%	*0.224*
	£1.715 per 2 m length

Cost per m = £0.86

4. 100 mm Cast iron coated soil and ventilation pipes with holderbatt fixings—m.

Quote: 100 mm pipes £1.85 per 2 m length; lead £0.25 per kg.

	£
Brought forward	*3.315*
Material	
Pipe—2 m length	*1.85*
Holderbatt—1 No.	*0.05*
	1.90
Waste 5%	*0.095*
1 kg lead at £0.25	*0.25*
Yarn (say)	*0.02*
Labour	
1.5 h 1 plumber and 1 apprentice per 2 m length	
1.5 h at £1.21	*1.81*
	4.075
Profit and oncost 15%	*0.611*
	£4.686 per 2 m length

Cost per m = £2.34½

5. Extra over 100 mm cast iron coated pipe for 100 mm cast iron coated bend—No.

Quote: 100 mm bend, £0.80.

	£
Material	
Bend	*0.80*
Waste 2½%	*0.20*
1 joint as before	*0.27*
Labour	
0.75 h 1 plumber and 1 apprentice	
0.75 h at £1.21	*0.908*
	2.178
Profit and oncost 15%	*0.327*
Carried forward	*2.505*

	£
Brought forward	*2.505*
Deduct	
300 mm length of 100 mm pipe at £2.34½ per linear m	*0.704*
Extra value	*£1.80 No.*

6. 90 mm Solid drawn lead soil pipe—m.

Quote: lead pipe, £1.65 per m delivered site.

	£
Material	
Pipe 1 m	*1.65*
Waste 2½%	*0.041*
Labour	
0.6 h 1 plumber and 1 apprentice 0.6 h at £1.21	*0.726*
	2.417
Profit and oncost 15%	*0.362*
	£2.78 m

7. Solid drawn brass tube ferrule connecting 90 mm lead and cast iron pipe, staved with molten lead including wiped soldered joint—No.

	£
Material	
Ferrule	*1.25*
Solder 0.75 kg at £0.70 per kg	*0.525*
	1.775
Waste 1½%	*0.027*
Labour	
1.25 h 1 plumber and 1 apprentice 1.25 h at £1.21	*1.513*
Carried forward	*3.315*

	£
Brought forward	*3.315*
Profit and oncost 15%	*0.497*
	£3.812 No.

Cost of brass tube ferrule = £3.81½

8. 22 mm Copper tubing with clips at 1 m centres—m.

Quote: Tubing £0.35 per m delivered site.

	£
Material	
Tubing 1 m	*0.35*
1 coupling at £0.15 every 4 m: 1 m	*0.038*
1 clip with screws	*0.020*
	0.408
Waste 5%	*0.02*
Labour	
0.35 h 1 plumber and 1 apprentice 0.35 h at £1.21	*0.424*
	0.852
Profit and oncost 15%	*0.128*
	£0.98 m

9. Extra over 22 mm copper tubing for forming bends—No.

	£
Labour	
0.15 h 1 plumber and 1 apprentice 0.15 h at £1.21	*0.182*
Profit and oncost 15%	*0.027*
	£0.209 No.

Cost of form bend = £0.21

10. Extra over 22 mm copper tubing for 22 mm tee piece—No.

Quote: Compression tee piece £0.30 delivered site.

	£
Material	
Tee	*0.30*
Waste 1½%	*0.005*
Labour	
0.2 h 1 plumber and 1 apprentice	
0.2 h at £1.21	*0.242*
	0.547
Profit and oncost 15%	*0.082*
	£0.629 No.

Cost of tee piece = £0.63

11. 635 × 460 mm white glazed lavatory basin with 35 mm diameter chromium plated waste, chromium plated hot and cold water taps and cantilever brackets fitted up complete—No.

	£
Material	
Basin	*5.00*
2 brackets	*0.75*
Breakages 5%	*0.288*
2 taps at £0.75	*1.50*
35 mm waste plug and chain	*0.50*
Screws (say)	*0.025*
Labour	
2 h 1 plumber and 1 apprentice	
2 h at £1.21	*2.42*
	10.483
Profit and oncost 15%	*1.572*
	£12.055

Cost of basin = £12.05½

12. Galvanised steel cold water cistern with cover 114 litre capacity under ballcock, holed for two 22 mm and one 28 mm pipes, including 22 mm high pressure ballcock with 150 mm tinned copper ball and lever, and connecting pipes—No.

	£
Material	
Cistern and cover	*4.00*
Ball valve	*2.00*
	6.00
Waste 1½%	*0.09*
Labour	
Fixing cistern 0.75 h	
Fix ball valve 0.50 h	
1.25 h 1 plumber and 1 apprentice	
1.25 h at £1.21	*1.513*
	7.603
Profit and oncost 15%	*1.14*
	£8.74½ No.

CHAPTER XVII

ELECTRICAL INSTALLATIONS

Labour Constants

	Electrician and Apprentice
Switchgear—switch unit	0.5 h each
Trunking (mild steel)	3 m per h
Couplings and caps on trunking	0.25 h each
Fixings to concrete	8 No. per h
22 mm steel conduit with clips in chases	3 m per h
1.5 mm² P.V.C. cable in 22 mm conduit	90 m per h
Erect and connect light fittings	1.5 h each
Erect and connect light and power switches	0.25 h each

Examples

1. Supply and erect 15 amp 1 way 4 gang surface switch unit—No.

	£	£
Materials		
Switch unit	*1.00*	
Waste 2½%	*0.025*	
		1.025
Labour		
0.5 h 1 electrician and 1 apprentice		
0.5 h at £1.21	*0.605*	
Overheads 20%	*0.121*	
		0.726
		1.751
Profit 6%		*0.105*
		£1.856 No.

Cost of switch unit = £1.85½

2. Supply, erect and connect 70 × 35 mm mild steel lighting trunking—m.

	£	£
Materials		
Trunking 1 m	*0.80*	
Waste 5%	*0.04*	
		0.84
Labour		
3 m per h 1 electrician and 1 apprentice, 3 m costs £1.21		
1 m costs	*0.403*	
Overheads 20%	*0.081*	
		0.484
		1.324
Profit 6%		*0.079*
		£1.403 per m

Cost per m = £1.40½

3. Supply, erect and connect straight couplings on light trunking —No.

Quote: Straight couplings £0.14 each.

	£	£
Materials		
Straight couplings	*0.14*	
Waste 5%	*0.007*	
		0.147
Labour		
0.25 h 1 electrician and 1 apprentice		
0.25 h at £1.21	*0.303*	
Overheads 20%	*0.061*	
		0.364
Carried forward		*0.511*

	£
Brought forward	*0.511*
Profit 6%	*0.031*
	£0.542 No.

Cost per straight coupling = £0.54½

4. 22 mm Steel conduit fixed to brick in chases—m.

Quote: 22 mm conduit—£0.16½ per m.

	£	£
Materials		
Conduit 1 m	*0.165*	
Waste 5%	*0.009*	
Allow for fittings		
50% *£0.083*		
Waste 2½% *0.002*		
	0.085	
		0.259
Labour		
3 m per h 1 electrician and 1 apprentice		
3 m cost £1.21		
1 m costs	*0.403*	
Overheads 20%	*0.081*	
		0.484
		0.743
Profit 6%		*0.045*
		£0.788 per m

Cost per m = £0.79

5. 1.5 mm² P.V.C. cables in conduit—m.

Quote: P.V.C. cable £0.05 per m.

	£	£
Materials		
P.V.C. cable 1 m	*0.05*	
Waste 5%	*0.001*	
		0.051
Labour		
90 m per h 1 electrician and 1 apprentice		
90 m cost £1.21		
1 m costs	*0.013*	
Overheads 20%	*0.003*	
		0.016
		0.067
Profit 6%		*0.004*
		£0.071 per m

Cost per m = £0.07

6. Erect and connect up pendant light fitting—No.

	£
Labour	
1.5 h 1 electrician and 1 apprentice	
1.5 h at £1.21	*1.815*
Profit and oncost 26%	*0.472*
	£2.287 No.

Cost of connecting up fitting = £2.28½

CHAPTER XVIII

PLASTERWORK AND OTHER FLOOR, WALL AND CEILING FINISHES

Labour Constants for Plastering per Square Metre

	1 Plasterer and 1 Labourer
Render and set on walls (2 coats)	0.5 h
Render and set on ceiling (2 coats)	0.55 h
Render, float and set on walls (3 coats)	0.6 h
Render, float and set on ceilings (3 coats)	0.65 h
In narrow widths: Under 100 mm wide	Add 125%
100 to 200 mm wide	Add 100%
200 to 300 mm wide	Add 75%

Labour Constants for Lath per Square Metre

	1 Plasterer and 1 Labourer
Fixing plaster lath	0.25 h
Fixing metal lath	0.35 h

First Coat Plaster to Walls

	mm	*mm*	*mm*	*mm*	*mm*
Finished thickness when applied	9.5	13	16	19	25
Thickness for estimating purposes:					
Brick walls	16	19	25.4	31.8	38
Rubble walls	19	22.2	28.6	44.5	47.5

The second coat for three-coat work should be considered as 9.5 mm and the setting coat as 6.4 mm.

General Labour Constants

	1 Plasterer and 1 Labourer
Forming arrises	3.75 m per h
Fixing metal corner beads	13.5 m per h

Working plaster to wood and metal frames	3.75 m per h
Run plaster cornices exceeding 150 mm but not exceeding 300 mm girth	1.0 m per h

Hardwall Plaster

Proportions by volume	1:1	1:2	1:3
Equivalent proportions by weight	1:1½	1:3	1:4½

Applications of Hardwall Plaster on Brick Walls (Two coats 12.7 mm thick)

Floating coat composed of 1 part Browning to 3 parts sand by volume scratched to provide good key.

Finishing coat should be finish, applied neat or with an admixture of well-slaked putty lime not exceeding 25% volume trowelled to a smooth surface.

Covering Capacity of 1 Tonne of Hardwall Plaster

	Proportion by volume	*m²*
On clay brick walls	Floating coat (1:3)	225–250
On concrete brick or blocks	Floating coat (1:2)	175–190
On plasterboards	Floating coat (1:1½)	205
On metal laths	Floating coat (1:2) and Rendering (1:1½)	115
Neat finish	—	370–410

Covering Capacity of 1 Tonne of Carlite Plaster

		m²
Carlite Browning		
On brick walls, clinker partitions, etc.	11 mm	140
Carlite metal lathing		
On expanded metal	8 mm	60–65
On wood wool slabs	11 mm	120
Carlite Bonding coat		
On concrete and on plaster boards	8 mm	150
Carlite Finish	1.6 mm	410–490

Examples

1. Expanded metal lath fixed to framing at 300 mm centres—m².

	£
Materials	
Metal lath 1 m²	*0.25*
Waste and laps 10%	*0.025*
Staples (say)	*0.035*
Labour	
0.35 h 1 plasterer and 1 labourer	
0.35 h at £1.27	*0.445*
	0.755
Profit and oncost 15%	*0.113*
	£0.87 m²

2. Gypsum lath and two coats hardwall plaster on ceiling—m².

Quote: Lath £0.17½ per m²; nails £0.16½ per kg; browning £9.50 per tonne; finish £9.50 per tonne; sand £1.00 per tonne, all delivered site.

Preambles: The floating coat to be composed of 1 part browning to 1½ parts sand by volume, scratched to receive finishing coat. The finishing coat to be finish hardwall plaster applied neat with a mixture of not more than 25% of volume of putty lime.

Lath	£	£
Material		
Lath 1 m²	*0.175*	
Nails (21 per m²), 0.06 kg at £0.16½	*0.01*	
	0.185	
Waste 2½%	*0.005*	
Labour		
0.25 h 1 plasterer and 1 labourer		
0.25 h at £1.27	*0.318*	
		0.508
Carried forward		*0.508*

	£
Brought forward	*0.058*
Plaster	
Material	£
Floating coat	
1 tonne browning at £9.50	*9.50*
2 tonne sand at £1.00	*2.00*
	£11.50
This covers 205 m²	
1 m² $= \frac{£11.50}{205}$	*0.056*
Finish	£
1 tonne finish at £9.50	*9.500*
0.25 tonne hydrated lime at £8.30	*2.075*
	£11.575
Labour preparing 0.25 tonne hydrated lime to putty lime 2 h labourer	
2 h at £0.60	*1.20*
	£12.775
This covers 450 m²	
1 m² $= \frac{£12.775}{450}$	*0.028*
	0.084
Waste 5%	*0.004*
Labour	
0.55 h 1 plasterer and 1 labourer	
0.55 h at £1.27	*0.699*
	0.787
	1.295
Profit and oncost 15%	*0.194*
	£1.489 m²

Cost per m² = £1.49

3. 2 coats Carlite plaster on brick walls—m².
Quote: Browning £13.00 per tonne; finish £11.00 per tonne, delivered site.

Material	£
Floating coat	
1 tonne browning at £13.00	
This covers 140 m², 1 m² = £13.00 / 140	*0.093*
Finishing coat	
1 tonne finish at £11.00	
This covers 450 m², 1 m² = £11.00 / 450	*0.024*
	0.117
Waste 5%	*0.006*
Labour	
0.5 h 1 plasterer and 1 labourer per m²	
0.5 h at £1.27	*0.635*
	0.758
Profit and oncost 15%	*0.114*
	£0.872 m²

Cost per m² = £0.87

4. 2 coats Carlite plaster on brick walls in narrow widths exceeding 100 mm but not exceeding 200 mm wide—m.

Material	£
As example No. 3	*0.123*
Labour	
As example No. 3 plus 100%	
£0.635 + 100%	*1.27*
	1.393
Profit and oncost 15%	*0.209*
	£1.602 m²

Cost per m (150 mm wide) = £0.24

5. Metal corner beads on external corners, including working plaster to same—m.

Materials	£
Metal beads 1 m	*0.07*
Waste 5%	*0.004*
Labour	
1 plasterer and 1 labourer 13.5 m per h	
£1.27 per 13.5 m: 1 m	*0.094*
	0.168
Profit and oncost 15%	*0.025*
	£0.193 m.

Cost per m = £0.19½

6. 2 coats cement plaster (1:3) on brick walls finished 19 mm thick—m².

Quote: Cement £8.25 per tonne; sand £1.00 per tonne, delivered site.

Material		£
Cement	*1 part × 1 440 = 1 440 kg at £8.25 per tonne*	*11.88*
Sand	*3 parts × 1 600 kg = 4 800 at £1.00 per tonne*	*4.80*
	4	*£16.68*
Deduct	*0.8 Shrinkage 20%*	
	3.2	
	0.2 Waste 5%	
	3.0	

Cost of materials only = £16.68 / 3 = £ *5.56 m³*

Carried forward 5.56

	Brought forward	*5.56*
Labour (mixing)		
**Hand mixing, 1 labourer 8 h per m³*		
8 h at £0.60	*4.80*	
	£10.36	*m³*

Required thickness is 19 mm, therefore estimating thickness is 31.8 mm.

	£	
Cost of 1 m² 31.8 mm thick at £10.36 m³.		
£10.36 × 0.0318 = £0.33 m²	*0.33*	
Labour		
0.45 h 1 plasterer and 1 labourer per m²		
0.45 h at £1.27	*0.572*	
	0.902	
Profit and oncost 15%	*0.135*	
	£1.03½	*m²*

7. Plaster cornice girth 230 mm—m.

	£	
Material		
Plaster stucco (say)	*0.17*	
Labour		
1.0 h 1 plasterer and 1 labourer per m		
1h at £1.27	*1.27*	
	1.44	
Profit and oncost 15%	*0.216*	
	£1.65½	*m*

* If machine mixing is required then the cost would be calculated in a similar manner to that of mortar in the section on mechanical plant.

8. Form arrises on plaster—m.

	£	
Labour		
3.75 m 1 plasterer and 1 labourer per h		
3.75 m costs £1.27: 1 m	*0.339*	
Profit and oncost 15%	*0.051*	
	£0.39	*m*

Cost per m = £0.39

9. 3 coats roughcast on brick walls—m².
Quote: Granite chippings £2.50 per tonne, delivered site.

		£	
Materials			
First 2 coats as 2 coats cement plaster			*0.33*
Dashing coat per 100 m²		*£*	
1.2 tonnes chippings at £2.50		*3.00*	
0.25 tonnes cement at £8.25		*2.063*	
	100 m²	*£5.063*	
1 m²			*0.051*
			0.381
Waste 5%			*0.019*
Labour			
2 rendering coats	*0.45 h*		
Dashing coat	*0.30 h*		
	0.75 h 1 plasterer and 1 labourer		
0.75 h at £1.27			*0.953*
			1.353
Profit and oncost 15%			*0.203*
			£1.556 *m²*

Cost per m² = £1.55½

10. Cement and sand screed (1:3) 25 mm thick finished smooth on top—m².

Material	£
Cost of material per m³ £10.36, as calculated for cement plaster.	
Require 25 mm, therefore estimate for 32 mm thick.	
Cost of 1 m² 32 mm thick at £10.36 per m³	
£10.36 × 0.032 =	*0.332*
Labour	
0.5 h 1 plasterer and 1 labourer per m²	
0.5 h at £1.27	*0.635*
	0.967
Profit and oncost 15%	*0.145*
	£1.112 m²

Cost per m² = £1.11

11. Granolithic 25 mm thick finished smooth on top—m².

Preambles: 2 parts cement; 1 part sand; 3 parts granite chips.

Material	£
Cement 2 parts × 1 440 kg = 2 880 kg at £8.25 tonne	*23.76*
Sand 1 part 1 600 kg = 1 600 kg at £1.00 tonne	*1.60*
Granite 3 parts × 1 760 kg = 5 280 kg at £2.50 tonne	*13.20*
6	*£38.56*
Deduct *1.5 Shrinkage 25%*	
4.5 Carried forward	

4.5 Brought forward	
0.2 Waste 5%	
4.3	
Cost of material only = £38.56 / 4.3 =	*£8.967m³*
Labour (mixing)	
Hand mixing, 1 labourer 8 h per m³	
8 h at £0.60	*4.80*
	£13.767 m³

Require 25 mm, therefore estimate for 32 mm thick.

	£
Cost of 1 m² 32 mm thick at £13.767 per m³	
£13.767 × 0.032	*0.441*
Labour	
0.5 h 1 plasterer and 1 labourer per m²	
0.5 h at £1.27	*0.635*
	1.076
Profit and oncost 15%	*0.161*
	£1.23½ m²

12. Quarry tiles to B.S.S.1286 type A size 100 × 100 × 15 mm bedded and jointed in cement mortar (1:3)—m².

Quote: Tiles, £25.00 per 1 000 delivered site.

Material	£
Cost of cement mortar per m³ £10.36 as calculated for cement plaster.	
Require 12 mm, therefore estimate for 19 mm thick.	
Cost of 1 m² 19 mm thick at £10.36 per m³	
£10.36 × 0.019	*0.197*
Grouting and pointing: ⅓ of £0.197	*0.066*
Carried forward	*0.263*

	Brought forward	*0.263*
Tiles, 100 at £25.00 per 1 000	*£2.50*	
Waste 2½%	*0.063*	
		2.563
Labour		
1.75 h 1 tiler and 1 labourer		
1.75 h at £1.27		*2.222*
		5.048
Profit and oncost 15%		*0.757*
		£5.805 m²

Cost per m² = £5.80½

CHAPTER XIX

GLAZING

Glazing (Without Beads) per Square Metre

	Putty *kg*	*1 Glazier* *h*
Steel Sashes		
Not exceeding 0.10 m²	1.20	1.85
Over 0.10 but not exceeding 0.50 m²	1.00	1.40
Over 0.50 but not exceeding 1.0 m²	0.50	0.65
Over 1.0 m²	0.45	0.45
Wood Sashes		
Not exceeding 0.10 m²	1.00	1.65
Over 0.10 but not exceeding 0.50 m²	0.75	1.20
Over 1.0 m²	0.45	0.55
Over 1.0 m²	0.40	0.35

Example

1. 3 mm sheet glass (OQ) in steel sashes with putty in panes exceeding 0.10 but not exceeding 0.50 m²—m²

Quote: 3 mm glass £1.07½ per m²; putty £0.08 kg; all delivered site.

	£
Material	
Glass 1 m²	*1.075*
Putty 1 kg at £0.08	*0.08*
	1.155
Waste 15%	*0.173*
Labour	
1.40 h tradesman	
1.40 h at £0.67	*0.938*
	2.266
Profit and oncost 15%	*0.34*
	£2.606 m²

Cost per m² = £2.60½

		£
Brought forward		*11.34*
Labour		
Prepare and 2 coats paint 30 h per 100 m²		
30 h at £0.67	*20.10*	
Allow for waste of brushes 5%	*1.005*	
	21.105	
	32.445	
Profit and oncost 15%	*4.868*	
	£37.313 per 100 m²	

Cost per m² = £0.37½

3. Two coats water paint on plaster walls—m².

Material	£
50 kg water paint at £0.20 per kg covers 250 m²	
1 m² (2 coats) $= \frac{£0.20 \times 50}{250} \times 2 =$	*0.08*
Waste 5%	*0.004*

Labour	£	£
First coat and prepare 6.75 m² per h: 1 m²	*0.095*	
Second coat at 10 m² per h: 1 m²	*0.067*	
	0.162	
Allow for waste of brushes 5%	*0.008*	
	0.17	
	0.254	
Profit and oncost 15%	*0.038*	
	£0.292 m²	

Cost per m² = £0.29

4. One coat primer, one coat undercoating and one coat gloss paint on new woodwork—m².

Material	£	£
Knotting 0.7 at £0.80	*0.56*	
Putty 2.0 kg at £0.08	*0.16*	
Primer 10.5 litre at £0.84	*8.82*	
Undercoating 8 litres at £0.84	*6.72*	
Finish 5.5 litres at £1.00	*5.50*	
	21.76	
Waste 5%	*1.088*	
		22.848

Labour	
Knotting	*4 h*
Stopping	*5 h*
Priming	*18 h*
Undercoating	*15 h*
Finishing	*14 h*
	56

		£
56 h at £0.67		*37.52*
Allow for waste of brushes 5%	*1.876*	
		39.396
		62.244
Profit and oncost 15%		*9.337*
		£71.581 per 100 m²

Cost per m² = £0.71½

5. Ditto, ditto on skirtings and the like, exceeding 100 mm but not exceeding 200 mm girth—m.

Material	£
As example 4	*22.848*
Carried forward	*22.848*

CHAPTER XX

PAINTING AND DECORATING

Materials

50 kg of water paint will cover about 250 m² of plasterwork in one coat.
2 kg of putty will stop about 100 m² of woodwork.
0.7 litre of varnish will knott about 100 m² of woodwork.
10.5 litres primer will cover about 100 m² depending on nature of base.
8 litres undercoating will cover about 100 m².
5.5 litres finishing coat will cover about 100 m².

Labour Constants

	Painter per h
Prepare and first coat water paint on walls	6.75 m²
Second coat water paint on walls	10 *m²*

Painting 100 m² of woodwork	*Painter per 100 m²*
Knotting	4 h
Stopping	5 h
Priming, including preparing	18 h
Undercoating (per coat)	15 h
Finishing coat	14 h

Wallpaper

A piece of English wallpaper measures 10 m long by 533 mm broad. Waste allowances are generally 10% on plain paper and 15% on pattern paper.

	Paperhanger per piece
Sandpaper and size walls	0.5 h
Wallpaper	1.25 h
	Paperhanger per m²
Strip existing paper and prepare walls	0.25 h

Examples

1. One coat primer, one coat undercoating and one coat gloss paint on plaster walls—m².

Material	£	£
Primer, 10.5 litre at £0.84	8.82	
Undercoat, 8 litre at £0.84	6.72	
Finish, 5.5 litre at £1.00	5.50	
		21.04
Waste 5%		1.052
Labour		
Priming, including Preparing 16 h		
Undercoating 15 h		
Finishing coat 14 h		
45 h		
45 h at £0.67	30.15	
Allow for waste of brushes, 5%	1.507	
		31.657
		53.749
Profit and oncost 15%		8.062
		£61.811 per 100 m²

Cost per m² = £0.62

2. Two coats emulsion paint on plaster walls—m².

Material	£	£
First coat 8 litres		
Second coat 5.5 litres		
13.5 litres		
13.5 litres at £0.80 litre	10.80	
Waste 5%	0.54	
		11.34
Carried forward		11.34

	£	£
Brought forward		*22.848*
Labour		
As example 4	*39.369*	
*Add 20% for cutting**	*7.879*	
		47.275
		70.123
Profit and oncost 15%		*14.025*
		£84.148 per 100 m²

Cost per m² = £0.84
Cost per m (200 mm wide) = £0.17

6. Supply and hang pattern wallpaper on plastered walls including preparing and sizing (prime cost value £1.75 per piece)—m².

	£	£
Material		
Wallpaper 1 piece	*1.75*	
Paste 0.25 kg at £0.22	*0.055*	
Sandpaper and size (say)	*0.075*	
	1.880	
Waste 15%	*0.282*	
		2.162
Labour		
Preparing 0.5 h		
Papering 1.25 h		
1.75 h		
1.75 h at £0.67	*1.173*	
Allow for waste of brushes 5%	*0.059*	
		1.232
Carried forward		*3.394*

* The 20% for cutting has been added to allow for extra labour cutting to line at change of colour on two edges.

Brought forward	*3.394*
Profit and oncost 15%	*0.509*
	£3.903 per piece

1 piece of wallpaper = 5⅓ m²
Cost per m² = £0.73

CHAPTER XXI

DRAINAGE

Labour Constants

For labour constants for excavations see under Excavation and Earthwork section.

Average Widths of Drain Track Excavations

	Diameter of Pipe			
	Up to 100 mm	*100 mm to 150 mm*	*150 mm to 230 mm*	*230 mm to 300 mm*
Track up to 1.5 m deep	460 mm	530 mm	610 mm	700 mm
Track 1.5 to 3.0 m deep	530 mm	610 mm	700 mm	760 mm

Fireclay Pipes

Diameter	*Yarn*	*Cement mortar*	*Labour laying and jointing 1 m pipes*
	kg	*litre³*	*man h*
100 mm	0.014	0.5	0.15
127 mm	0.023	0.5	0.15
150 mm	0.027	0.9	0.16

Pipe Trench Excavations

Rates for excavations are calculated in a similar manner to that for foundation trench excavations.

The m³ rate for pipe trench excavations is first calculated, e.g. pipe trench excavations not exceeding 1.5 m deep—m³.

Excavate, get out and remove surplus	2.5 h
Refill and ram	1.0 h
	3.5 h
Labourer 3.5 h at £0.60	£2.10
Profit and oncost 15%	0.315
	£2.41½ m³

Examples

1. Excavate trench not exceeding 1.5 m deep and average 1.25 m deep for 127 mm drain pipes, form bottom to correct falls, return, fill in and ram and remove surplus material, including all necessary planking and strutting—m.

Volume of excavations per m of trench:
1.0 × 0.53 × 1.25 deep = 0.663 m³ at £2.41½
= £1.601 m

Allow for planking and strutting if considered necessary. The cost may be calculated in a similar manner to that shown in Chapter IX example 7.

Drain Pipes and Fittings

Cost of mortar (1 part cement: 1 part sand) for jointing:

	£
Materials	
Cement 1 part × 1 440 kg = 1 440 kg at £8.25 per tonne	*9.405*
Sand 1 part × 1 600 kg = 1 600 kg at £0.60 per tonne	*0.960*
	£10.365
Deduct *0.4 Shrinkage 20%*	
1.6	
0.3 Waste 20%	
1.3	
Cost of material per m³ = £10.365 / 1.3 =	*7.973*
Labour	
Hand mixing, 1 labourer 8 h per m³	
8 h at £0.60	*4.80*
	£12.773 m³

Cost per litre³ = £0.013

2. 100 mm Salt glazed fireclay drain pipes laid and jointed with (1:1) cement mortar—m.

Quote: 100 mm pipes delivered site—list price £0.15 + 5% + 55% per m.

Material	£	£
100 mm drain pipe	*0.15*	
Plus 5%	*0.008*	
	0.158	
Plus 55%	*0.087*	
		0.245
1 joint		
0.5 litre³ mortar at £0.013	*0.007*	
0.014 kg yarn at £0.90	*0.013*	
		0.02
		0.265
Waste 5%		*0.013*
Labour		
1 drainlayer and 1 labourer 0.15 h per m		
*0.15 h at £1.23**		*0.184*
		0.462
Profit and oncost 15%		*0.069*
		£0.53 m

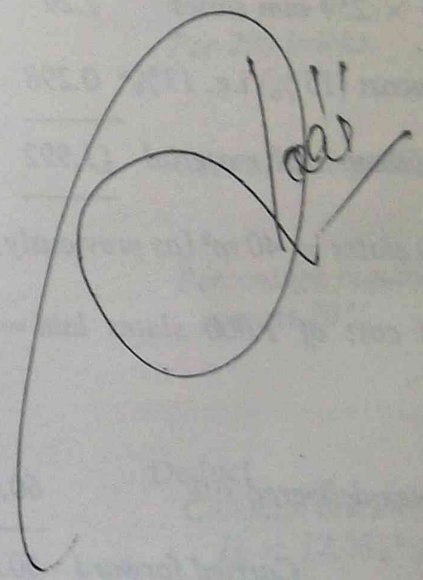
3. Extra over 100 mm fireclay drain pipes for 100 mm salt glazed fireclay branch piece—No.

Quote: 100 mm branch piece delivered site—list price £0.25 + 5% + 55%.

Material	£	£
100 mm branch piece	*0.25*	
Plus 5%	*0.013*	
	0.263	
Plus 55%	*0.145*	
		0.408
Carried forward		*0.408*

* A drainlayer is a semi-skilled labourer.

	£
Brought forward	*0.408*
2 joints	
2 joints as example 2—2 at £0.02	*0.04*
	0.448
Waste 2½%	*0.011*
Labour	
Laying and making 2 joints, 1 tradesman and 1 labourer 0.23 h at £1.23	*0.283*
	0.742
Profit and oncost 15%	*0.111*
	0.853
Deduct	
Branch displaces 1.0 m of 100 mm drain pipe at £0.53 per m	*0.53*
Extra value for branch piece	*£0.32½ No.*



CHAPTER XXII

PRO RATA RATES

Variations in building contracts in which a bill of quantities forms the basis of the contract are normally priced at bill rates or at rates in strict accordance with bill rates. The determination of these *pro rata* rates requires a prior knowledge of building estimating procedure. In order to build up a new rate for agreement between the surveyor and the contractor, the surveyor must first analyse the appropriate bill rates in order to establish either the labour involved or the percentage to add for profit and oncost. The new rate is built up on the same basis as the analysed rate and the new labour rate or the calculated percentage for profit and oncost added.

Examples

Method 1—To establish the labour content.

1. Break down of bill rate for 406 × 254 mm slates laid to a 76 mm lap—Bill rate £2.29 per m².

	£
Rate for 406 × 254 mm slates	*2.29*
Deduct	
*Profit and oncost (15%) i.e. 13%**	*0.298*
Net cost of labour and material	*£1.992*

Area covered by 1 000 slates = 40 m² (as previously calculated in Roofing Section).

Labour and material cost of 1 000 slates laid = 40 m² × £1.992 = £79.68.

	£
Material	
Cost of 1 000 slates delivered site	*60.00*
Carried forward	*60.00*

* In order to calculate the true amount of profit and oncost that has been added to the cost of materials and labour to arrive at a unit rate the deduction from the unit rate would be one-ninth, thirteen per cent and one-sixth for profit and oncosts of 12½%, 15% and 20% respectively.

...English bond, key pointed as the work proceeds—Bill

PRO RATA RATES

	£
Brought forward	*60.00*
Unloading and stacking, 1 labourer 2 h:	
2 h at £0.60	*1.20*
Holing, 1 slater 4 h: 4 h at £0.67	*2.68*
Cost of materials prepared for laying	*63.88*
Nails, 2 per slate = 2 000 nails,	
i.e. 9.35 kg at £0.15	*1.403*
	65.283
Waste 5%	*3.264*
Cost of materials	*£68.55*

Cost of labour per 1 000 slates = £79.68 − £68.55 = £11.13.

$$\textit{Cost of labour per } m^2 = \frac{£11.13}{40} = £0.278.$$

Build up of rate for 355 × 203 mm slates laid to a 76 mm lap—m².

$$\textit{Gauge} = \frac{(355 - 25) - 76}{2} = 127 \text{ mm}$$

$$\textit{Area covered} = 203 \times 127 \text{ mm} = 25\,781 \text{ mm}^2.$$

$$\textit{Number of slates per } m^2 = \frac{1\,000\,000}{25\,781} = 39.$$

$$\textit{Number of } m^2 \textit{ per } 1\,000 = \frac{1000}{39} = 25.6.$$

Allowing for rough edges, etc., say 27 m².

	£
Materials	
Cost of 1 000 slates delivered site	*40.00*
Unloading and stacking, 1 labourer 2 h:	
2 h at £0.60	*1.20*
Holing, 1 slater 4 h: 4 h at £0.67	*2.68*
Nails, 2 per slate = 2 000 nails,	
i.e. 9.35 kg at £0.15	*1.403*
Carried forward	*45.283*

	£
Brought forward	*45.283*
Waste 5%	*2.264*
	£47.55

Area covered by 1 000 slates = 27 m².

Cost of materials per m² = $\frac{£47.55}{27}$ = £1.76.

Labour

Amount of labour per m² in breakdown of rate was £0.278.

Rate of laying 406 × 254 mm slates is 6.75 m² per h.

Rate of laying 355 × 203 mm slates is 5.75 m² per h.

Labour in ratio of 6.75:5.57
i.e. 27:23

Labour for laying 355 × 203 mm slates per m² is greater than that for laying 406 × 254 mm slates.

Labour for laying 355 × 203 mm slates = $\frac{27}{23}$ × £0.278 = £0.326

	£
Material	*1.76*
Labour	*0.326*
	2.086
Profit and oncost 15%	*0.313*
	£2.399 m²

Cost per m² = £2.40

Method 2—To establish the percentage allowed for profit and oncosts.

2. Break down of bill rate.
Extra over common brickwork for facings P.C. £15.00 per 1 000 in English bond, key pointed as the work proceeds—Bill rate £0.86 m².

No. of bricks, 10 mm beds and joints (calculated before)	*60*
Add for headers, i.e. double number of bricks each alternate course, ½ of 60	*30*
	90

	£
Materials	
Bricks, 90 at £15.00 per 1 000	*1.35*
Waste 5%	*0.067*
Mortar, 0.04 m³ at £4.29	*0.172*
Labour	
4 bricklayers and 2 labourers laying 50 bricks per h—200 bricks per h	
Bricklayers	£
4 at £0.67	*2.68*
Labourers	
2 at £0.60	*1.20*
Per 200 bricks	*£3.88*
Cost of laying 90 = $\frac{£3.88}{200}$ × 90 =	*1.746*
	3.335
Percentage required for profit and oncost 20%	*0.667*
	4.002
Deduct	
Common brickwork allowing for headers: 1½ × £2.08½ per m²*	*3.127*
Bill rate	*£0.87½ m²*

* From example 1 in the Brickwork and Blockwork Section.

Build up of Pro Rata Rate.

Extra over common brickwork for facings P.C. £18.00 per thousand in Flemish bond, key pointed as the work proceeds—m².

No. of bricks, 10 mm beds and joints (calculated before)	*60*
Add for headers, alternate headers and stretchers, ⅓ of 60	*20*
	80

	£
Materials	
Bricks, 80 at £18.00 per 1 000	*1.44*
Waste 5%	*0.072*
Mortar, 0.04 m³ at £4.29	*0.172*
Labour	
4 bricklayers and 2 labourers laying 45 bricks per h = 180 bricks per day*	
As before £3.88 per 180 bricks	
Cost of laying 80 = $\frac{£3.88}{180} \times 80 =$	*1.724*
	3.408
Add profit and oncost as calculated previously 20%	*0.682*
	4.09
Deduct	
Common brickwork allowing for headers: $1\frac{1}{3} \times £2.08\frac{1}{2}$ per m²	*2.78*
	£1.31 m²

Pro rata *rate = £1.31 per m²*

* Bricklayers more accustomed to laying bricks in English bond therefore the output will be greater than that for Flemish bond.

CHAPTER XXIII

INCENTIVE SCHEMES

The following is a statement from the Working Rules of the National Joint Council for the Building Industry on the general principles governing both the operation of incentive schemes and the making of productivity agreements.

1. Objects

The objects of incentive schemes and/or productivity agreements are:

(*a*) to increase efficiency, thereby keeping the cost of building at an economic level, and

(*b*) to encourage greater productivity thereby providing an opportunity for increasing earnings by increased effort, while maintaining a high standard of workmanship and avoiding a waste of labour and materials.

It follows that such agreements must be strictly related to productivity.

2. Incentive Schemes—Application

The intention is that incentive schemes shall be applied generally throughout the Building Industry and shall cover all trades and/or occupations.

The effective application of incentive schemes depends upon willing co-operation between management and operatives to ensure on the one hand that the organisation of the job is such as will permit realistic targets to be achieved and on the other hand a genuine effort is made to improve output. Where it is necessary to carry out work study this should be arranged by mutual consent.

3. General Principles

(1) A target should be issued by management for each operation to be performed by an individual operative, or gang, and, according to the extent that performance is better than the target, an additional payment should be

made over and above the appropriate standard rate of wages.

(2) Targets should be issued before operations are started and, wherever it is possible to do so, they should be agreed with the accredited representatives of the operatives concerned, or with their union officer.

(3) Targets should be based on standards of performance which have, wherever possible, been determined on jointly accepted work study principles published by the B.S.I.

(4) Targets are dependent on the saving rate adopted in each scheme. The incentive scheme must state the proportion of the saving which is to be paid out as bonus.

(5) The number of operatives to be treated as a unit for bonus purposes should be as small as is operationally practicable. Bonus should not be paid on a trade or site collective basis except where there are exceptional circumstances and it has been jointly agreed.

(6) Incentive schemes should be expressed in simple and precise terms in order that
(*a*) operatives may readily know what they have to do to increase their earnings, and
(*b*) misunderstandings and disputes may be avoided.

4. Operating Principles

(1) The target should be stated as a given quantity of work to be done in a given number of hours, to the satisfaction of management. (The given number of hours may be expressed as a monetary value where this method is customary.)

(2) Where tasks are pre-measured they should be of short duration so that, as far as is possible, they do not extend into a second payweek.

(3) Gains and losses occurring in different payweeks shall not be off-set, except where a target which has been pre-measured covers work to be done in more than one payweek.

(4) Working targets once fixed may not be altered unless there is a significant change in the job content or in working methods and then only after joint consultation.

(5) At the commencement of repetitive work a jointly-agreed 'learning-curve' allowance is permissible having regard to the improvement in productivity that should subsequently follow.

(6) The target will be inclusive for craftsmen and labourers and all hours will be chargeable against the target except where there is an interruption of work beyond the control of the parties.

(7) The time of non-working supervision should not be charged against the gang. In the case of part-time working supervision the proportion of time to be charged against the gang should be agreed in advance.

(8) The time of first-year apprentices should not be charged against the gang. In the case of apprentices in their later years of apprenticeship the proportion of their time which should be charged should, as a guide, be the same as the proportion of the craftsmen's rate which they receive under the apprentices' wage for age scale.

(9) Overtime premiums, guaranteed time and travelling time should not be charged against targets.

(10) Bonus payments, after adjustment in the case of a proportionate scheme, should be made at the standard plain time rate of the operative concerned, including extra payments under N.W.R.'s 1.10, 1.11, 3B and 3D.

(11) The amount of bonus earnings should be notified to operatives not later than the pay-day next following the payweek in which the work was completed. The bonus should be paid not later than the next pay-day after that.

(12) Where work for which bonus has been paid proves defective and has to be re-executed in whole or in part, (i) the remedial work shall be carried out by the same operative gang, (ii) no bonus shall be paid therefor, and (iii) the time taken shall be off-set against any savings on subsequent targets. This provision shall not apply where the original work had been carried out strictly in accordance with precise instructions.

5. Productivity Agreements

The objective of a productivity agreement is to make a joint effort to improve efficiency by reducing unit costs through such

means as the use of balanced gangs, greater flexibility or the relaxation of specified work practices. Such an agreement should provide an opportunity for high earnings.

6. **Disputes**

(1) In the event of a dispute or difference arising over an incentive scheme or productivity agreement, there shall be no restriction of work or withdrawal from operation of the scheme whilst the procedure outlined in this paragraph is being followed. Any settlement of such a dispute or difference shall apply with retrospective effect from the date upon which the dispute or difference was raised officially by the accredited site representative.

(2) The dispute shall be discussed in the first place between management and site representatives of the operatives concerned in accordance with the provisions of N.W.R.7. If these discussions are not successful there should be a meeting between management and the full-time officer of the union(s) concerned. If the dispute remains unresolved the parties, or either of them, may ask the National Joint Council to arrange for an independent investigation of and report upon the point of difficulty.

(3) If thereafter the parties are still unable to resolve the difficulty, they shall refer it for decision to the joint industrial machinery in which event the report on the independent investigation will be made available to the Conciliation Panel.

(4) Details of incentive schemes and/or productivity agreements should be made available, on request, to Employers and Operatives Local (or Regional) Secretaries.

DIFFERENT METHODS OF REMUNERATION AND INCENTIVES

The above principles refer mainly to premium bonus schemes but before studying them in detail it is worth considering other methods of incentives that are used.

There are several methods in current use for calculating the earnings of employees for work done. The most common method is that based on Time-Work Rates in which the rate

paid per hour is multiplied by the number of hours worked by the employee. The rates of wages and the working rules being laid down by the National Joint Council for the Building Industry. This may be a good method when quality is more important than quantity or when expensive materials are being used and where speed may have a serious effect of the amount of wastage. This method, however, has a big disadvantage in that it offers no incentive to the good worker to increase his output or to improve the efficiency of the methods used. The workmen also tend to await instruction rather than show initiative or seek further instructions from the foreman. Good supervision is, therefore, necessary in order to achieve continuity of work from employees.

The cost of labour is a major factor in the cost of building and should, therefore, be studied with a view to reducing overall costs. Low wages to employees do not necessarily mean low labour costs. Higher wages and greater efficiency may prove to be more economical since the saving in labour hours may more than compensate for the higher wages. The builder must ensure, however, that he is achieving greater efficiency when the men are earning higher wages as these themselves do not necessarily mean a greater output, other than when initially introduced. This may be done by introducing good incentive schemes.

An incentive scheme in itself does not ensure that the contractor will not make a loss but it encourages his workmen to work harder and reach the level of performance at which they can earn bonus. A good scheme will be designed so that a competent workman can earn bonus without materially affecting his standard of workmanship.

The main incentive schemes in operation are:

(1) Piece Work Rates;

(2) Profit-Sharing and Co-partnership; and

(3) Premium Bonus Schemes.

(1) Piece Work Rates. Under this method the employees earnings are related to the output he achieves. His earnings will be based on the number of units completed multiplied by the rate per unit, irrespective of the time taken to do the work.

Generally there is no guaranteed basic wage for the time spent on the job, e.g.:

Labour only sub-contractor being paid £10.00 per 1 000 bricks laid.

Payment = 15 000 bricks laid at £10.00 per 1 000 = £150.00.

This method has the advantage of increasing output and standardising the labour cost of production. Its disadvantage is that output is only increased to the extent that the workmen consider to be a reasonable level of earnings. The quality of work needs inspection to ensure that it is not reduced due to increased speed of production.

The method described is Straight Piece-Work Rates but there are variations of this such as Differential Piece-Work Rates and Piece-Work Rates with a guaranteed day rate.

(2) Profit-Sharing and Co-partnership. These schemes try to foster loyalty to the firm and collective effort of employees by dividing between them, at set intervals, a proportion of the profit of the business. The more prosperous the business the greater the profit. An employees share of profit is usually related to his length of service and his annual earnings.

These schemes may be run jointly or separately. In co-partnership the profit bonus is left in the company as shares or as a high interest loan.

The advantages of this scheme is that provided the general wages are good then the employees will feel that they are receiving a fair deal. Moral will be good, turnover of labour low, good productivity, greater care in handling plant and equipment and less wastage of materials will be achieved.

The disadvantages are that all employees are paid profit irrespective of individual efforts, the interval between payments tends to be lengthy, i.e. annually or half yearly, and the interest of the workmen tends to wane, the amount of profit earned is not fully in the control of the workmen and may be influenced by good or bad management, and also a great deal must be taken on trust as all employees cannot have access to the firms books.

(3) Premium Bonus Schemes. There are several systems of premium bonus schemes. In the building industry they are probably the most commonly used to arrive at incentive payments.

They are based on a different concept from the other incentive schemes in that the employee is paid at ordinary time-work rates for the hours worked plus a bonus based on the number of hours saved. The employee may increase his wages but he cannot lose money because a bonus scheme is in operation. It is, therefore, a combination of time-work rates and piece-work rates.

The amount of time saved that is paid to the employee as bonus varies with the scheme used. This decision is an important one as it affects the setting of targets, the bonus calculation and the method of control.

The more common methods of distributing the time saved are:

(i) 100% scheme. All the time saved is paid to the workmen as bonus.

(ii) 50% scheme or Halsey scheme. The workmen are paid a fixed percentage of the time saved, i.e. 50% of time saved is paid as bonus.

(iii) Rowan scheme. The bonus hours are calculated using the formula:

$$\text{Bonus hours} = \frac{\text{Time taken} \times \text{time saved}}{\text{Time allowed}}$$

There are other schemes using different percentages paid to the workmen and also curved geared methods.

In the 100% scheme there is the psychological advantage that the operatives feel that they are being fairly treated in that they are paid the whole of the saving. Employees working at standard performance will earn the same on this scheme as they would on other schemes and workmen exceeding standard performance earn higher bonus than on other schemes. It has the disadvantage that, for the slow worker, bonus starts at a higher level of performance than on other schemes (no bonus earned at 75 rating or under) and that management do not get any benefit from the fast worker to help finance the running of the scheme or for work done at under 75 performance rating. The greater amount of work done by the men in the same time however increases turnover and reduces the effect of the fixed overheads.

The 50% scheme and the Rowan scheme have the advantage that the employees start earning bonus at a lower performance level and that the employers get the advantage of savings with

performances of workmen above standard performance level. At standard performance the workmen will earn the same amount on this scheme as they would on other schemes. There is therefore an incentive to both workmen and management to see the scheme functioning properly. It has the disadvantage however that the men feel that they are being paid less than they are entitled and that cost control may not be as straightforward as in the 100% scheme.

In order to calculate the bonus hours allowed under the various schemes the time required to do the job at standard performance is determined. To this is added a percentage which will give the workmen a bonus of $33\frac{1}{3}$% of the basic rate.

In the 100% scheme add $33\frac{1}{3}$%

e.g. 6 h (standard performance) + $33\frac{1}{3}$% = 8 h (Target)

In the 50% scheme add $66\frac{2}{3}$%

e.g. 6 h (standard performance) + $66\frac{2}{3}$% = 10 h (Target)

The Effect of Incentive Schemes on Estimating

The incentive scheme should be based on the outputs allowed for in the estimate. If this is not done then the contractor is in a dangerous position not knowing whether he is paying his men too high a proportion of money for which he has contracted to do the work. The amount of bonus to be paid to the men must be planned. The increased payments he is making to the men must be allowed for in the estimate. If this simply means an addition on the rates then the principles of a good incentive scheme are not being met and the contractor will be less competitive. Bonus payments should be coupled with greater productivity and this should be reflected in the labour outputs used to prepare the estimate.

To calculate the cost of labour working at standard performance (i.e. 100 rating)

	Joiner £		*Joiner* £
Wage for week of 40 h at £0.50 per h	20.00		20.00
Planned bonus—30%	6.00		—
	26.00		20.00
	÷ 40		÷ 40
Planned bonus	£0.65	No	£0.50
		bonus	

INCENTIVE SCHEMES

At standard performance a joiner will lay 10 m² of 25 mm T & G softwood board flooring in 5 h.

Working at a normal performance of 75 rating the time taken for a joiner to lay 10 m² of flooring would be:

$$\frac{\text{standard time} \times \text{standard rating}}{\text{observed time}} = \frac{5.0 \times 100}{75} = 6.7 \text{ h.}$$

Cost of labour at 100 performance earning bonus
joiner 5 h at £0.65 = £3.25

Cost of labour at 75 performance not earning bonus
joiner 6.7 h at £0.5 = £3.35

Comparing the 100% and 50% Incentive Schemes

(i) **100% scheme**

Standard hours	*Allowed hours (S.H. + 33⅓%)*	*Time taken hours*	*Time saved hours*	*Bonus hours*	*Total hours*	*Rate per hour* £	*Total wages* £	*Effective hourly rate* £
21	28	17(125R)	11	11	28	0.50	14.00	0.82
21	28	21(100R)	7	7	28	0.50	14.00	0.67
21	28	28(75R)	—	—	28	0.50	14.00	0.50
21	28	35(60R)	—	—	35	0.50	17.50	0.50

(ii) **50% scheme**

Standard hours	*Allowed hours (S.H. + 66⅔%)*	*Time taken hours*	*Time saved hours*	*Bonus hours*	*Total hours*	*Rate per hour* £	*Total wages* £	*Effective hourly rate* £
21	35	17(125R)	18	9	26	0.50	13.00	0.77
21	35	21(100R)	14	7	28	0.50	14.00	0.67
21	35	28(75R)	7	3.5	31.5	0.50	15.75	0.56
21	35	35(60R)	—	—	35	0.50	17.50	0.50

At 100% performance the workmen earn the same irrespective of which scheme is being operated. The fast worker in the 100% scheme earns more per hour than the fast worker in the 50% scheme but the slow worker in the 100% scheme earns less than the slow worker in the 50% scheme. In the 100% scheme provided 75 performance is achieved then the contractor is

reimbursed the costs allowed in his estimate but under 75 performance he makes a loss. In the 50% scheme the workman still earns a bonus even if working at under 100 performance but the cost to the contractor may exceed the amount of money allowed for that operation in the estimate. This is compensated however by the fact that workmen above standard performance are not paid as much as they would have been paid if working in the 100% scheme.

Bonus Earning Distribution

Bonus payments are either calculated and paid out as an average to all men working bonus on the site or calculated for and paid to individual squads of men. Bonus payments are normally allocated as follows:

Journeymen—four shares; labourer—three shares; apprentices (depending on year)—from half share to three shares.

A portion of bonus earnings may also be paid to non-productive workmen, who themselves cannot earn bonus but due to their efforts make it possible for the workmen to earn bonus.

The targets agreed may represent the labour constants allowed by the estimator when pricing the bill of quantities but in order to prevent this information being passed on to competitors the actual constants are not normally used.

General

Incentive schemes, as mentioned previously have three main aims:

(i) by increasing efficiency to reduce the cost of building;

(ii) to increase individual and collective production;

(iii) to provide opportunity for increased earnings.

A good incentive scheme should be easy to understand, it should state clearly the method of payment which should be straight forward to calculate and it must be seen to be fair by the operatives. All jobs should be accurately defined and the targets stated. The targets should be issued to the operatives prior to the work commencing and once the scheme is in operation then they should not be altered unless by mutual agreement between the workmen and the management. The

work should be continuous and measurable and allowances should be made for any delays there are outside the control of the operatives. Bonus payments should be related to individual or group performances and there should be no restrictions on the amount of bonus that can be earned. Bonus earnings are generally calculated weekly. Overtime working should be paid at basic rates and not at time and a quarter or time and a half.

The targets in an incentive scheme should be based on standard times. The amount of work that can be reasonably expected from an average operative may be determined by the use of work study techniques. The operation may be method studied at first to ensure that the best method is being used and then time studied to arrive at a standard time. The men should be informed of the outcome of the method study and shown how to improve their output on this basis. The work targets and the amount of bonus payments should be agreed between the contractor and the union for each site prior to the commencement of the work.

The scheme should be drawn up so as to make it possible for the workmen to earn from 20% to 30% above their normal hourly rates.

In the following examples of a geared bonus scheme the amount of saving in money due to the increase in output by the workmen is divided proportionately between the contractor and the workmen. The workmen will receive a bonus payment of two-thirds of the money saved and the remainder will go to the contractor in order that he may be reimbursed for the cost of operating the scheme and also give him some additional profit.

Examples of Geared Scheme

1. Squad of 2 plasterers and 1 labourer engaged on bonus on a large building. Targets agreed between contractor and union.

Operation	*Basic output per man/h*
Fixing plasterboard on walls and ceilings	$3\frac{1}{2}\ m^2$
Fixing metal corner beads	$7\frac{1}{3}\ m$
2 coats plaster on lath	$1\frac{7}{8}\ m^2$
2 coats plaster on brick	$1\frac{1}{3}\ m^2$
3 coats plaster on concrete	$1\frac{1}{4}\ m^2$

One week's production:

Operation	*Quantity*	*Target*	*H*
Plasterboard	*150 m²*	*÷ 3½ m²*	*50*
2 coats plaster on ditto	*60 m²*	*÷ 1⅞ m²*	*32*
Metal corner beads	*33 m*	*÷ 7½ m*	*4½*
2 coats plaster on brick	*60 m²*	*÷ 1⅓ m²*	*45*
3 coats plaster on concrete	*40 m²*	*÷ 1¼ m²*	*32*
			163½
		Total h worked	*120*
		H saved	*43½*

Bonus payment: 43½ h at £0.323 = £14.05*

Allocation of bonus between workmen

	H	*Share*	*Total*	*Bonus*
				£
Plasterer	*40*	*× 4*	*160*	*5.11*
Plasterer	*40*	*× 4*	*160*	*5.11*
Labourer	*40*	*× 3*	*120*	*3.83*
	120		*440*	*£14.05*

2. Squad of 2 slaters and 1 labourer engaged on bonus on housing scheme. Targets agreed between contractor and union.

Operation	*Basic output per man/h*
Laying 300 × 150 mm slates, including felt	*1⅞ m²*
Raking cutting	*5½ m*
Laying and bedding ridging	*4½ m*

One week's production:

Operation	*Quantity*	*Target*	*H*
Laying slates	*261 m²*	*÷ 1⅞ m²*	*139*
Raking cutting	*44 m*	*÷ 5½ m*	*8*
Ridging	*54 m*	*÷ 4½ m*	*12*
		Carried forward	*159*

* Two-thirds of basic hourly rate average of 2 plasterers (or slaters) and 1 labourer.

	H
Brought forward	*159*
Total h worked	*120*
H saved	*39*

Bonus payment: 39 h at £0.323 = £12.53

Allocation of bonus between workmen

	H	*Share*	*Total*	*Bonus*
				£
Slater	*40*	*× 4*	*160*	*4.56*
Slater	*40*	*× 4*	*160*	*4.56*
Labourer	*40*	*× 3*	*120*	*3.41*
	120		*440*	*£12.53*

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CHAPTER XXII

PRO RATA RATES

Variations in building contracts in which a bill of quantities forms the basis of the contract are normally priced at bill rates or at rates in strict accordance with bill rates. The determination of these *pro rata* rates requires a prior knowledge of building estimating procedure. In order to build up a new rate for agreement between the surveyor and the contractor, the surveyor must first analyse the appropriate bill rates in order to establish either the labour involved or the percentage to add for profit and oncost. The new rate is built up on the same basis as the analysed rate and the new labour rate or the calculated percentage for profit and oncost added.

Examples

Method 1—To establish the labour content.

1. Break down of bill rate for 406 × 254 mm slates laid to a 76 mm lap—Bill rate £2.29 per m².

	£
Rate for 406 × 254 mm slates	*2.29*
Deduct	
*Profit and oncost (15%) i.e. 13%**	*0.298*
Net cost of labour and material	*£1.992*

Area covered by 1 000 slates = 40 m² (as previously calculated in Roofing Section).

Labour and material cost of 1 000 slates laid = 40 m² × £1.992 = £79.68.

	£
Material	
Cost of 1 000 slates delivered site	*60.00*
Carried forward	*60.00*

* In order to calculate the true amount of profit and oncost that has been added to the cost of materials and labour to arrive at a unit rate the deduction from the unit rate would be one-ninth, thirteen per cent and one-sixth for profit and oncosts of 12½%, 15% and 20% respectively.

	£
Brought forward	*60.00*
Unloading and stacking, 1 labourer 2 h:	
2 h at £0.60	*1.20*
Holing, 1 slater 4 h: 4 h at £0.67	*2.68*
Cost of materials prepared for laying	*63.88*
Nails, 2 per slate = 2 000 nails,	
i.e. 9.35 kg at £0.15	*1.403*
	65.283
Waste 5%	*3.264*
Cost of materials	*£68.55*

Cost of labour per 1 000 slates = £79.68 − £68.55 = £11.13.

$$\text{Cost of labour per m}^2 = \frac{£11.13}{40} = £0.278.$$

Build up of rate for 355 × 203 mm slates laid to a 76 mm lap—m².

$$\text{Gauge} = \frac{(355 - 25) - 76}{2} = 127 \text{ mm}$$

Area covered = 203 × 127 mm = 25 781 mm².

$$\text{Number of slates per m}^2 = \frac{1\,000\,000}{25\,781} = 39.$$

$$\text{Number of m}^2 \text{ per } 1\,000 = \frac{1000}{39} = 25.6.$$

Allowing for rough edges, etc., say 27 m².

	£
Materials	
Cost of 1 000 slates delivered site	*40.00*
Unloading and stacking, 1 labourer 2 h:	
2 h at £0.60	*1.20*
Holing, 1 slater 4 h: 4 h at £0.67	*2.68*
Nails, 2 per slate = 2 000 nails,	
i.e. 9.35 kg at £0.15	*1.403*
Carried forward	*45.283*

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Preface

Specification writing is the Cinderella subject within the construction industry disciplines. Lip service is paid to concise and authoritative specifications but when it comes to actually writing them the work is skimped. In theory it is the architect's duty to write the specification but he either does not have the time or else cannot be bothered and he passes the job to the quantity surveyor. The quantity surveyor, in his turn, leaves the work until he has finished all his measuring and then has not the time to produce a proper document.

The root of the trouble is that many people do not like writing specifications because they have no clear conception of what they should be trying to achieve, nor of the process by which the specification should be produced. In general, the professional and industrial organisations have failed to give a lead by codifying the principles of good specification writing. Notable exceptions to this have been given by the British Standards Institution and the Royal Institute of British Architects, but their publications give only outline notes without providing a guiding text.

I have therefore attempted to remedy this situation by setting down the principles and describing the methods of producing a good specification. I would not suggest that, by merely reading this book, anybody can become proficient at writing specifications but he will at least understand what a specification should be, what it has to achieve, and what is the logical method of producing one. To become really adept in the art the tyro must write specifications, and more specifications, and yet more specifications, and as each is completed it must be read and corrected with a critical eye.

I wish to express my thanks to the Royal Institution of Chartered Surveyors and the Institute of Quantity Surveyors for permission to include past examination questions, to the

Royal Institute of British Architects for permission to reproduce part of its publication 'Handbook of Architectural Practice and Management' and extracts from the standard forms of contract, and to the British Standards Institution for all its help and for permission to reproduce, almost in their entirety, BS 685 and PD 6112, as well as numerous extracts, quotations and statements from other BSI publications. Finally, I wish to thank my wife for all her help in reading the proofs and my typist, Rita Warren, for her work in converting yards of heavily corrected manuscript into clear typescript.

ERIC C. EACOTT

September 1970

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CHAPTER I

WHAT IS A SPECIFICATION?

The specification in the construction industry is one of the documents by which the designer communicates his thoughts and ideas on the type and standard of construction to the other members of the construction team.

The *Shorter Oxford English Dictionary* (3rd edition, 1952) defines the word 'Specification' as '. . . a detailed description of the particulars of some projected work in building . . . the document containing this'.

It later defines to 'Specify' as 'to speak or make relation of some matter fully or in detail, to mention, speak of or name (something) definitely or explicitly, to set down or state categorically or particularly'.

The specification therefore operates by naming explicitly and mentioning definitely the details of some projected work. The important phrases here are 'name explicitly' and 'mention definitely'. The specification, if it is to be of any use, must be definite and unambiguous; it is the document which describes and sets the standard of materials and workmanship to be used in construction. If it is ambiguous or loosely worded the building contractor will not know the standard he is expected to attain.

The principal aim of the specification is to state in words and phrases the standard of work and the quality of finish required in the construction work. It must define matters that cannot adequately be expressed by the drawings and it should therefore not repeat and re-phrase that information but should amplify and enlarge upon it, so that the specification is complementary to the drawings and not synonymous with them.

Assume, for example, that the timber rafters of the pitched roof to a domestic building have to be specified. The clause written into the specification for this purpose often reads:

RAFTERS
The rafters should be 4in. × 2in. sawn softwood set at 18in. centres and pitched against and securely fixed to the 7in × 1½in. ridge board at the top and to the wall plate at the bottom.

What has this clause accomplished?—very little. The size and spacing of the rafters could have been taken from the drawings; the fact that the rafter pitches from ridge to wall plate is again shown on the drawings; all that is gained is the instruction to fix securely, but with what is not specified. A far better way to specify this would be:

STRUCTURAL SOFTWOOD
Structural softwood for use in the roof shall be straight-grained timber free from all dead knots, sapwood, waney edge, rot or beetle attack.

ROOF TIMBERS GENERALLY
Roof timbers shall hold up to the full sizes as shown on the drawings and shall be straight and true and free from all warp or twist.

RAFTERS
The rafters shall be set out evenly throughout the roof and shall be securely spiked with long wire or cut nails to the ridge board at the top and to the wall plate at the bottom. All bevels and birdsmouths shall be accurately cut to give a full bearing of the timber.

These clauses are a great deal longer than the first example but they achieve more. The first two do not deal with rafters in particular but with all structural timber generally and this will include the roof timbers. The clauses do not repeat the drawings, but deal in matters which cannot be found in the drawings, namely the quality of the material and the standard of the workmanship expected in executing the work.

In writing specification clauses which are unambiguous, definite and explicit, it is very easy to go to the other extreme and in the attempt to be clear and concise, the clause may tell the contractor how to carry out the work. The specification must never tell the contractor how to do his job but must describe the final result required by the designer. This is often difficult but with thought and care it can be achieved. As an example of this, study the following clauses.

A. PROTECTION
The contractor is to take all necessary precautions to protect all brickwork and blockwork from damage whether by frost, drying winds, sun, extreme weather conditions or any other cause.

B. PROTECTION
Every night the contractor is to cover up and protect the newly laid brickwork and blockwork with hessian or sacking from damage by frost.

In clause A, damage by any cause at any time is made the responsibility of the contractor, whereas clause B tells him how to protect the work and against what; therefore if the brickwork is damaged by drying wind or the hot sun at mid-day, there will be no redress.

A difficulty in specifying the result rather than the method to obtain the result is often found when the quality of a surface finish needs to be defined. The matter should be specified as accurately and as definitely as possible. For example, a french polished surface can be described by using such phrases as 'a good deep polish finished with a high gloss surface' or 'a light polish which fills the grain finished with an eggshell surface' but the only sure way to get exactly the finish required (if this is absolutely important) is to have a sample of the quality of finish and give each contractor the opportunity of inspecting the sample.

Always avoid such nebulous phrases as 'To the satisfaction of the architect', 'In a good workmanlike manner', 'Of a quality to be approved by the architect'.

What do these phrases mean? What will satisfy the architect, and what quality has he in mind? Has the architect exacting standards or will he be satisfied with the average? Who is to know?

These phrases usually appear when the person specifying is not familiar with the material, trade process or type of work about which he is writing. He is not clear what standard he wants because he does not know what standards can be achieved; he is ignorant of what is required or does not understand the work in question. To use these phrases throws the onus on to the contractor, who will price for what he thinks is needed and, if he is wrong, will have to provide what is required possibly at a loss to himself. The only answer to this situation is for those responsible for writing specifications to make themselves familiar with all types and classes of work and all building trades and processes.

The phrase 'in a good workmanlike manner' is not quite as loose as the others, as it could be held to mean of average

standard, such as a competent workman is likely to achieve bearing in mind the overall type and quality of the work, but it should be avoided if it is at all possible and a more precise phrase used.

CHAPTER 2

SPECIFICATION WRITING

A definite, explicit and unambiguous specification is a difficult thing to write. Such a wide range of knowledge is required before the specification can be started that the best specifications are generally the work of a group of experts rather than of one man.

To be able to write an adequate specification, it is necessary to study the industry in all its aspects and to understand fully the following matters.

1. *Construction Technology*
Not only must the theory and practice of the part of the construction to be specified be known, but the whole conception of the job must be thoroughly understood. If one piece of work is dealt with in isolation it is likely that it will lose its relevance to the whole and the resultant specification may be inconsistent in that it defines a different standard of work from the rest of the documents.

2. *Building Processes and Trade Operations*
If the standards of workmanship that can be achieved are known, it then becomes easier to specify the standard that is required and so properly influence the cost of the work. The standard of work that is required is not always the best obtainable, as the client cannot always afford to pay for the best, but what is usually required is a good average and competently executed job. If the best and the worst are known, then it is possible to choose the right standard for the work in hand.

3. *Building Materials*
A thorough knowledge and understanding of the properties and uses of all the general building materials is essential. This basic

THE SPECIFICATION IN THE CONSTRUCTION INDUSTRY

The architect must ensure that each specialist keeps within the originally agreed standard by checking the specification of each specialist before he passes the final design. If the budget is a large one this is a fairly easy task but in these days, when every client wants real value for money, it can be a thankless job.

Nevertheless architects can take heart from Professor Parkinson who, in his book *The Law and the Profits*, writes 'Artists and craftsmen know that there is a virtue in the resistance of their material. A statue made of granite has a quality not discoverable in a statue made of butter. The resistance of the architect's material is represented (in part) by the factor of cost. The intrusion of this factor produces a better building than could have been produced in its absence. Where there is no ceiling cost the architect merely goes off his head . . . The economical solution is also the best, calling for an intellectual effort which would otherwise never be made. The final answer has . . . a quality to which the resistance of the material is vital.'

The quantity surveyor is generally waiting for the design team to complete its work before he can finish drafting the contract documents and, because of his position as last in the work chain, he will usually organise the collection of the notes and combine them into the draft specification for use in the contract.

Drafting the Documents

When the design is complete, the architect and the other specialists have used their skills and knowledge to produce the ideal solutions to the various constructional problems, and have stated these conclusions in the form of drawings and specification notes, all that is left to be done is for the parts to be brought together to form one set of documents for use in the contract. The drawings are complete in themselves but each draft specification will have been written in virtual isolation from the others and will need editing and vetting before it is passed for final inclusion as a contract document.

This combining and drafting can be a long job requiring a special skill in its performance. It should not be hurried, as a hurriedly written specification will generally finish as an ambiguous and contradictory jumble of clauses. The designers

SPECIFICATION WRITING

will have spent many hours considering the problems presented by the job and a poor specification can very easily destroy all their careful work. Therefore it is necessary to read and understand all the specification notes, not only to discover what has been specified but to gain an insight into the kind of work the designer has in mind. When this has been done, the drafting of the final document can begin.

To begin, make notes of the extent of the work described in each elemental specification, particularly where they overlap one another. The notes should be studied and analysed to see into what main sections and sub-sections the final document can be divided. (See Chapter 3.) The specification is now beginning to take shape. Now choose one main section (the simplest or alternatively, the most comprehensive; for example 'Bricklayers' work'), and make a note of which elemental specifications contain that type of work. Go through each elemental specification in turn, taking out all the clauses and notes referring to materials, and combine or rewrite them into the draft specification. When this is complete, do the same thing with the notes referring to quality of workmanship. Within each section some attempt should be made to put the clauses into a reasonably logical order.

As the section containing workmanship progresses, materials which have not been previously mentioned will be brought to light and so clauses covering these must be added to the materials section. As further collation in subsequent sections progresses, further clauses defining standards of work or materials in other sections will be found and these in turn must be added or noted for later consideration.

When one section is complete, choose another and continue until finally, with a good deal of writing and rewriting, drafting and redrafting, numerous consultations with the designers, coupled with hard work, the specification will be ready for the lithographer.

CUT AND SHUFFLE SPECIFICATION WRITING

One method of drafting the final specification (or even of writing the original notes) is to write each clause on a slip of paper as it comes to hand (Fig. 1). The heading is written in the left hand margin and the detailed clause drafted on to the

information must be supplemented by an up-to-date file of all the proprietary brands and makes of materials and components. Having both of these, it is possible to select the correct grade of material or the correct component for the work in hand.

4. *Technical terms and expressions*

Each trade or profession has its technical terms and it has been said that these terms are invented by the technician to confuse the layman. Technical terms are used because by their use, one word or phrase can convey a great deal of meaning. When the word 'skirting' is used, even the layman understands but in essence this is a technical term and means 'the cover fillet set at the base of the wall within the room, covering the junction between the wall and floor finishes'.

Other parts of construction may have as commonplace an existence but their function and, consequently the terms, are not so readily understood, *e.g.* 'architrave'. Occasionally these terms take on a legal meaning when an action is fought over them and when this has happened care must be taken to ensure that the term is used within the definition given to it by the courts. (For example, in the case of *Leedsford Limited* v. *Bradford Corporation* (1956) the meaning of the words 'or other approved firm' was defined.) Technical terms and expressions are the means of communication in the industry and these must be learned and used correctly, otherwise the specification will become unreal and will lose its value as a practical document for use in the construction.

Having decided what skills must be learned, we can now consider what a specification attempts to do, how it does it and how it is written.

WRITING THE SPECIFICATION

The specification must convey to the other members of the construction team the intentions of the designers on all points that cannot be adequately expressed on the drawings. It will do this by describing the building, its construction, its materials and the standard of workmanship in every aspect of the work, and this description must be written within a standard format of sections, sub-sections and clauses, in a clear, concise and unambiguous manner.

The Background

The architect's brief from his client will contain either an indication of the standard of the building required or a note of the size of building required together with a target cost. Either way the standard of construction and finishings is set. In providing schemes for the client's consideration the architect will make certain basic decisions on the standard of construction and finishes to be used and these decisions, given in the form of notes, will be typed out as a series of statements. These statements, which will be in no particular form or order, will be used firstly by the client, who needs them to judge whether the scheme is what he wants; secondly by the quantity surveyor, who will use them in his calculation of the cost; and thirdly by the specialists and sundry draughtsmen, who will develop the scheme.

The notes, whilst being brief and concise, are the guidelines for the quality and extent of the scheme and must not linger on any detail but indicate the overall quality of the work; they deal in the concept of the scheme as a whole, not in details. Even though these brief specification notes are written at a very early stage in the design process, they must be accurate and must never be varied. They form the bedrock for the quality of the work and any variation from them may cause a major variation of cost.

In the development of the scheme, the brief specification notes are enlarged and developed and will begin to take an elemental form: e.g. when the architect designs the element 'Roof' he will probably write his specification notes for that element under that heading. Great care must be exercised by the designer at this stage or, in the enthusiasm of detailing, the original standards will be over-set; it is so easy to add the extra frill here and to produce an over-complicated constructional detail when competent construction is all that is required.

At this stage many specialist consultants will join the design team, some of whom will not be working directly for the design architect but as sub-contractors for the design of a piece of specialist work (e.g. heating or electrical work). Each specialist will develop his own part of the scheme and produce his own elemental specification and these must all be kept within the framework and spirit of the original brief specification notes.

Jul 4th 1978	Section W British Standards and Codes of Practice	The following British Standards and British Standard Codes of Practice shall be held to be incorporated in this specification BS
Jul 4th 1978	Section W Storage of Materials	All painters and decorators materials are to be stored in a properly insulated store in such a manner as to protect them from extremes of temperature
Jul 4th 1978	Section W Painting in inclement weather	No paint of any type is to be applied to external surfaces during damp foggy or inclement weather or when moisture is present on the surface to be painted No paint
Jul 4th 1978	Section W Painting in inclement weather (Cont)	shall be applied when the temperature falls below 4°c

Figure 1: Layout and use of 'cut and shuffle' paper for specification writing

remaining section. When the whole specification has been written on these slips, they can be indexed and sorted (shuffled) into a reasonably logical order. The final draft document can then be written from the slips.

SCISSORS AND GLUE SPECIFICATION WRITING

It is common practice to cut up old documents and, with the addition of new clauses and inserts into old clauses, paste them together again to produce a draft specification for a new job. Whilst there is nothing basically wrong with this (even if we write the specification out in full every time, we must draw on past experience and the use of typewritten rather than remembered experience does not make it any the worse) it is necessary to be quite sure that the clauses re-used do, in fact, apply to the new standards and circumstances of the new work. Each clause, before being re-used, must be read, studied and thoroughly checked to make sure that it does not contradict or repeat any previous clause and does set the correct standard for the work in hand.

REFERENCES TO STANDARD SPECIFICATIONS

Standard specifications are produced by many organisations such as local authorities and Government departments and a practice is growing up of referring in a specification to clauses in one of these standard specifications.

If the reference is made by rewriting the clause as a whole there is little difference between this and a scissors and glue specification, but when reference is made by giving only a clause number and the title of the document from which it came, care must be taken that the clause says, in fact, what it is thought to say.

THE USE OF BRITISH STANDARDS

British Standard specifications are prepared by committees of the British Standards Institution after due research, investigation and consultation with the various interests concerned. These British Standards or BS as they are known, cover all manner of industrial products and consumer goods and there are marking schemes in operation for certain standards whereby manufacturers whose products comply with the

requirements may apply to use the BSI 'Kite' mark (a registered certification mark) on their goods. In every case the presence of the mark means that the BSI has satisfied itself by independent inspection and testing, that the product has been made in accordance with the BS requirements. The granting of a licence to use the 'Kite' mark is not a 'once and for all' approval; regular inspection, testing and checking of production control methods continues throughout the commercial life of the product.

Figure 2: Example of BSI Kite Mark, as used on salt-glazed stoneware drain pipes made to BS 65

The British Standards for use in the construction industry are summarised and issued in the BS Handbook No. 3. This handbook should be in the office of every architect, quantity surveyor and engineer for general reference, but it should be remembered that these are only summaries of the full standards and as the preface to the handbook says '. . . it is important to remember that every word in a British Standard is significant. Therefore a British Standard cannot be summarised and still retain the whole meaning of the original document. When, therefore, it is desired to use a British Standard in connection with a contract the British Standard Specification and not the summaries contained in this handbook should be consulted.'

The correct way to refer to a British Standard is: BS 685: Sequence of Trade Headings and Specification Items. The BSI itself quotes on its published copies of the standards and summaries the year of publication or revision thus: BS 685:1951.

The standards are revised from time to time and as the number, once allocated, normally remains unchanged, it is necessary to quote the date only to avoid doubt as to which

edition is intended. However, only one edition is correct, the former one being automatically superseded by the new issue.

The British Standards connected with the construction industry fall mainly into four groups:

1. Those that specify the quality of materials; *e.g.* BS 12: Portland Cement (ordinary and rapid hardening).
2. Those that specify the quality of workmanship; *e.g.* BS 1181: Clay flue linings and chimney pots.
3. Those that specify both materials and workmanship; *e.g.* BS 585: Wood Stairs.
4. Those that classify and do not attempt to set down rules of manufacture or workmanship; *e.g.* BS 2660: Colours for Building and Decorative Paints.

The common forms are those numbered 1 and 3 in the list. Each BS will specify a standard below which the material or work must not fall, but in many cases more than one grade within that standard will be given. It is therefore not enough to say that a material must comply with the BS but that it must comply with a particular sub-section of that BS, *e.g.* 'The material for damp-proof courses must comply with BS 743: Type 5F', which clearly, concisely, accurately and conclusively defines the damp-proof course material.

The BS may also set the standard of construction and workmanship. If the construction is not of the exact type, and to the same sizes and with the same grade of materials, as the BS then it is not in accordance with the BS and no purpose is served in mentioning the BS. If the standard of work is better than that specified in the BS then it is possible to say that the work shall be of a standard not less than that laid down in the BS.

The use of BS in a specification can ease the task of the writer as it is no longer necessary to specify all the details where there is a relevant BS. Thus, in specifying timber for joinery, instead of saying the timber shall be 'free from rot, rack, heart-shake, cup-shake, checks, splits, etc.', it can be given as 'of a quality not less than that laid down in BS 1186 part I and shall be of the type given as "Suitable" in table 1 and 2.' Care must be taken to ensure that the BS does say and specify what you

think it does: to say 'timber connectors are to comply with the requirements of BS 1579 and are to be used and fixed in accordance with the recommendations of that BS' is of no value because if a check were made with the full BS it would be found that it is for material and dimensions only and makes no mention of fixing and use.

THE USE OF BRITISH STANDARD CODES OF PRACTICE

British Standard Codes of Practice are issued, after due research and consultation, by the Council for the Codes of Practice of the British Standards Institution. The codes (BSCP) recommend a standard of good practice in the design and workmanship within a particular sphere. They make extensive use of British Standards in their recommendations.

The codes of practice for use in the construction industry can be divided as follows:

1. **Building Codes**

   a. Basic design codes, *e.g.* BSCP 3, Chapter V, Loading Pt. I: Dead and Imposed loads, which gives the recommended loadings to be used in calculations by engineers in their structural design.

   b. General codes, including services, *e.g.* BSCP 102: Protection of Buildings against Water from the Ground, which sets forward the basic problems of rising dampness and contains design recommendations to deal with the problems.

   c. Other building codes including special types of buildings, *e.g.* BSCP 56: Access for the Disabled to Buildings.

2. **General Engineering Codes**

   a. Civil engineering codes, *e.g.* BSCP 2001: Site Investigation, which summarises in convenient form the information it is desirable to obtain in the investigation of the stability of sites as they affect the design and construction of civil engineering works.

   b. Mechanical engineering codes, *e.g.* BSCP 3002, Pt. I: Installations Burning Class D fuel oil and C.T.F. 50, which gives recommendations on the design and installation of this type of unit.

   c. Electrical engineering codes, *e.g.* BSCP 1007: Maintained Lighting for Cinemas, which relates to the safety lighting and management lighting in all parts of the building.

As with the British Standards, the British Standard Codes of Practice can greatly ease the task of the specifier, as they can be used to specify the standard of workmanship for a job but it is necessary again to be sure that the BSCP actually covers the type and quality of work in hand.

THE USE OF PRIME COST AND PROVISIONAL SUMS IN SPECIFICATIONS

1. **Prime Cost (P.C.) Sums**

A PC sum is one that is provided to cover the cost of materials supplied, or work done, by specialists. A PC sum should not be used for work to be carried out by the main contractor. If the contract is to be let on the basis of quantities then there will be a bill of quantities and the PC sums will be written in the bill, but if there are no quantities then the PC sum will be included in the specification. The sum to be inserted is that before discounts or other trade allowances have been deducted. If the quotation obtained against the PC is given as NETT then the RIBA standard form of contract says that a minimum discount of 5 per cent on suppliers and 2½ per cent on sub-contractors shall be allowed.

If the PC is for materials to be supplied, *e.g.* sanitary fittings, then the main contractor will be entitled to add to this for profit and the fixing of the materials will be provided for elsewhere, but if the PC is for work to be executed then the main contractor will be entitled to a profit for administering the work and to be paid for general and special attendance on the specialist. The terms 'General' and 'Special' attendance are defined in the Standard Method of Measurement of Building Works (SMM) as 'General attendance . . . shall be

deemed to include only allowing use of standing scaffolding, mess rooms, sanitary accommodation and welfare facilities; providing space for office accommodation and for storage of plant and materials; providing light and water for the work; clearing away rubbish,' and 'Special Attendance . . . shall be . . . given as an item . . . giving particulars (*e.g.* unloading; storing; hoisting; placing in position; providing power; providing special scaffolding).' Attendance does not include the builder's work in connection with the item, *e.g.* fixing, cutting chases, holes, etc.

A typical item for a PC sum is electrical work and it will be written as follows:

ELECTRICAL WORK
Provide the PC sum of £250 for electrical work to be executed complete by a firm to be nominated by the architect.

Add for Profit
Allow for general attendance on the electrical contractor in allowing him the use of all facilities in storage, toilets, standing scaffolding, etc.

Allow for special attendance on the electrical contractor detailed as follows:

a. Provide scaffolding towers for fixing and wiring driveway light.
b. Unload, get in store and place in position:
Cooker size overall 22in. × 48in. × 60in. high.
Deep freezer size overall 20in. × 24in. × 42in. high.

2. Provisional Sums

A provisional sum is one provided to cover the cost of unforeseen work and of work, the extent of which cannot be estimated at the present time.

A provisional sum should only be used for work to be carried out by the main contractor; the final work carried out under this sum will be priced at the unit rates and prices used for the remainder of the job or at rates and prices analagous thereto. (If the work is carried out under an RIBA contract where quantities do not form part, then the work should be priced at rates and prices contained within the schedule of rates obtained under clause 3 of that contract.)

If a provisional sum is given for work and subsequently it is decided to nominate a specialist, the main contractor may have cause for a claim for loss of profit. If it is intended from the

beginning to nominate a firm to do that part of the work then a PC sum should have been used.

A provisional sum does not need items of profit or attendance, as the profit will be taken into account in the final account when the work included under that provisional sum is priced at contract rates and the attendance will be of the main contractor upon himself and will also be contained in the rates.

A typical item for a provision sum would be written as follows:

BOILER HOUSE
Provide the provisional sum of £500 for additional work in the boiler house in cutting away and making good and general adaptations during and after the installation of the new boilers.

WRITING A SPECIFICATION IN THE EXAMINATION HALL

It is all very well knowing what happens in practice but how do we write the specification in the examination room, when we have no team of specialists to write brief specification notes or expanded elemental specifications for us to refer to and cannibalise? The process is basically the same as writing the specification for practical purposes but the only reference that can be made is to yourself.

First read the question and see how many marks it will bring and convert marks into time, *i.e.* in a 2-hour paper for 100 marks, 25 marks should mean ½-hour of work; then on the basis of being able to write one page of foolscap script in 15 minutes convert time into pages. The immediate conclusion you will come to is that it is impossible to complete the question in the time and space allowed, so we must start work as soon and as quickly as possible.

Take three sheets of paper (this is a commodity that you have plenty of) and head one 'Generally', one 'Materials' and one 'Workmanship'. Start writing specification clauses for all the materials you can think of relevant to the question, then write your list of BS numbers for your 'Generally' section on that sheet and finish it off with the hardy annuals of 'Testing' and 'Protection'.

Now comes the difficult part: start writing the 'Workmanship' clauses. Remember in workmanship you must: amplify the

drawings, be precise and unambiguous, and say what is to be done and not how to do it. As the work develops (and the time runs out) further clauses will suggest themselves and these can be added to the appropriate sections as they occur.

TRADE PREAMBLES

Many examiners in specification writing ask the candidate to write 'Trade Preambles'. This form was originally used for items written before each work section in the bills of quantities to amplify the measured items, but it has now come to mean a brief specification written in the bills of quantities with the relevant clauses put at the beginning of each work section. Therefore if the examiner asks for 'Trade Preambles' he will usually require brief specification notes.

CHAPTER 3

ORDER, LAYOUT AND ANNOTATION

The order, annotation and general appearance of the documents may not appear to be very important when considering the preparation of the specification, but they should not be treated as a trivial part of the work. Logical, orderly and attractive documents are pleasant to use and, in addition, can be used efficiently and effectively. In an orderly document, any particular item, once located, can be referred to briefly and accurately.

SEQUENCE OF TRADE HEADINGS

BS 685: Sequence of Trade Headings and Specification Items, gives a typical layout of a specification with headings and sub-headings under which clauses should be written. The foreword to this British Standard says it is '. . . based on the sequence of trade headings as given in the Standard Method of Measurement of Building Works, except where it was considered that divergence from that order would simplify the preparation and clarity of a specification'. Since this British Standard was produced in 1951, however, a further edition of the Standard Method of Measurement has been published, which drastically alters the sequence of trade sections and the work to be given under each. BS 685 is reproduced in full in Appendix C, but in order that a comparison between the two documents can be made, the headings to the main sections are reproduced on the following pages:

As each of these documents gives a different approach the one to be used must be decided by another criterion and the most common is the method by which the contract is let.

Comparison between the List of Trades given in BS 685 and the Work Sections given in The Standard Method of Measurement of Building Works.

BS 685 Section No.	BS 685 Heading	Standard Method of Measurement Section Letter	Standard Method of Measurement Heading
1	Preliminaries	B	Preliminaries
2	Demolitions, shoring and works on site	C	Demolitions and works on site
3	Excavation and earthworks	D	Excavation and earthworks
4	Piling	E	Piling
5	Concrete	F	Concrete work
6	Hollow slab and precast unit construction	—	(included in F)
7	Brickwork and block partitions	G	Brickwork and blockwork
8	Drainage, sewage and sewage disposal	—	(see Section X)
—	(no separate section)	H	Underpinning
9	Asphalt	—	(see section L)
10	Pavings	—	(included with Section U)
		J	Rubble walling
11	Masonry	K	Masonry
—	(see Section 9)	L	Asphalt work
12	Roofing	M	Roofing
		N	Carpentry (including carpenter's metalwork)
13	Timber and hardware	P	Joinery (including ironmongery)
14	Structural steelwork	Q	Structural steelwork
15	Metalwork	R	Metalwork
16	Plasterwork, wall tiling and terrazzo	—	(see Section U)
17	Sheet metal work	—	(see Section R)
18	Rainwater services	S	Plumbing and Engineering Installations. This section is sub-divided and given in the order of:
19	Cold water services and sanitary plumbing		Gutterwork
20	Hot water services		Rainwater pipes
21	Gas and water mains		
22	Heating		
23	Ventilating		

Section No.	Heading	Section Letter	Heading
18-23 continued			Waste pipes
			Soil and vent pipes
			Cold water services
			High pressure cold water supply
			Water mains
			Cooling water
			Condense water
			Hot water services
			Low pressure hot water heating
			High pressure hot water heating
			Steam heating
			Low pressure hydraulic
			High pressure hydraulic
			Gas
			Compressed gas
			Compressed air
			Oil pipework
			Smoke flues
			Gas flues
			Duct work
			Equipment (for all above)
			Appliances (for all above)
			Ancillaries (for all above)
			Thermal insulation
24	Electrical work	T	Electrical work
—	(Sections 10 and 16)	U	Plaster work and other floor, wall and ceiling finishes
25	Glazing	V	Glazing
26	Painting and decorating	W	Painting and decorating
—	(see Section 8)	X	Drainage
—	(included in Section 13)	Y	Fencing
27	Provisional sums and work by specialists	No	comparable section, but common practice is either: a. to group all prime cost and provisional sums together and

Section No.	Heading	Section Letter	Heading
27	Provisional sums and work by specialists *(continued)*		put them as the first or alternatively the last section of the specification or bills of quantities. or
		b.	to keep each prime cost or provisional sum in the position in the specification or bills of quantities that it would occupy if it were a normal item; *e.g.* a prime cost sum for ironmongery should be the last item of Section P. A provisional sum for additional excavation would appear with Section D.

LETTING A BUILDING CONTRACT

There are three main ways of letting a building contract:

1 *On the basis of a bill of quantities*

The bill of quantities is a document which sets out firstly the rights and obligations of the parties under the contract in general and in detail and secondly gives a list of the measured quantities of labour and materials necessary to complete the work. In tendering, the contractor puts a price against each individual right, obligation or measured item. The total value of these items should therefore be the total value of the contractor's tender and will form a basis for all monetary adjustments and variations during the contract and also for the final account. The bill of quantities will be supplemented by drawings, a form of agreement and a specification.

If this is to be the method of letting the contract, the obvious order for the specification would be that followed by the bill of quantities which in turn would, no doubt, be that of the SMM.

The matter of the order of the specification in accordance with the Standard Method of Measurement and bills of

quantities should be taken to its logical conclusion. If the bills of quantities are sub-divided into separate parts, then it would be logical and advisable to divide the specification into these same parts. Each part would then be sub-divided into the appropriate work sections of the SMM and the general order within each work section should follow that of the SMM as closely as is practicable. Clauses will inevitably be repeated from section to section (*e.g.* both main building and sub-station will need the same clauses for 'Treating bottoms of excavation' and 'Reinforcement') but repetition can be avoided by referring in one part to the particular clause in the previous part. It is advisable, therefore, to put the most comprehensive specification first The same principle of referring to items from one part to an earlier part is quite usual in bills of quantities and one would also put the most comprehensive bill first so, in general, specification order will follow bill order. The disadvantages of having to refer from one part of the specification to another is far outweighed by the advantages of having two complementary documents in the same basic order.

Having decided that the main sections and work sections of the specification will follow the standard method of measurement order then within each work section the clauses will be sub-divided into:

a. **General Clauses**

These are clauses which have no definite position in the other sub-divisions. From the list of typical specification clauses in chapter 7 it will be seen that these are usually the list of British Standard numbers, the testing of materials, protection of works, etc.

b. **Materials Clauses**

These are clauses which specify the materials to be used in the work. They will in some cases repeat materials included in the BS list from the previous sub-division but in this section the materials must be specified in detail, *e.g.* the British Standard list will give: 'BS 743: Materials for Damp-Proof Courses'. This British Standard mentions eight materials for use as a damp-proof course and some of the

consists of individual items of repair, maintenance or renovati
which, when put together, form one contract. Th
which the specification is written is of no
it is logical and orderly, but
principles laid down
form part

materials mentioned are sub-divided into grades, so the clause dealing with this should specify the precise grade of material to be used.

c. **Workmanship Clauses**

These clauses should specify the quality of workmanship expected in the work. They should be clear and concise and should tell the contractor not how to achieve a result but the result that is required. These clauses are the most important in the specification as they will set the standard of work. In setting the standard of work, these clauses also affect the cost. If the work is overspecified the cost will be higher than expected as the contractor will price the standard of work that he believes the architect requires, that is, the standard given in the workmanship clauses.

2. *On the basis of a specification*

It has been recommended by the Joint Contracts Tribunal that in contracts where the total value of work is not expected to exceed £8,000 there should be no quantities. The contractor will calculate his price for the work on the basis of the information shown on the drawings and described in the specification; he is not required to price individual items but will state one lump sum for completing the entire contract.

If this is to be the method of letting the contract then it is immaterial in which order the specification is written, provided it is logical and easily understood. Most quantity surveyors would follow that of the SMM as this is the system with which they are most familiar but the British Standard order would serve just as well.

It may sometimes happen that the type of work does not lend itself to writing the specification in either order. The order then would be one which is logical and easily understood, say the construction order for a small building or room order for works of alterations and repair. The best example of specification writing in construction order *is* one of alterations and repair, and any attempt to write this type of specification in anything other than construction order would lead to confusion, as the estimator will price this work on the basis of individual tasks and the contract will be carried out in a series of isolated jobs.

As the specification is the document upon which the contract is based, it has a greater part to play in this type of contract, and must therefore contain details of the entire contractural liability of the contractor under the contract. The sections of this specification will therefore be:

a. **Preliminaries**

These are clauses which set down the rights and obligations of the contractor under the contract or give items of general information on the contract. This section is general to the whole of the contract.

b. **The remainder**

The remainder of the document is divided into work sections in accordance with the SMM exactly as has been previously described for a 'with quantities' contract with the addition of Description of Work clauses. These additional clauses are similar to those given in the Workmanship section (which describe the work in general) but they differ in that they describe the work in detail.

c. **Appendices**

This section is general to the whole contract and gives or requires supplementary information on the contract, *e.g.*:

(i) Giving details of positions where electric current can be obtained with its appropriate phasing and voltage.

(ii) Asking for a bond, in a particular form and value, for specific performance.

3. *On the basis of a prime cost agreement*

The prime cost will be defined in the agreement and will generally include the cost of all labour, materials and hire of plant. A fixed fee will be added either in the form of a definite sum or an agreed percentage of the prime cost. The agreement may be supplemented by drawings and a specification; neither of these is absolutely necessary but one or the other is desirable.

If this is the method of letting the contract, the work is obviously of such a character that it is difficult to define its nature and extent and therefore the division of the documents into either of the other forms is not suitable. The work probably

consists of individual items of repair, maintenance or renovation which, when put together, form one contract. The order in which the specification is written is of no importance, provided it is logical and orderly, but it would generally follow the principles laid down for the contract where quantities do not form part.

CLAUSE LAYOUT AND ANNOTATION

Each of the previous types of specification is divided into sections, each section divided into work sections and each work section sub-divided into clauses. Each clause of the specification should be set out and annotated so that:

1. the subject matter of each individual clause is clear and obvious at a glance;
2. the clause may be referred to quickly and accurately with no ambiguity.

Within these two rules the layout and annotation of the clauses is a matter of fashion and personal preference.

Setting out the clauses

The two most common methods of setting out specification clauses are both illustrated and described as follows:

Descriptive heading to clause written in the margin

The clause is written out in full without abbreviations. It should be noted that the descriptive heading is not part of the specification clause and therefore if the heading is 'Reinforcement' the clause should not start 'To be mild steel bars . . .' but 'Reinforcement is to be mild steel bars . . .'

Descriptive headings to the clauses written above the body of the clause and underlined

The clause is written out in full as before and is inset to form a margin but in this case the margin is not so large as would be used in the previous example. The remarks regarding the headings apply here also.

ORDER, LAYOUT AND ANNOTATION

The first example is the more usual at the present time and in addition it follows the layout used by the RIBA in the standard form of contract. To use the same layout as the RIBA will give uniformity to the documents of the contract.

The second method is still being used but has generally been superseded by the first; its main advantage is that having the descriptive heading set over the clause and the clause inset gives a longer line and consequently more information is contained on each page, the document contains less pages. This will show a saving in lithography and printing charges.

Numbering the Specification

The basic methods of numbering clauses are as follows:

1. **The construction industry method**

This method is in general use in the building and construction industry. With this system each page is numbered consecutively and each clause on that page is lettered in order with the first clause on each page lettered A. (Fig. 3.)

To refer to a clause it is necessary to quote the page number and the clause reference letter thus: Page 26, Clause D, or Clause 26/D.

2. **The engineering industry method**

This is a method which originated in the mechanical engineering industries and with the increasing use of engineering installations in buildings, this method is becoming more common in the construction industry. With this system each work section is numbered consecutively (the appropriate number used in BS 685 or letter of the Standard Method could be used) and within each section the clauses are numbered consecutively and continuously through the pages from first to last. (Fig. 4). To refer to a clause it is necessary to quote the clause reference which will indicate the section and the clause, thus Clause 1:13. Pages are, of course, numbered in the normal way but are not used in referencing.

3. **Consecutive numbering**

With this system clauses are numbered consecutively from the beginning of the specification to the end. To refer to a clause

Item		Painting and decorating (contd.)
A	Testing of Materials	If the Architect considers it desirable to analyse all or any of the materials, samples and containers will be provided by the Contractor for this purpose. These samples may be taken from the sealed containers or the foreman's kettles on the works. All work executed with materials found not to fulfil the requirements of this Specification shall be burnt off or otherwise removed and the work re-done as directed by the Architect.
B	Storage of Materials	Materials are to be stored in suitable covered store to prevent extremes of temperature. Before using, all materials are to be thoroughly stirred.
C	Painting in inclement weather	No paint of any kind is to be applied to external work during foggy or inclement weather. No paint is to be applied to any surface upon which moisture is present or at temperatures below 4°C.
D	Ironmongery and fittings	All fittings, small articles or ironmongery and bright metal work not to be painted, such as lock furniture, finger plates, etc. are to be taken down or removed before painting and replaced when the paint is dry.
E	Preparation	On timber and plastered surfaces and special smooth metal panels, the priming coats are to be only lightly rubbed down. Priming coats on structural steel and similar surfaces are not to be rubbed down. Undercoats are all to be "flatted" to produce a smooth surface and remove all irregularities. Dulux Gloss and Eggshell finishes shall not be flatted between coats but only lightly rubbed down to remove nibs. All surfaces which have been lightly rubbed down or flatted are to be wiped clean and when dry freed from all dust by the use of "Tacky Dusters". Undercoats to be flatted shall generally be rubbed down with suitable wet and dry paper used wet. No paint shall be applied until the surfaces have been approved by the Architect.
F	Thinning	Thinning may only be carried out by permission of the Architect. Thinning materials and proportions must be those recommended by the manufacturers for the types of material used.

Item		Painting and Decorating (Contd.)
A	Samples	Sample tints of all paints are to be applied to the work where directed by the Architect for approval
B	Tints	All paints, tints and colours are to be indicated in the paint schedule and to the satisfaction of the Architect. The Architect may select a larger range of colours than is normal and the Contractor is to allow in his prices accordingly. In the case of oil paint, no consecutive coats are to be of the same colour except where white is used Exterior and Interior Paintwork
C	External Metal Work	Immediately after erection this metal work is to be thoroughly cleaned with a suitable solvent to remove all dirt and grease and thoroughly scraped and wire-brushed to remove all rust and all other deleterious matter back to a bright face The surfaces shall then be primed immediately with:- 1 coat I.C.I. Billingham Red Lead Primer Immediately before further paint is applied the surfaces shall be examined and where necessary the foregoing treatment shall be re-applied to the satisfaction of the Architect. The surfaces shall then be painted with:- 1 coat Dulux Undercoat in the appropriate colour. 2 coats Dulux Gloss Finish in the selected colours. The finish for all interior metalwork except structural steelwork shall be two coats Dulux undercoat and one coat Dulux Gloss Finish. N.B. Where a flat finish is specified, 2 coats of Dulux Flat Finish shall be applied direct over the primer.
D	Plywood	Where specified all plywood shall be free of all dirt, plaster or other deleterious matter and then primed with one coat of Wood Primer No. 2 which may be thinned with 10% Dulux Thinner if required

Figure 3: Typical layout of two consecutive pages of a specification with the construction industry method of annotation

SECTION 7

Item		BRICKWORK AND BLOCKWORK
7.1	British Standards	The provisions of the latest revised editions of the following British Standards shall be held to be incorporated in the Specification unless it is specifically stated otherwise BS 12 Portland Cement (ordinary and rapid hardening) BS 187 Sand Lime (calcium silicate) Bricks BS 743 Materials for Damp-proof Courses BS 890 Building Limes BS 1165 Clinker aggregate for plain and pre-cast concrete BS 1180 Concrete Bricks and fixing bricks BS 1200 Sand for Mortar for plain and reinforced brickwork BS 1243 Metal ties for cavity wall construction BS 2028 Precast concrete Blocks BS 3921 Bricks ans blocks of fired brick, earth clay or shale
		<u>Materials</u>
7.2	Common Bricks	The Common Bricks are to be Sand Lime Bricks in accordance with BS 187 Class B
7.3	Engineering Bricks	Engineering Bricks to sides of ducts and elsewhere where shown on drawings are to be Southwater or similar approved Engineering Bricks in accordance with BS 3921 Table 6 Class B Blue Staffordshire Engineering Bricks in accordance with BS 3921 Table 6 Class A are to be used internally for the first two courses above floor level. Bull nosed blue bricks are to be used in the cills to the linkways
7.4	Facing	The bricks for external facings are to be Freshfield Lane Facings as manufactured by the Sussex and Dorking Brick Co. Ltd

Section 7 (contd.)

Item		Brickwork and Blockwork (contd.)
7.5	Internal Fair Face	Where internal fairface is specified in the finishing schedules or indicated on the drawings Midhurst White Facing Bricks are to be used for faces exposed to view.
7.6	Fixing Bricks	Fixing bricks are to be 9" x 4½" x 3" nominal concrete bricks in accordance with BS 1180 Class A but of such consistency as shall permit easy driving of and good purchase for screws or nails.
7.7	Partition Blocks	Partition blocks are to be precast concrete in accordance with BS 2028 type A size 9" x 4½" x 18" with type A aggregate. Blocks in panels are to be set out from the centre and rates are to include for any necessary cutting at each end.
7.8	Belroc	Belroc panels are to be 3" thick and erected by an approved Belroc licensee all in accordance with the manufacturer's specification for fixing at top and bottom, jointing panels and door frame junctions etc. Panels are to sit on a timber plate at bottom as shown on the manufacturer's detal sheet no. 3 and the head of the panel is to be fitted with scrim and plaster wedges; details are to be read in conjunction with the drawings.
7.9	Plugs	Fixings for joinery to concrete are to be made with Philplug No. 97 concrete inserts and where described as plugged and fixed or plugged and screwed to concrete, rates are to include for the supply and fixing of these inserts at suitable intervals.
7.10	Wall Ties	Galvanised wire butterfly ties to column brickwork and 11" cavity construction to BS 1243. First floor cavity walls to have galvanised m.s. ties 16" long x 1" x 20 gauge with split ends built in as work proceeds bent twice to bed into opposite course below.
7.11	Walcrete	Walcrete Masonry Cement is to be obtained from the Cement Marketing Co. and be used strictly in accordance with the manufacturer's instructions.
7.12	Mastic	Mastic is to be obtained from an approved manufacturer.
7.13	Damp-Proof	Damp-Proof Courses are to comply with BS 743 Part 2 type 5A as Messrs.W.Briggs' 71b "Aqualite" or similar approved.

Figure 4: Typical layout of two cosecutive pages of a specification with the engineering industry method of annotation

under this system it is necessary to quote only the clause number.

What are the advantages and disadvantages of each of these numbering systems?

In Chapter 2 the preparation of the specification was discussed and it was shown how it is built up from the brief specification notes to the full draft specification. It is inevitable that in one part of the document reference will be made to a previous part. If this is done under the first system, the page and clause references will be quoted and as three pages of draft will equal approximately two printed pages, it is conceivable that what is item 28A on the draft will be item 18D in the final document. It is necessary, therefore, to leave the insertion of all clause references until the proof copy of the documents is ready. On receipt of the proof, a search must be made through it to fill in the references, sometimes with disastrous results as it cannot be remembered to which of several previous clauses the reference was made. These disasters can be avoided by proper office routine and organisation (*i.e.* references are made from draft to draft and inserted in pencil with instructions to the lithographer not to type in pencil figures). The routine checking of references, if intelligently done, can be a final check on the specification and its coherence.

If the second system of annotation is used, the matter of incorrect referencing appears to be avoided, as the reference number of the clause will not alter in the production of the proof copy, but as the general method of specification production means that clauses are inserted, altered, cut out and moved to different positions during its drafting, the problem of incorrect referencing remains. The method of avoiding this is the same – that is systematic working, frequent checks, routine and organisation.

Consecutive numbering is not a practical proposition in handwritten specifications of purpose-made buildings, but when more standardisation of building components, with standard qualities of workmanship, is achieved, it will be possible to use standard specification clauses. The writing of a specification will then involve the instruction of a machine (probably a computer) to put together the final specification. The machine will take the responsibility of numbering and

referencing the clauses and, provided the initial programming has allowed for this, will do a far more efficient job than the mere human being.

CHAPTER 4

THE SPECIFICATION AND THE CONTRACT

The law appertaining to construction contracts is outside the scope of this book but, to understand the part played by the specification in the contract, it is first necessary to understand what a contract is, what are the parts of the contract and what is the relationship of those parts.

WHAT IS A CONTRACT?

A contract is an agreement between two parties to do, or forbear from doing, certain specified acts. To put this into the context of the construction industry, a contract is an agreement between a building contractor and another person to execute and to pay for the execution of certain specified construction works.

The contract may be made verbally or in writing, and provided it satisfies the following essential points, it will constitute a valid contract.

1. There must be on either side the intention to create a contract, in that a good and proper offer must have been made and the offer must have been accepted.
2. There must be valuable consideration, *i.e.* each party must benefit in some way from the agreement.
3. The subject matter must not be illegal, immoral or against the public interest.

Verbal Contracts

A verbal contract can be made for construction work. It is only necessary for one party to say 'I offer to complete the work for £20' and for the other to reply 'I accept' or 'Done', or other such words implying acceptance, and a contract is made. The difficulty then arises – what has been agreed, what is the extent

THE SPECIFICATION AND THE CONTRACT

of the work, has one party misunderstood the other? The verbal contract for construction work should be confined to minor works of repair or maintenance where documentation is unnecessary because the extent of the work is obvious and the quality of materials and workmanship will have to match those existing and cannot come into dispute.

Written Contracts

Written contracts are essential in the construction industry because of the complexity of the subject matter and each agreement should define:

1. The terms and conditions under which the agreement is made.
2. The extent of the contract, *i.e.* drawings showing the work or a specification defining the work, or both.
3. The consideration or a statement defining the means of calculating the consideration, *i.e.* statement of lump sum in a letter, or a bill of quantities.

Contracts by Correspondence

A number of small contracts are placed by an exchange of letters between the parties and, provided the general principles of the law have been satisfied, there is a valid contract between the parties which the law will enforce. The letters will often define the extent of the work and state an agreed price but they are generally rather vague on the terms and conditions under which the agreement is made and will not define the standard of materials and workmanship to be used in the work.

If a dispute should arise under such a contract, the letters exchanged will be used to determine what the parties had in mind when they were written and from them a judgment will be made on the basis of previously settled cases and on what a reasonable man would expect, bearing in mind all the circumstances obtaining at the time.

Standard Forms of Contract

It has long been realised that construction industry contracts have special and continually recurring problems, and to overcome these the professional institutions have drawn up standard forms of agreement and conditions of contract to suit every class

and condition of construction work. It is upon one of these standard forms of contract that the majority of major construction work is let.

The most common standard forms of construction contract are:

1. RIBA Form,* Private Edition (with quantities).
2. RIBA Form,* Local Authorities Edition (with quantities).
3. RIBA Form,* Private Edition (without quantities).
4. RIBA Form,* Local Authorities Edition (without quantities).
5. RIBA Fixed Fee Form* of Prime Cost Contract.
6. Institution of Civil Engineers General Conditions of Contract.
7. General Conditions of Government Contract for Building and Civil Engineering Works (CCC/Wks 1).
8. Faculty of Architects and Surveyors, Short Form of Building Contract, Private Edition.
9. Faculty of Architects and Surveyors, Short Form of Building Contract, Local Authorities Edition.

Each of these forms is used for a different type and class of work and therefore each has its own pecularities. One of the differences concerns the documents necessary to the formation of the contract.

All construction work requires that certain documents, *i.e.* drawings etc., be issued, in order that the ideas and instructions of the designer may be communicated to the contractor. This documentation will, in the first instance, include drawings, specification and bills of quantities and later expand to include correspondence, the form of tender, architect's or engineer's instructions, day work sheets, etc., as well. All these documents are necessary to the smooth running and administration of the contract but not all are necessary for the formation of the contract.

Each standard form of contract divides the documents into two categories, the contract documents and the others. The

* Although commonly referred to as the RIBA Form of Contract, these forms are actually published on the authority of the Joint Contracts Tribunal, a composite body on which eleven organisations, including the RIBA, are represented.

contract documents are the premier documents, the bedrock of the contract, and the others, whilst very necessary, are only the means of administration. The specification is a document that is very necessary to the smooth and efficient working of a construction contract, but it is not always to be found amongst those listed as contract documents, as the following examination of each form of contract will show.

RIBA FORMS: PRIVATE EDITION AND LOCAL AUTHORITIES EDITION (WITH QUANTITIES)

The differences between the private edition and the local authorities edition of this contract do not affect the position of the specification in the contract. All references to and quotations from the contract made in the text will relate to the private edition.

These forms of contract contain two sections, firstly the articles of agreement and secondly the conditions of contract.

The articles of agreement give the parties to the contract and the proposed works, name the architect and continue 'And whereas the contractor has supplied the employer with a fully priced copy of the said bills of quantities (which copy is hereinafter referred to as "the Contract Bills") and whereas the said Drawings numbered . . . to . . . inclusive (hereinafter referred to as "the Contract Drawings") and the Contract Bills have been signed by or on behalf of the parties hereto . . .'

This does not mention the specification as a contract document but says that the contract documents shall be the bills of quantities, the drawings (whose numbers are quoted) and the executed agreement and conditions. This does not mean that the specification is not needed or has no authority in the contract but merely that it is not amongst the premier documents. The specification has its place in the contract as a document necessary for the execution of the works and has the same authority as the other documents mentioned in clause 2, 'Architect's Instructions' or clause 11, 'Variations'.

This view of the contract is further emphasised in clause 3, 'Contract Documents', which says: 'The Contract Drawings and the Contract Bills shall remain in the custody of the Architect or of the Quantity Surveyor . . .' and also 'Immediately after the execution of this Contract the Architect with-

out charge to the Contractor shall furnish him (. . .) with: (a) one copy certified on behalf of the Employer of the Articles of Agreement and of these Conditions; (b) two copies of the Contract Drawings; (c) . . . and one copy of the Contract Bills.'

No mention is made of the specification as a contract document, but the necessity for a specification is recognised for the conditions continue: 'So soon as is possible after the execution of this Contract the Architect without charge to the Contractor shall furnish him (. . .) with two copies of the specification, descriptive schedules or other like document necessary for use in carrying out the works.'

In his book on this form of contract, Sir Derek Walker-Smith says of this sub-clause: 'The Architect is required as soon as possible after the execution of the contract to supply the Contractor with two copies of a specification or other like document, and the doubt as to whether he was obliged to do so which existed in the 1939 Form is removed. The Architect is no longer required to write a formal specification, but he must supply the Contractor with some documents of the kind described, *e.g.* annotated bills of quantities such as are necessary for use in carrying out the works. Nothing in such documents alone can bind the Contractor to carry out work or supply materials beyond the obligations contained in the contract documents.'

This opinion of Sir Derek's is questionable on the grounds that annotated bills of quantities do not provide the contractor with a properly drafted specification. The specification will amplify the drawings and will enlarge upon the items in the bills of quantities. To write a description in the bills of quantities to contain a full and complete specification clause would make a long and unwieldy document which would be inefficient either as a specification or as a bill of quantities.

Clause 3 says 'Provided that nothing contained in the said specification, descriptive schedules or other documents shall impose any obligation beyond those imposed by the Contract Documents, namely by the Contract Drawings, the Contract Bills, the Articles of Agreement and these Conditions.' This emphasises that the specification is a document necessary to the contract but it does not take precedence over other contract documents.

If there is a discrepancy between the various contract documents the matter would need to be settled and a natural order of preference would be articles of agreement and conditions of contract, drawings and lastly, bills of quantities. The reasons for preferring this order is that the articles and conditions state the matter of the contract, the drawings are produced to enlarge further upon the works and the bills of quantities are produced from the drawings.

RIBA FORM: PRIVATE EDITION AND LOCAL AUTHORITIES EDITION (WITHOUT QUANTITIES)

The differences between the private edition and the local authorities edition of this contract do not affect the position of the specification in the contract. All references to and quotations from the contract made in the text relate to the private edition.

These forms of contract contain two sections, firstly the articles of agreement and secondly the conditions of contract.

The articles of agreement give the parties to the contract and the proposed works and continue to say that the employer . . . 'has caused Drawings and a Specification marked "A" showing and describing the work to be done . . .' This definitely involves the specification as a contract document but states that this shall be a clearly identifiable copy of the specification marked 'A'. Many disagreements and threatened litigation could have been, and can be, avoided by making sure that just one copy of the specification is marked 'A' and put away with the conditions of contract.

The articles of agreement continue: 'And whereas the said Drawings numbered . . . to . . . inclusive (hereinafter referred to as "the Contract Drawings") and the Specification (hereinafter referred to as "the Specification") have been signed by or on behalf of the parties hereto . . .' This makes particular reference to the specification not as a contract specification but as the specification which has to be signed by the parties.

In this form of contract Clause 3, 'Contract Documents' says: 'The Contract Drawings, the Specification and the schedule of Rates hereinafter referred to shall remain in the custody of the Architect . . .' and later, 'Immediately after the execution of this Contract the Architect without charge to the Contractor shall furnish him (. . .) with (i) one copy certified on behalf of

the Employer of the Articles of Agreement and of these Conditions; (ii) two copies of the Contract Drawings; and (iii) two copies of the Specification.' This clause particularly includes 'the specification' as part of the contract documents.

If a discrepancy occurred between the various contract documents, the preferable order would be articles of agreement and conditions of contract, drawings and lastly, specification. The reasons for preferring this order are that the articles and conditions state the matter of the contract, the drawings are produced to enlarge further upon the work and the specification is to amplify the drawings.

RIBA FIXED FEE FORM OF PRIME COST CONTRACT

The Joint Contracts Tribunal has written introductory notes explaining the scope of the contract and a section from this is reproduced here:

'Apart from the forms prepared during the war for the limited purpose of the reconstruction of war-damaged property there has been no standard form of contract in the industry appropriate for use where the Works constitute extensive repair or renovation to, or even the reconstruction of, existing buildings in circumstances where it is not possible to know in advance the full extent of the work likely to be involved so that bills of quantities or a full specification may be prepared. The Joint Contracts Tribunal has now met this need by the publication of a Fixed Fee Form of Prime Cost Contract.

In producing the Form the Tribunal has taken care to preserve wherever possible the provisions of the Standard Forms of Building Contract, and no changes have been made in the principles underlying the clauses of these Forms. Nevertheless, many of those clauses are inappropriate for use where the contract is let on a prime cost basis, and in such cases the appropriate modifications have been made.'

Unlike the other RIBA forms, this contract is in one part only, an agreement. The recital on the first page mentions in three separate places 'Drawings and a Specification' and each time a reference is made to a footnote which says that when there are no drawings the words 'Drawings and . . .' must be deleted. This would indicate that it is considered that a specification is relevant to the contract whereas drawings are of secondary

importance. This is further supported on page 2 of the recital, which defines the term 'the Specification' as used in the agreement as being 'Drawings (if any) and the Specification referred to in the recitals to this agreement'. The term 'the works is defined as meaning 'the items of work described in the Specification. . . . A footnote applying to this clause says that 'the Architect cannot alter the nature or scope of the works' and it further refers to Clause 3, which expressly prohibits the architect from issuing an instruction which requires 'an alteration in the nature of the Works.'

The specification therefore becomes, in this form of contract, the most important document after the agreement as it defines the nature and extent of the work as well as the standard of work, and it should be compiled and written with this in mind.

GENERAL CONDITIONS OF CONTRACT, ISSUED BY THE INSTITUTION OF CIVIL ENGINEERS

These conditions are issued in three forms, each of which follows the same pattern and varies only slightly from the others. These forms are:

1. **General Conditions of Contract**
   This form is for use by United Kingdom contractors for works within the United Kingdom. All references to, and quotations from, the contract made in the text relate to this edition.

2. **Conditions of Contract for Overseas Work**
   This form is for use by United Kingdom contractors working overseas.

3. **Conditions of Contract (International) for Works mainly of Civil Engineering Construction**
   This form is for use in international tendering.

The form of contract is in three parts, firstly the general conditions, secondly the form of agreement, and lastly the form of tender.

The form of agreement, after stating the parties to the contract and the proposed works, says: 'The following documents shall be deemed to form and be read and construed as part of

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this Agreement, *viz.*: (a) the said Tender; (b) the Drawings; (c) the General Conditions of Contract; (d) the Specification; (e) the Bills of Quantities; (f) the Schedule of Rates and Prices (if any).

This rather extensive list of contract documents particularly includes the specification. The list is repeated in Clause 1 (Definitions) which says that 'Contract' means the general conditions, specification, drawings, priced bills of quantities, schedule of rates and prices (if any), tender and contract agreement.

Later, when the contract defines drawings it, says that 'Drawings' means the drawings referred to in the specification.

The term 'Specification' is not defined in the contract.

Clause 6 lays down the principle of all contract documents being mutually explanatory but gives no indication as to what is considered a reasonable order of precedence in the event of dispute. The clause says 'The several documents forming the Contract are to be taken as mutually explanatory of one another and in the case of ambiguities or discrepancies the same shall be explained and adjusted by the Engineer who shall thereupon issue to the Contractor instructions directing in what manner the work is to be carried out'.

The engineer is here given power to explain ambiguities and discrepancies and to give his instructions as to what he wants. This is good practical sense, as only the engineer can know what is required on the job, but it does not help if the contractor has suffered financial loss by reason of the mistake. Who is to pay for the mistake, if a mistake has in fact occurred? The answer, as always, is to refer to the contract documents and make a decision on this basis.

The specification has a greater part to play in civil engineering work and the bill of quantities (or schedule of rates) is of minor importance; therefore the order of preference is likely to be, form of agreement, conditions of contract, drawings, specification, bills of quantities, form of tender.

GENERAL CONDITIONS OF GOVERNMENT CONTRACTS FOR BUILDING AND CIVIL ENGINEERING WORKS: (CCG/WKS 1)

As its title suggests, this form of contract is mainly used by Government departments although it is available, through

HMSO, for use by others. (The initials CCC stand for 'Contracts Co-ordination Committee'.)

The contract is in the form of general conditions only and is not accompanied by a form of agreement to be executed. Nevertheless a formal agreement needs to be executed, or letters of intent need to be exchanged, and these would have to include the conditions of contract.

In defining the contract, Clause 1 of the conditions says that 'the Contract' means the documents forming the tender and the acceptance thereof, together with the documents referred to therein including the conditions, the specification, the bills of quantities and the drawings, and all these documents taken together shall be deemed to form one contract and shall be complementary to one another.

This clause makes a definite mention of the specification as a contract document and the reason for this becomes evident as the clause continues. 'When there are no Bills of Quantities all reference to Bills of Quantities in the Contract shall be treated as cancelled except, where the context so admits, any Schedule of Rates supplied by the contractor under Conditions 5A hereof shall be substituted therefor.'

From this it can be seen that these conditions may be used whether there is a bill of quantities, a schedule of rates or merely a lump sum quotation. In some respects this is similar to the RIBA contracts, (except that they issue two distinct contract forms) in that a schedule of rates may be substituted for a bill of quantities.

Clause 2 defines 'the Works' as 'the Works described in the Specification and/or Bills of Quantities and/or shown on the drawings', thereby giving the specification the power to define the extent of the works.

Clause 4, in settling the matter of ambiguity or discrepancy within the documents, says 'In case of discrepancy between these conditions and the Specification and/or the Bills of Quantities and/or the Drawings, the provision of these Conditions shall prevail'. This clause therefore definitely establishes the conditions as the premier document but the discrepancy is rarely between the conditions and the other documents, but usually between any two of the other documents.

If a dispute should arise, the solution is to look at the work

and, if it is mainly of a building nature and quantities have been used to treat the order of precedence of the contract documents as if it were an RIBA 'with quantities' contract and use similar reasoning for building work when there are no bills of quantities. If the work is mainly of a civil engineering nature, use the order of precedence as if it were an Institution of Civil Engineers contract.

FACULTY OF ARCHITECTS AND SURVEYORS SHORT FORM OF CONTRACT: PRIVATE EDITION AND LOCAL AUTHORITIES EDITION

These two abbreviated forms of contract are both very useful additions to the contractual armoury of the architect and surveyor. They are both for use without bills of quantities and appear to be based on their RIBA counterparts. The comments relating to the RIBA forms will therefore apply to these.

The usefulness of these contracts lies in the fact that whilst they are no less binding than the equivalent RIBA form, they appear in a shorter version and can be used for work which is of short duration and is probably being carried out by a jobbing builder. The smaller contractor may not be prepared to put his signature to the formal-looking 19-page RIBA document, whereas he would willingly sign the single page of this form.

The specification is an important document in the building contract whether it is classified as a contract document or not, as it is the one which sets the standard of the work as no other can. On this basis it may be argued that the specification is of such importance that it must always be a contract document. This is a reasonable view but it is felt that the draftsman of the RIBA forms have used the principle of keeping the number of contract documents to the minimum. The more contract documents there are the greater is the chance of discrepancies between them.

CHAPTER 5

THE USE OF A SPECIFICATION

The previous chapters have dealt with the compilation of a specification, but it must be remembered that it is written to be read. As well as its function among the documents of the contract, it will be used by the contractor and his sub-contractors when calculating their prices and as a guide to the quality of the workmanship during the construction.

The uses the contractor makes of the specification can be given under three headings: preparing the estimate for submission as a tender; ordering materials for use in the works; and organisation and execution of the works.

PREPARING THE ESTIMATE

At a very early stage in the design, the architect writes to selected contractors to ask them if they are willing to submit a tender at some future date, and he usually gives them an outline of the type of construction and an approximate cost of the work, but the first time the contractor sees any details of the work is when he receives a letter and the documents formally asking him to submit a price for completing the work. The tender documents are generally a bill of quantities, a specification, and a selection from the drawings, and it is from these that the contractor must produce his tender.

When the request is received, it is passed to the board of directors to decide if they want to submit a price. The board, represented by the managing director, must decide:

(1) whether this is a contract within the scope and experience of the organisation. An examination of the bills of quantities and drawings will show the size, scope and quality of the project and on this evidence it may be decided that the contract is too big or costly for the financial resources of the company, or

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is outside the experience of its staff, or is below the quality with which they wish to be associated. If any of these considerations apply, the documents must be returned and the offer declined.

(2) whether the timing of the contract suits the programme of other contracts within the organisation. The bills of quantities generally contain a clause giving the proposed programme for the work and a decision must be reached on the basis of this. If no dates are given, then an analysis of the work from the bills of quantities, specification and drawings must be made to ascertain how long the work will take. If these times are examined in conjunction with the programme of work in hand, it will show when the contract can be handled.

(3) whether there is a reasonable chance of obtaining the contract by submitting a competitive tender and, once having got it, of making a profit from it. This is the most difficult decision to be made, but it must be faced and dealt with as a managerial problem. Advice can, and should, be sought by the managing director from the technical staff, but the responsibility is his alone. Some of the background work which will help in reaching a conclusion will have been done in the investigations into the matters of scope and timing, but the whole contract must be re-examined with the questions of obtaining the job and the profit particularly in mind. The directors must be sure that they can successfully complete the work to the satisfaction of the architect and the employer, in a manner that will enhance the reputation of the company and last, but not least, show a proper return on the capital outlay.

When the managing director has satisfied himself on all these matters, the documents can be sent to the estimator for him to prepare his estimate of cost.

Before the estimator can start pricing the bills of quantities, he must become familiar with the design and the standard of workmanship it requires. The type and detail of design is shown on the drawings and the standard of work is described in the specification, and the estimator must study, compare and absorb all the detail until he understands what the architect is trying to achieve in the design and the exact standards he requires in the construction.

Quotations can now be obtained from sundry sub-contractors and suppliers and the information upon which they will base

A. Test cubes	Concrete cubes for works tests are to be cast at the frequency shown in the table, or when directed by the architect. Not less than three cubes are to be cast at any one time and the cubes are to be made, cured,

their prices will be extracted from the tender documents. The estimator therefore has to edit the specification, extract the necessary quantities from the bills of quantities and re-cast them in a form satisfactory for use by sub-contractors and suppliers.

The basic prices of the more usual materials, such as sand, cement, aggregates and common bricks, are known and the pricing of the bills of quantities for these items can start immediately, but it will be necessary to wait until the quotations for the more unusual materials are returned before pricing the items which include these. It is possible, however, to enquire and research into the methods of using these materials so that the estimator is familiar with the processes necessary to obtain the standards required, and to discuss with the planning department how the work is to be carried out.

As the quotations are received, they are checked to see that they are for the material and standard of workmanship that the specification requires and, if they are correct, the information can be incorporated into the prices in the bills of quantities. A material or process may occasionally appear in the bills of quantities and not be mentioned in the specification. If this should happen, the matter must be referred to the architect, for he is the sole arbiter of quality and he must supply the appropriate specification. It should be noted, however, that in a contract where bills of quantities form part, the bills take precedence over the specification. If, therefore, the work is adequately and completely described in the bills of quantities, there may be no need of a specification but, as discussed in Chapter 4, this will rarely happen.

The specification is essential to the estimator's work as it sets the standard of the job he is to price; without a specification, the standard will be in doubt and the price a matter of guesswork instead of intelligent analysis.

ORDERING THE MATERIALS

Most of the larger contracting organisations have a purchasing department which has the task of ordering the materials for the work at competitive prices, and of ensuring that they comply with the specification, and are within the terms of the quotations previously obtained by the estimator. The purchasing officer is generally also responsible for seeing that the materials arrive at

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the site at the right time and in good order. To assist him in this, the planning department lists all the materials required by both the permanent and temporary construction on a schedule showing the approximate quantities and the dates on which they are required on site. The purchasing officer must then make due allowance for the time taken for delivery and fabrication, if necessary, as stated on the quotation and ensure that the necessary orders are sent out and contracts placed in good time. Each order will be checked against the bills of quantities and specification so that it is for the correct quantity, the correct quality of material, and if necessary, the correct grade of workmanship. This must be done for all sub-contractors and suppliers, both the nominated and the direct, because even though the supplier is nominated by the architect it does not relieve the contractor of his responsibility to provide materials and workmanship in accordance with the drawings, bills of quantities and specification. The purchasing officer must also arrange with an independent testing laboratory for the tests to be carried out in the manner prescribed by the specification and must remind the site foreman when these are to be taken. He must make arrangements with the site or a supplier for any samples of materials required by the architect to be taken and submitted for approval.

The purchasing department is responsible for ordering, purchasing and supplying the correct quality of material to the site at the right time and in sufficient quantities to keep the work progressing. The timing and the quantities required can be obtained from the bills of quantities but the quality can only be found in the specification.

ORGANISING AND EXECUTING THE WORKS

The estimating, planning and purchasing departments are all concerned with the materials and workmanship in the abstract, but the construction department handles the actual material and translates the architect's design, by the use of the materials, into a fact. The men on site, therefore, must be familiar with the architect's requirements as expressed on the drawings and written in the specification. When the materials are delivered, the men must know that they are of the type and quality required for the work and, when they are in use, the men must

be aware of the requirements of the specification so that they may use the materials to obtain the required result.

As each material arrives on site, the site foreman must inspect the consignment to see that it complies with the requirements of the specification and if it is not up to standard it should be rejected and sent off the site. If the site foreman does not reject the defective material, the architect or his representative will do so when he next visits the site, and by that time it may have been built into the permanent construction. The consequent damage to the surrounding work will far outweigh any inconvenience caused by rejecting defective or unsuitable material in the first place.

The specification will require certain materials to be tested by an independent testing laboratory and the site foreman is generally required to take the necessary samples. The purchasing department makes the necessary arrangements for the test to be carried out, and should remind the site foreman of the need to submit samples for testing, but the man on site is still responsible for the sampling. It is essential, in taking samples for testing, that the requirements of the specification are carried out. If, for example, the clause requiring tests to be carried out on bricks says that the samples are to be taken in accordance with the principles of sampling laid down in BS 3921, then the site foreman must be sure that he understands the requirements of the BS on sampling. If he takes the sample in the way he thinks fit and not in accordance with that BS, then the architect can reject the test results on the grounds that the sample was not a fair one as it was not taken in accordance with the principles set out in the specification. This will mean a fresh sample and another test with a consequent loss of time and extra expense.

The specification does not deal only with the quality of the materials, but is also concerned with the quality of the workmanship. Therefore, when the site foreman has satisfied himself that the materials are of the required standard, he must ensure that the work also will be of the required standard. Everyone on the job must know the standard of workmanship he is expected to attain: this does not mean that every tradesman and labourer must have his own copy of the specification, but it does mean that every trades foreman, charge-hand and ganger must

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have access to the copy kept in the site foreman's office. When a trade foreman or charge-hand is 'set on' a new part of the work, it is usual for him to discuss its problems with the site foreman in the office and it is then that the trade foreman should be told the standard of work he and his colleagues are expected to attain. The site foreman must make it clear that this is the quality of work that he, as well as the architect, wants and that should the work fall below this standard he will have no hesitation in having it pulled down or removed. He must be firm and implement this policy if he wants to maintain a good standard of work. The architect has the right to have sub-standard work removed (just as he has the right to have sub-standard materials removed) and generally, by the time he sees it on his next visit to site, it will cause more consequential damage than if it had been removed on the orders of the site foreman in the first place. The architect will use the specification as a basis for checking the standard of the work and will make his decisions as to what work is sub-standard on the substance of what is written in the specification. The site foreman must, therefore, not treat the specification as a document to which he refers only when the information he requires is not to be found elsewhere, but as the primary document of reference on the standards of materials and workmanship on the contract.

CHAPTER 6

TYPICAL SPECIFICATIONS

The first typical specification given in this chapter is for normal reinforced concrete work and is written in the form to be expected for a contract where bills of quantities are to be used. This specification covers reinforced concrete work only. If the job contained mass concrete, precast concrete or prestressed concrete, either this specification could be altered and lengthened by the addition of clauses dealing with these works or a separate section could be written covering these extra items of work.

From its form, it can be seen that the items in the first section are general to the whole of the specification and cannot be easily classified under either of the other headings of 'Materials' or 'Workmanship'. The 'protection' clause has been made the last clause of this general section, even though it is popular practice to make it the last clause of the workmanship section. The materials section takes each material in turn in the order in which it would appear in the Standard Method of Measurement and specifies it in detail. With a composite material such as concrete, each component material is specified separately.

The workmanship section follows the order of the SMM with each operation specified in detail. The processing of each material is followed through in its logical order, and so the clauses on concrete follow through as quality, batching, mixing, transporting, placing and lastly, finishing.

The principle of specifying the result required rather than the method of achieving the result is clearly illustrated in the clauses specifying 'concrete quality' and 'mix ratios'. Clause 54/A says that the concrete shall attain a certain crushing strength in a certain period and provided the concrete passes this test the architect is not concerned how this is achieved. For concrete quality 'A' to attain a crushing strength of 4,500 lb/sq. inch

after 28 days will probably require a mix ratio of 1:1½:3, but if the contractor can obtain the required result by using a ratio of 1:2:4 then he may use it. The architect only requires the contractor, in Clause 55/B, to state the mix ratios he proposes to use so that a quality of concrete to be mixed can be readily set on the weigh-batcher and checked by the architect's representative on site.

The second typical specification given is for drainage work and is written in the form that would be expected for a small contract which is to be tendered for on the basis of a specification and drawings. The sections of Preliminaries and Appendices have been omitted in this case for the sake of clarity. It can be seen that this specification is similar in layout and content to that where a bill of quantities is to be used with the addition of an extra section for Description of Works.

NORMAL REINFORCED CONCRETE

A. British Standards

The provisions of the latest revised editions of the following British Standards and British Standard Codes of Practice shall be held to be incorporated in this specification unless it is specifically stated otherwise:

BS 12 Portland Cement (Ordinary and Rapid Hardening)
BS 785 Hot Rolled Bars and Hard Drawn wire for the Reinforcement of Concrete.
BS 812 Sampling and Testing of Mineral Aggregates, Sands and Fillers.
BS 882 & 1201 Aggregates from Natural Sources for Concrete
BS1144 Cold Worked Steel Bars for the Reinforcement of Concrete.
BS1221 Steel Fabric for the Reinforcement of Concrete
BS1478 Bending Dimensions and Scheduling of Bars for the Reinforcement of Concrete.
BS1881 Methods of Testing Concrete.
BSCP114 The Structural use of Reinforced Concrete in Buildings.
BSCP144:100 Suspended Concrete.
& 144:105 Floors and Roofs.

B. Testing apparatus

The contractor shall provide for the use of the architect on site such equipment as is necessary for the testing of concrete in accordance with the British Standards described herein.

A. Test cubes

Concrete cubes for works tests are to be cast at the frequency shown in the table, or when directed by the architect. Not less than three cubes are to be cast at any one time and the cubes are to be made, cured, stored, transported and tested in accordance with BS 1881. The tests are to be carried out at a testing station selected by the architect and the report on each test shall be sent direct from the testing station to the architect.

Table 1: Tests required for concrete work

Type of work	Total cubic yards of concrete placed	Number of tests to be taken, each test comprising three cubes
General concrete work other than roads, etc.	0–100	1 test for each 50 cu. yd.
	100–1000	1 test for each 125 cu. yd.
	1000–2000	1 test for each 175 cu. yd.
	2000 upwards	1 test for each 250 cu. yd.
Roads, etc.	—	2 tests for each 1000 sq. yd. of road

B. Load testing

Load testing on the completed structure or parts of the structure, are to be made if there is reasonable doubt as to the strength of the structure. Load tests will not be made until the expiry of 56 days after placing the concrete in question. The test will be carried out in accordance with the BSCP. Tests may be called for if:

a. The works cubes do not attain the specified strength.
b. If the architect has reason to believe that the structure has not been constructed in accordance with the drawings.

C. Protection

Cover up and protect the whole of the work from damage by extreme weather conditions, mechanical damage or damage by any other means.

Materials

D. Suppliers

The contractor shall submit to the architect a list of the suppliers he proposes to employ for each material required for the whole contract. Samples of each material are to be tested in accordance with the relevant British Standard and sent direct from the testing station to the architect. Access shall be provided to all sources of supply for the architect to make

such tests as he considers necessary. No change shall be made in the sources of supply without the written consent of the architect. Any material delivered to the site or casting yard which is not equal to the approved sample shall be removed and replaced.

A. Ready-mixed concrete — If the contractor decides to use ready-mixed concrete for all or part of the work, he should first inform the architect of his decision and obtain from the supplier samples of all the materials to be used. These samples must be tested in accordance with the relevant clauses of this specification and the results sent direct from the testing authority to the architect. The contractor must also obtain from this supplier permission for the architect to visit the batching plant and to take samples of all materials as he desires.

B. Cement quality — The cement shall be of British manufacture and comply with BS 12 in all respects. High alumina or rapid-hardening cements are not to be used without the written consent of the architect.

C. Cement test certificate — The contractor shall supply to the architect, a certificate in respect of a sample of cement taken at the commencement of the work and for every subsequent 100 tons proposed to be delivered to the site. The certificate must indicate that the sample has been tested and analysed by a competent authority and that it complies in all respects with BS 12. The test for fineness shall be for specific surface and for strength shall be for compressive strength in accordance with this specification.

D. Delivery and storage of cement — All cement shall be delivered in a sound condition and in properly secured bags, in bulk into specially constructed silos or by other approved methods. Any defective bags are to be removed from site immediately. Sufficient quantities must be stored to ensure continuous supplies for the works and all cement must be used in the order in which it is delivered. All bagged cement must be stored in a watertight shed on a floor raised at least 12in. from the ground.

E. Separation and storage of aggregates — All aggregates delivered to the site shall be kept separate from each other and free from contact with all deleterious matter. Suitable partitions shall be constructed between each different type of aggregate and all aggregates shall be stockpiled to ensure consistent grading.

F. Fine aggregates — Fine aggregates for concrete shall comply with BS 882, Table 2, Zone 2. Sands conforming with BS 882

Table 2, Zones 3 and 4 or any other sand may only be used with the written approval of the architect.

A. Coarse aggregates — Coarse aggregates for concrete shall comply with BS 882, Table 1, $\frac{3}{4}$in. to $\frac{3}{16}$in. Coarse aggregates other than this may only be used with written permission of the architect.

B. Grading envelopes — The fine and coarse aggregates are to be combined so that the mixed aggregate will fall between the limits of the gradings set out below:

Table 2: Grading of aggregate

BS Sieve No. or Aperture Size	Percentage passing
$\frac{3}{4}$-inch	100
$\frac{3}{8}$-inch	45–65
$\frac{3}{16}$-inch	30–42
No. 7	23–35
No. 14	16–28
No. 25	9–21
No. 52	2–5
No. 100	0

The grading of the fine and coarse aggregates is to be tested at least once for every 100 tons supplied to ensure that the grading is uniform and the same as that of samples used in the preliminary tests.

C. Water — Mixing water used for concrete must be from a reliable source, free from organic matter and any constituent which, in the opinion of the architect, would adversely affect the concrete.

D. Water/cement ratio — The ratio–$\frac{\text{Total weight of water in mix.}}{\text{Total weight of cement in mix}}$ shall be known as the water/cement ratio.

E. Additives — Proprietary additives to the concrete may only be used with the written permission of the architect.

F. Reinforcement — Reinforcement shall comply with the requirements of either BS 785 parts 1 and 2, or BS 1144 and be free from grease, dirt, loose rust, mill scale or any other coating which will adversely affect its bond with concrete.

G. Mesh reinforcement — Mesh reinforcement shall comply with BS 1221 parts A and B and unless otherwise agreed by the architect in writing shall be supplied in flat sheets.

H. Formwork — Any material used as formwork to concrete is to be of adequate strength as defined in Clause 57/D and shall in no way cause damage to, or discoloration of, the concrete.

THE SPECIFICATION IN THE CONSTRUCTION INDUSTRY

Workmanship

A. Concrete quality

Concrete shall be mixed to give the minimum resistance to crushing (cube strength) as defined for the various qualities below.

Table 3: Qualities of concrete

Quality	6-inch cube compressive strength in lb/sq. in. At 7 days after mixing	At 28 days after mixing	Maximum permissible water/cement ratio	Aggregate grading type
A	3000	4500	0.42	1
B	2500	3750	0.50	1
C	2000	3000	0.58	1
D	1500	2250	0.65	1
E	800	1100	0.75	1

Note: The contractor may use aggregate of $\frac{3}{8}$in. maximum with the approval of the architect. If the architect gives permission for the $\frac{3}{8}$in. maximum aggregate to be used the contractor shall prove by tests that the concrete produced is at least equal to the equivalent concrete quality for $\frac{3}{4}$in. maximum aggregate.

Trial mixes are to be made in accordance with BSCP 114, Clause 209b.

B. Replacement of defective concrete

Where the minimum strength shown in the table is not obtained, the contractor will be required to remove and replace the defective concrete and make good all other work affected entirely at his own expense, including loss of progress and claims from sub-contractors and the cost of the defective cube tests.

C. Workability

Workability is to be such that the concrete can be adequately compacted for the purpose for which it is designed and provide the surface finish which is specified. The contractor is to provide the architect with compacting factors for the various items of the work. The compacting factors are to be based on the use of the small standard compacting factor apparatus. Testing equipment must be available on site to enable tests to be carried out. Approval of compacting factors will not affect decisions taken concerning concrete compaction in Clause 55/E.

A. Batching

The aggregate shall be measured by weight, due allowance being made for water content, in a proper weigh-batching machine unless otherwise authorised in writing by the architect. The weigh-batching machine shall be accurate within ±1 per cent and is to be periodically checked for this accuracy. Cement may be measured by weight or by the bag. Where it is proposed to use bags, the amount of aggregate used in each batch shall be such as will allow an integral number of bags to be used per batch. No split or damaged bags of cement are to be used.

B. Mix ratios

The contractor shall at the commencement of the contract, submit to the architect details of the ratios of coarse to fine aggregate and cement and combined aggregates to cement that it is proposed to use in each mix. Any variations to these ratios may only be made with the architect's permission.

C. Mixing

The concrete is to be mixed dry in an approved mechanical batch mixer conforming to the requirements of BS 1305 for at least two minutes to produce a uniform distribution of the materials throughout the mix. The mixer is to be provided with a device for measuring and discharging with consistent accuracy the quantity of water to be added to each batch to provide the correct water/cement ratio. After adding the water, the mixer shall continue mixing for at least 1½ minutes more before discharging to give a consistent mix and uniform distribution of water. The mixer must be thoroughly cleaned out before a different quality of concrete is put through it.

D. Transporting and placing

After mixing, the concrete is to be transported and placed with great care to ensure that it does not segregate. It is to be deposited as near as is practicable to its final poistion. Re-handling or flowing is to be avoided if possible. All concrete must be placed, tamped, vibrated and finished within 30 minutes of being mixed. Any concrete not in position within 30 minutes is to be removed. A concrete pump and any other method of transporting and placing concrete may be used provided there is no deviation from the above requirements. A record shall be kept of the time and date of placing of concrete in each position of the works.

E. Compaction

The concrete shall be fully compacted to ensure that no air voids are present. The concrete is to be worked well against the forms and around all reinforcement and any special fittings. Tamping and ramming shall be completed within 30 minutes of mixing and

thereafter the concrete shall not be disturbed in any way. Any finished concrete showing lack of compaction shall be cut out and re-cast.

A. Vibrators

Approved immersion type vibrators only may be used. Vibrators shall not be fastened or applied to the formwork unless permission is first obtained from the architect. Vibrators shall not be allowed to come into contact with the reinforcement or to disturb previously deposited concrete. If the contractor elects to vibrate the whole of the concrete, then cubes cast must be correspondingly vibrated in accordance with BS 1881. The plunger in the vibrator is to be immersed vertically wherever possible and at regular intervals at approximately 18in. centres. In no circumstances must the vibrator come into contact with the concrete after 10 minutes of pouring. Each immersion must not be for a longer period than 30 seconds and the vibrator must be withdrawn slowly to ensure that no air pockets are left.

B. Construction joints

Wherever possible, once concreting has commenced it must be carried on to its natural completion or at least to properly constructed day's work joints. If, however, temporary cessation of work is unavoidable or where day's joints are to be formed, the joint must be made in the middle third of the span of the beam or slab at right-angles to the direction of the span. Where it is necessary to terminate a beam or slab, suitable vertical stop boards must be provided to the full thickness of the finished work to form a proper construction joint. Provision must be made to allow the reinforcing steel to run continuously through the joint without being temporarily bent or otherwise displaced. Any concrete flowing past the joint is to be hacked off as soon as it has set. The position of construction joints in foundations, walls, columns and similar types of structures shall be agreed with the architect, and shall be either dovetail or straight-joint type whichever is directed. These joints shall be finished by lightly spraying the surface with clean water to remove all laitence and expose the aggregate. This operation is to be carried out between one and three hours after mixing.

Immediately before placing the next lift or bay, the surface of the joint must be thouroughly wetted and brushed clean. One half inch of cement and sand grout of similar proportions to the concrete mix excluding the coarse aggregate, must then be applied to the joint. The next lift or bay must be placed

within twenty minutes of applying the grout. In no circumstances shall a thin layer of concrete be first placed in the bottom of beams or slabs. Where beams and slabs together form an integral part of the structure, they shall be cast in one operation.

A. Joining to to matured concrete

Where new concrete is to be placed against well matured concrete, the face of the mature concrete shall be thoroughly hacked and cleaned, wetted and coated with ½in. of cement and sand (1:1) grout.

B. Curing concrete

All concrete is to be kept continuously and thoroughly moist for a period of at least seven days. If rapid hardening cement is used, this may be reduced to three days. Concrete not protected by formwork is to be covered with damp hessian, a layer of waterproof material or by a patent curing membrane immediately after the concrete has been placed. If the contractor intends to use a patent curing membrane, the type to be used and the method of use shall be agreed with the architect.

C. Concreting in cold weather

No concreting shall be carried out when the temperature is below 2°C with a rising thermometer or 4°C on a falling thermometer. No concrete is to be made with frozen aggregates or water unless proper heating methods are used to de-freeze the aggregates and water. If frost occurs during the setting of the concrete, adequate protection shall be given to such concrete as is unset and the formwork shall not be removed without the permission of the architect. Permission given by the architect does not relieve the contractor of his responsibility for the work. Any work affected by frost shall be cut out and re-constructed.

D. Formwork, general

The formwork must be constructed so that the true dimensions shown on the drawing are maintained and shall withstand all loading without movement of any kind except a permissible deflection of 1/10 inch or 1/600 of the unsupported span whichever the lesser, under the weight of the wet concrete and all temporary loadings, *i.e.* workmen, plant, etc.

Before any concrete is placed, all formwork must be checked for position and alignment.

E. Formwork, finishes

The contractor's attention is drawn to the fact that the formwork must be executed in strict conformity to the following requirements. Where described as sawn formwork this shall be so constructed as to provide a true and even face to the concrete and to prevent the loss of water and fine material during the placing and setting of the concrete.

Where described as wrought formwork, this shall, in addition to the foregoing, be so constructed as to provide a good fair face using wrought boards. The contractor may adopt the use of other materials such as steel and plywood, but written permission must be obtained from the architect before using these. Wrought boards shall be so arranged and jointed as to produce a uniform appearance on the concrete face and the heading joints on the boards shall be set at least 20 inches apart. Old and new boards must not be used together in the same panel or member and subsequent re-use of old boards will be at the discretion of the architect.

Rubbing down after striking the formwork shall only be carried out with the architect's written permission, and permission will only be given for the removal of certain fins or excrescences. No slurry or other filling materials shall be applied to the concrete after striking the formwork.

A. Formwork, cleaning and oiling

Before placing the concrete all formwork and moulds must be cleaned of all concrete or mortar adhering to the surface and all rubbish, sawdust, chippings, nails and other deleterious materials must be removed. Formwork which is to come in contact with concrete is to be wetted and treated with a mould oil. Care must be taken that the oil or composition does not touch the reinforcement or accumulate at the bottom of the forms.

B. Striking of formwork and shuttering

After concreting, formwork may be removed as given in the table. Days during which the temperature falls below freezing point should be added to given periods and the contractor shall provide and maintain a reliable maximum/minimum thermometer calibrated in degrees centigrade, and keep a daily record of temperatures on site.

Table 4: Hardening periods for ordinary portland cement concrete

Formwork	Cold weather (just above freezing)	Normal weather (about 15°C)
Beam sides, walls and columns	6 days	2 days
Slab soffits (props replaced)	10 days	3 days
Beam soffits (props replaced)	14 days	7 days
Removal of props to slabs	21 days	7 days
Removal of props to beams	28 days	16 days

When rapid hardening cement is used, formwork may be removed before the time given in the above table, but the time must be agreed with the architect. The guide to striking times, or the agreement to use rapid hardening cement, does not relieve the contractor of his responsibility to safeguard the structure in every aspect.

In no circumstances shall structure be subjected to greater loads than their own weight until the concrete is at least 28 days old. Where recently constructed work is required to support further work above, the lower shuttering and propping must be kept in position until the work is at least 28 days old. After the work is 28 days old the contractor is to provide temporary strutting necessary to allow for such incidental loads as he may impose on the structure in excess of the designed superimposed load.

A. Reinforcement bending

All reinforcement is to be bent cold unless otherwise authorised in writing by the architect and must be carried out so as not to overstress or injure the bars in any way. Where hot bending is allowed the temperature shall not exceed 840°C and the bars must be allowed to cool down gradually. No welded joints will be allowed in reinforcement stressed in tension. Welding of joints stressed in compression may only be carried out with the written permission of the architect and then only by qualified welders using methods agreed, prior to the work, between the architect and the contractor.

B. Reinforcement placing

All reinforcement shall be positioned strictly in accordance with the drawing and securely fastened so that it does not move during the placing of the concrete and the contractor is to provide temporary fixings, chairs and supports where necessary to ensure that this requirement is carried out. All passings and intersections are to be tied with binding wire which shall be thoroughly annealed No. 16 SWG or approved equivalent fastening.

Before placing the concrete, the reinforcement will be checked by the architect, but this does not relieve the contractor of his responsibilities.

C. Reinforcement, cover

The contractor shall ensure that the cover to all reinforcement shown on the drawings is maintained during placing and he is to provide precast spacer blocks for this purpose.

DRAINAGE WORK

British Standards

The provisions of the latest revised editions of the following British Standard Specifications and British Standard Codes of Practice shall be held to be incorporated in this specification unless specifically stated otherwise:

BS 12 Portland cement (ordinary and rapid hardening).
BS 65 & 540 Clay drain and sewer pipes including surface water pipes and fittings.
BS 78 Cast iron spigot and socket pipes (vertically cast) and spigot and socket fittings.
BS 497 Manhole covers, road gulley gratings and frames for drainage purposes.
BS 539 Dimension of drain fittings.
BS 882 Aggregates from natural sources for concrete.
BS1199 Sands for external renderings.
BS1200 Sands for mortar for plain and reinforced brickwork, blockwalling and masonry.
BS1247 Manhole step irons.
BS3921 Specification for bricks and blocks of fired brick earth clay or shale.
BSCP301 Building drainage.
BSCP303 Surface water and subsoil drainage.

A. Testing — The whole of the drainage work shall be tested in accordance with the tests and methods laid down in BSCP 301 and shall withstand the tests laid down in the 'Building Regulations 1965', Clauses N11, N12(2).

B. Protection — The whole of the drainage work including manholes, is to be protected against damage by extreme weather conditions or any other cause.

Materials

C. Concrete — Cement, sand, aggregate and water for use in concrete shall be as described in the Concrete Work section.

D. Mortar — Cement, sand and water for use in mortar for brickwork or pipe jointing shall be as described in the Brickwork and Blockwork section.

E. Bricks — All bricks used in the construction of manholes and for drainage work below ground, shall be engineering bricks class 'B' as given in BS 3921, Table 6.

F. Pipes and fittings — Salt-glazed stoneware pipes and fittings for soil drains shall be spigot and socketed pipes of 'British Standard' quality in accordance with BS 65 and shall bear the stencilled mark of the British Standards Institute to that effect. Salt-glazed stoneware drain pipes and fittings for surface water drains shall be 'Surface water' quality in accordance with BS 65 and

which have finished ceilings exceeding 11ft. 0in. and not exceeding 20ft. 0in., and those exceeding 20ft. 0in., shall be given.

Sign boards — Each contractor and sub-contractor on the job will want to display a sign board. If this is not controlled the entrance to the site will become a rash of odd sign boards. It is usual to limit the erection of name and sign boards to one large board incorporating the title of the job, the name of the client, his architect, quantity surveyor and consultants, and that of the contractor, with suitable space for sub-contractors to insert their names. It may be necessary to obtain a licence or other permission from the local authority for the erection of sign boards.

Photographs — The contractor will generally require progress photographs during the contract and these will be at his expense. If the employer requires progress photographs, either allow a provisional sum for this or state the number of visits per month required and the number of photographs per visit. Irrespective of who pays for the photographs, it must be the employer's prerogative as to what use is made of these, *i.e.* advertising, etc., as they may contain details which the employer does not wish made public.

Drying the works — A provisional sum should be given for fuel and attendance for drying out the work. If drying is to be achieved by temporarily operating the heating system, then this must be given as an item on the appropriate section, but the cost of fuel should be given here.

Rubbish — The contractor must be required to remove all rubbish from the job at the end and from time to time during the contract.

Protection — An item for protecting the work is given in each work section for each different form of construction, but an overall item of protection should be given for the whole work.

Contingencies — A provisional sum shall be given for contingencies.

SECTION C: DEMOLITIONS AND ALTERATIONS

Each job of demolitions and alterations must be treated on its merits and changes must be made to the general pattern if experience shows that the conditions demand them. Generally, this work can be divided into:

a. *Major Demolition Works*

If a large amount of demolition is contemplated before re-

building, it is generally advisable to make this a separate contract or sub-contract. If it is decided to use a separate contract, sub-divide the document into:

(i) Preliminaries
(ii) Demolition preambles
(iii) Demolition bills of quantities.

If it is decided to make this a sub-contract to the main contract, sub-divide the document into:

(i) Repeat of main contract preliminaries.
(ii) Demolition preambles.
(iii) Demolition bills of quantities.

b. *Alteration Works*

Alteration work which will include minor demolition work will generally be part of a much larger scheme and this section will be part of a larger document. The section can therefore be divided into:

(i) Small demolition work in connection with alterations.
(ii) Alteration work.
(iii) New work.
(iv) Decorations and re-decorations.

MAJOR DEMOLITION WORK

Preliminaries	These should follow the pattern given in Section B of this chapter.
Demolition preambles	The clauses written for demolition work are more in the nature of preambles than specification clauses, *i.e.* they describe and amplify the measurement, they do not amplify the drawings; they will therefore be written on paper with cash columns to facilitate pricing.
Confirmation of work	The contractor should be required to confirm with the architect before work commences if there should be any doubt as to the actual extent of the demolition work.
References	It is often necessary to give the location of items to be demolished and therefore reference should be made to a drawing whose title is given here.
Definitions	It is inevitable that in itemising demolitions the words 'grub-up', 'pull down' etc., will be used. Each of these phrases must be defined exactly.

CLAUSE HEADINGS AND NOTES FOR SPECIFICATIONS

Method of demolition	The method the contractor intends to use for demolishing the buildings is generally at his discretion, but limitations may be put on the use of such things as explosives. He should also be referred to the next clause.
Avoidance of nuisance	Demolition work will cause dust, noise and general inconvenience to surrounding property, but the problem arises of where reasonable noise and dust become a nuisance. The contractor will generally be required to indemnify the employer against any claim arising out of 'nuisance' caused by the work.
Strutting, shoring and hoardings	The contractor should be made responsible for 'providing adequate strutting and shoring to adjoining land and buildings and for providing all necessary protection for the public. He will also be responsible for all claims for damage to persons and property.
Reinstatement of damaged work	Should the contractor damage adjoining property or demolish the wrong item or structure, he must replace or repair it to the owner's satisfaction.
Prices and credits	The contractor should be required to give his price in two parts, first for the cost of the actual demolition work and second for the credit he intends to give for the materials he recovers. The nett cost is the difference between the two. If the employer requires all or part of the materials from the demolition, then he may take them and the price is adjusted by not deducting the credit from the calculation of the nett cost. The contractor should be told that this will be the method employed in settling the nett cost and that, if no credits are allowed, it will be assumed that the material has no credit value and that the employer can retain the material without charge if he so desires.

The demolition work will then be itemised and described in a bill of quantities.

ALTERATION WORK

This will generally be one part of a larger scheme and so will be covered by the preliminary clauses of the whole work.

Demolition and Alteration Preambles

The clauses written for demolition and alteration work are in the nature of preambles and are consequently written on paper with cash columns which will allow them to be priced.

The items will generally follow the order of those for major demolition work except that it should be remembered that the work is not so extensive.

Confirmation of work	This can be coupled with the next clause.
References	The necessity of good referencing in minor demolition work cannot be too strongly emphasised, and it is advisable that the contractor be made liable for checking and reporting any inconsistencies between a reference drawing and the bills of quantities.
Definitions	The principles are the same as for major demolition work, it is the terms used that are different. For example, 'make good' needs to be defined as to the extent to which making good shall be deemed to be included and what can be claimed as extra work.
Method and order	Method of work is always at the contractor's discretion, but certain things may not be permitted, *e.g.* compressors within the building. The order of work, if it is not at the contractor's discretion, must be stated together with any provision as to finishing one part before starting another.
Avoidance of nuisance	The contractor must be made responsible for any nuisance caused by the work. He must also be made aware of what will be considered nuisance within an existing building.
Strutting, shoring hoardings and temporary partitions	The contractor will be responsible for strutting, shoring and the protection of the public by temporary barriers, hoardings, lighting, etc. He should also be made aware that he will be expected to cover up and protect the existing building with dust sheets, screens and fans. Any special partitions or screens should be dealt with as measured work or as a provisional sum.
Reinstatement of damaged work	The contractor should be reminded that should his work cause undue damage to the surrounding work, then he will be responsible for making this good.
Prices and credits	The same method of recording prices and credits as described for major demolition work should be used.

The clauses describing the new work used in the alteration and the re-decorations should all be specified in their respective positions in the remainder of the specification.

SECTION D: EXCAVATION AND EARTHWORK

General

British Standards and British Standard Codes of Practice	A list of all current and relevant BS and BSCP should be given.
Weather conditions	It is usual to give the architect the power to delay or suspend excavation work when he is of the opinion that the weather conditions warrant it.
Keep excavations clear of water	The trenches and excavations must be kept clear of water and this must be stated. An item that can be priced will be written in the bills of quantities.

Materials

Filling materials	The exact type of filling material or materials required should be stated, giving precise details as to grading, consistency, clay content, compactability or any other matter that is relevant.
Temporary work	With all temporary work, the type and quality of the material is at the discretion of the contractor. The only control that the architect has is that the material shall be of adequate strength and shall not have an adverse effect on the permanent work which comes into contact with it.

Workmanship

Generally	A clause defining the general principles of what is required should be given. The contractor will be required to excavate to lines, levels, slopes, cambers, depths and sizes shown on the drawings and to disturb the sub-strata as little as possible.
Nature of subsoil	This clause, whilst giving bore hole information, will make general site investigation the responsibility of the contractor.
Datum and levels	The datum for the site will be levelled in by the architect and all levels will be referenced to this point. The accuracy of levels, other than that of the datum, will be the contractor's responsibility.
Approval of excavation	The architect must approve the bottom of the excavation before further work is started. When the bottom has been approved, subsequent construction must proceed before it can deteriorate due to adverse weather conditions.
Accuracy of excavation	The contractor is responsible for the accuracy of the excavations and will need to make up any over-excavations in weak concrete.

Method of excavation	The method of excavation is at the discretion of the contractor, but if methods are used which are likely to damage the sub-grade, then the architect must have the right to suspend work.
Removal of surplus material	Directions as to what must be done with surplus soil should be given.
Timbering to trenches	This is controlled by the factory inspector under the Construction (General Provisions) Regulations 1962. The timbering must be sound and of adequate strength, bearing in mind the nature of the soil to be supported. The architect will usually reserve the right to have any timbering he considers unsafe strengthened or replaced.
Backfilling to excavations	Specify the material to be used, the extent of the consolidation and the thickness of the layers.
Laying and compacting filling materials	The method of laying and compacting the material should be given. Care must be taken not to say how the job is to be done but the result required and the compactions factors required.
Maintenance of formations	The contractor will be required to maintain the formation in the state approved by the architect until subsequent construction is laid.
Softspots	The method of dealing with 'softspots' found in the bottoms of excavations must be given.

SECTION E: PILING

The drilling, augering or boring of end bearing or friction piles is done by specialist contractors, each using their own patent or specialised system. This, therefore, means that the specification will be written in general terms with enough width to allow each specialist or patentee to use his own system.

General	
British Standards and British Standard Codes of Practice	A list of the current and relevant BS and BSCP should be given.
Nature of ground	The contractor should be advised to visit the site to ascertain the nature of the ground. If any special or hidden conditions exist he must be told of these. He will be assumed to have visited the site whether he does so or not. Bore-hole records must be given or made available.
Tidal waters	If the work is near tidal waters or rivers, then times and heights of tides should be given. The water table should be stated. If pumping in the bores is anticipated, it should be mentioned here and given as a provisional sum in the bills of quantities.

Testing	All tests required on the piles must be given stating the load and the duration the pile is expected to sustain it.
Protection	The work must be protected from all kinds of damage. This will mainly apply to protection of cast *in-situ* concrete piles.
Materials	
Wood piles	The type of timber to be used must be given, pitch-pine, greenheart and oak being common ones. The timber must be straight grained and free from all defects, particularly shakes and checks.
Precast concrete piles	The concrete, reinforcement and moulds should be dealt with as in Section F: Concrete Work. If the job also includes a specification for that section, references to the relevant clauses should be given. Generally, a higher quality of concrete and workmanship will be required because of the extra stresses caused by driving.
In-situ concrete Reinforcement or stressing wires	Specify *in-situ* concrete piles as for normal concrete. There will be no difference between the reinforcement and stressing wires in piles and in normal concrete work, therefore refer in these clauses to Section F: Concrete Work.
Metal caps, shoes and bands	Generally, the steel driving caps and the pointed shoes are of patent manufacture. Specify the correct type for the situation, giving catalogue references.
Steel sheet piling	If steel sheet piling is used as a temporary support to excavations, the architect will have no more control over the material than he has over any other temporary work, but if the sheet piling is part of the permanent construction the strength of the material required should be given. Specify a particular type of sheeting manufactured under a patent or give all the necessary data that will permit the contractor to calculate what is required.
Workmanship	
Piling generally	This is a general clause giving overall conditions of work, stating that piles are to be driven to the depth as shown on the drawings, that vertical piles will be vertical, or give a tolerance; give bearing capacities.
Drilling, augering, boring or driving	If there is a preference for one or other system, say so. There may be restrictions on a site against driving due to noise or vibration. A restriction on the exces-

sive use of water as a lubricant in boring piles must be made.

Concreting piles *in-situ*: The clauses from Section F: Concrete Work will apply (except the one referring to refraining from dropping concrete more than 4ft.0in.). Each patent system will have its own method of punning the concrete, but the contractor will be required to ensure that the concrete is adequately compacted.

Disposal of spoil: The surplus spoil must be kept clear of the piling operations and cleared off the site at frequent intervals.

Driving sheet piling: The sheeting must be set in true to line and level, truly vertical and properly interlocked at the joints and corners. The method of setting it in will be at the discretion of the contractor, but if the sheeting is part of the permanent construction and the site is in an area where the driving of sheet piling has been adjudged a nuisance, the contractor must be told.

SECTION F: CONCRETE WORK

The specification for reinforced concrete has been dealt with as a typical specification in Chapter 6. The specification for plain (mass or unreinforced) concrete would follow closely the pattern for reinforced concrete.

PRECAST CONCRETE

Precast concrete construction work varies from small lintels, bearing blocks and other minor items to major precast industrialised building units.

If the extent of the precast work is small, then a clause or two in a reinforced concrete specification (referring to previous clauses on materials, mixing, strength, etc.) will suffice.

If there is a great deal of precast work, a separate section will be required:

General

British Standards and British Standard Codes of Practice: A list of all current and relevant BS and BSCP should be given.

Testing: If site tests are to be carried out, describe the type of test desired and require the contractor to provide test facilities and equipment.

Load testing, Protection: Similar to typical specification.

Materials

Cement, Fine aggregate, Coarse aggregate, Water, Reinforcement, Forms: Clauses similar to those in the typical specification should be written, as the materials of the precast concrete units are no different from those used for *in-situ* concrete.

Workmanship

Concrete quality: Specify the design strength of set concrete similar to that in the typical specification.

Batching, Mixing, Transporting and placing, Compaction, Vibrating, Curing: If the units are factory produced, the factory will have its own methods of batching, mixing and placing and the architect will generally have to rely on site or cube testing together with a check on surface finish to keep control of the standard. It is essential, therefore, that provision be made for the architect to visit the casting works, should he so desire, to see that the specified standards are being maintained. If the units are being site cast, then it is not unreasonable to use similar clauses to those in the typical specification.

Formwork generally and finishes: Strength, deflection and finish all need to be specified, but it should be remembered that if the units are factory cast, the special techniques of form making will make some clauses obsolete. With site-produced units, the normal clauses would apply plus those for 'striking' and 'cleaning and oiling'.

Reinforcement, bending, placing and cover: Whether the work is factory or site cast, the typical clauses are relevant.

This specification must now be extended to cover the casting-in of hoisting points and the actual hoisting and grouting into position of the units.

HOLLOW BLOCK CONSTRUCTION

This work generally only requires additional clauses added to the general specification for reinforced concrete work. These clauses would be:

THE SPECIFICATION IN THE CONSTRUCTION INDUSTRY

Materials	
Hollow pots and filler tiles	Describe the type of pot and if it is, of a patent type, give its maker's name and the reference number.
Workmanship	
Positioning and alignment of blocks and tiles	Positions, dimensions and tolerances in the alignment of the blocks should be given.
Transporting	The clauses of the typical specification should be enlarged to prevent damage to the blocks and tiles by running barrows, etc., on unprotected blocks.
Placing concrete	The careful spreading of the concrete so as not to disturb the blocks must be specified. The practice of filling in the ribs and then placing the topping should be discouraged.
Filling ends of blocks	If sealed-end blocks are not standard units with the type of blocks used, then it should be specified that some means be used at the ends of rows to prevent concrete flowing into the open ends.

PRESTRESSED CONCRETE AND PRECAST PRESTRESSED CONCRETE

Prestressed concrete is high grade concrete with high tensile steel wires passing through it which, when stressed, will transfer their load on to the concrete. The specification will, therefore, follow the typical specification for the items of concrete materials, transporting and placing etc., and the items for reinforcement will be replaced by ones for stressing wires. Additional clauses would then be added dealing with stressing and loading of the wires.

SECTION G: BRICKWORK AND BLOCKWORK

Generally	
British Standards and British Standard Codes of Practice	A list of all current and relevant BS and BSCP should be given.
Sampling and testing	BS 3921 sets out methods of taking samples of bricks and of testing them. Describe the method by which the sample is to be taken and enumerate the tests to be carried out and the results expected. All tests are usually carried out by an independent testing laboratory and paid for by the contractor, therefore the frequency of sampling and testing must be given.

CLAUSE HEADINGS AND NOTES FOR SPECIFICATIONS

Protection	The contractor is responsible for all damage to the brickwork however caused.
Sample panels	It is usual for the architect to require sample panels of brickwork to be built showing different standards of work and types of jointing. One of these will be selected and used as the standard of work for the whole job.
Materials	
Common bricks, sand-lime bricks, engineering bricks, Clay blocks	One BS covers bricks and blocks of clay and each individual type of brick should be specified by reference to that BS.
Facing bricks	If a particular type of facing is required, this should be stated together with the manufacturer's name and address. A sample of the type of brick required will generally be held in the architect's office for inspection.
Special bricks	There are many special types of brick for special purposes, *e.g.* refractory bricks, bricks for cutting and rubbing. Each of these should be specified separately and in detail giving the name of the manufacturer.
Mortar	Mortar may be described as a single material (which will involve specifying cement, sand, lime, water and mixing as one item) or it may be given as its constituent parts with the mixing of mortar specified as a workmanship' item.
Plasticisers	The use of plasticisers should be strictly controlled or they may damage the strength of the mortar. Their use will generally be at the discretion of the architect.
Wall ties	A BS for cavity wall ties gives three basic types. Choose one and specify it.
Fine concrete and mortar filling to cavities	The material to be used as cavity filling below ground level should be given as for mortar.
Damp-proof course materials	BS 743 describes most common forms of dpc materials. Select the type required and specify it.
Tiles for cills, creasings etc.	The type, size and quality of tile must be stated. If it is intended to use plain tiles, say so and use the BS.
Glass blocks, gas flue blocks, flue liners, chimney pots, air bricks	All or any of these may come into the work; if there is a BS for them, use it, if not quote a manufacturer's catalogue number rather than try to describe the quality of the article in detail.

Workmanship Work in inclement weather	The bricks will not be damaged by inclement weather, but the mortar will suffer if it becomes frozen. The brick facework will suffer if laid during heavy or consistent rain, as this will wash the mortar out of the joints and down the face of the work. The resulting stains are extremely difficult to remove.
Setting out	State the tolerances which will be allowed in overall brick dimensions and that the work will be to the lines and levels given on the drawing.
Brickwork generally	Specify the brick bond; if different parts of the work are to be built in different bonds, specify each bond and where it is to be used. State the gauge of the work and the conditions under which it will be carried out.
Brick walls and piers	Although the contractor should never be told how to lay the bricks and build the walls, restrictions and conditions must be put on the method of working. All courses must be flushed up and grouted solid in mortar, all headers must be whole bricks and the centre of the wall should be in headers. Brickwork must be carried up all round at the same height and during construction one part of the wall should not be more than 4ft. 0in. higher than any other part.
Day's work joints	Bricklaying will not continue straight from beginning to end, neither will it always finish to a level course all round the building at the end of a day; therefore it should be racked back and all surplus mortar cleaned off. On no account must toothings be left to pick up the next day's work.
Hollow walls	The sizes and tolerances in the widths of cavities should be given. The spacing of wall ties must be stated together with an instruction to keep the cavity clear of mortar droppings. Ties must be set into the brickwork as it rises and not pushed into the joints when the work has been built: this means that both skins of the hollow wall must be carried up together.
Closing cavities at reveals	In hollow walls, the cavity will be closed with facing or common brick (as appropriate) and a vertical dpc used. Extra wall ties are usually set around openings.
Brick facework	The standard of facework must be stated together with an explanation of the meaning of the descriptions of the various types of joints. *e.g.* 'neat struck

	joint as the work proceeds' shall mean that the bricklayer, after laying the brick and pressing it into the mortar bed or joint, shall strike off the surplus mortar level with the face of the wall with a shearing action and not touch the joint again with the trowel or any other tool.'
Facing to reveals of openings maintained.	The facing bricks must be carried to the full width of the external reveal and the standard of facework

SECTION H: UNDERPINNING

Underpinning is generally carried out in conjunction with works of a major nature and will be measured and priced in a bill of quantities under a separate heading. The measured items will include all the work in connection with the underpinning irrespective of the work section to which it rightfully belongs. The specification will be a reiteration of the relevant clauses from the other work sections.

Preambles written in accordance with the requirements of clauses E1 (a), (b), (c) and (d) of the Standard Method of Measurement should be included in the bills of quantities.

SECTIONS J AND K: RUBBLE WALLING AND MASONRY

Generally British Standards and British Standard Codes of Practice	A list of all relevant and current BS and BSCP should be given.
Protection	Stone needs protection from damage in the same manner as brick walling. Make special reference to carving or ornamentation.
Testing	If tests are required the system of taking samples must be defined. The tests to be performed must be stated with the results expected.
Samples	The architect will have samples of the stone he requires and this should be brought to the contractor's notice.
Storage of material	Stone and other materials must be properly stored to avoid discolouration and deterioration. Specify proper storage, covered if necessary.

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Materials	
Natural stone	The type and quality of the stone must be given. If for ashlar or similar facing work, state the quarry and the bed from which it is to come.
Cast stone	Generally specify the manufacturer together with the particular grade, type or class of stone.
Stoneware, terra-cotta and the like	These are manufactured articles, so state the manufacturer together with the grade, type or class of material.
Cement, sand, lime, water, plasticisers, mortar, concrete and reinforcement, wall ties	These will all have been given elsewhere in the specification; refer to these clauses.
Dowels, cramps and anchors	There are many different types – describe the type required, with reference to a manufacturer's catalogue if necessary, or give the type of fixing to be used and the load to be carried. The cramp must be of a non-ferrous metal that will not stain or destroy the stone.
Mastics	Mastics for jointing and expansion are given by type, stating the material on which it is to be used. Refer to a particular brand or brands if necessary. Mastic for use in expansion joints which show on the face must be suitable for use with stone, must be of a colour toning with the surrounding stone and must not react with the material in any way.
Slurries	Protecting slurries must be capable of being cleaned off without damage to the stone.
DPCs, cavity fillings, air-bricks, etc.	These will have been given elsewhere in the specification; refer to these clauses.
Workmanship	
Work in inclement weather	The weather will damage stonework in the same way as it will damage brickwork, therefore write the specification in the same terms.
Generally	Describe the general standard of the work, all stones to be bonded, every stone on its natural bed or with the natural bed at right angles to the direction of the load.
Random rubble, Random rubble built to courses, Uncoursed rubble, Snecked rubble, Dressed stone, Ashlar	Define each type and class of stonework and the standard to be achieved by each.

5. *Concrete* Generally	Materials and workmanship. Concrete mixes, con-

CLAUSE HEADINGS AND NOTES FOR SPECIFICATIONS

Jointing and pointing	Describe the mix of mortar and the quality of the joints. Describe the finish to the joint.
Cramping and dowelling	Give the spacing and frequency of dowels and cramps and state the method of fixing in position.
Block bonding to brick backing	Give conditions of work and state maximum spacing between bonding blocks.
Carving and enrichments	These will generally be done off the site and the carved stone brought in for setting. Describe the handling, storing and setting of these stones.
Cleaning down	The face of the stonework must be left clean on completion with all slurry cleaned off and mouldings cleaned out. The face of stonework should be washed down.

SECTION L: ASPHALT WORK

Generally	
British Standards and British Standard Codes of Practice	A list of all relevant and current BS and BSCP should be given.
Protection	The contractor is entirely responsible for the protection of the work from damage. Unless the asphalt is intended to be used as a floor, when a particular grade will be used, it should be protected from traffic as soon as it is laid. Mastic asphalt, even the flooring quality, will flow if warmed and will be marked by heavy objects left on it for longer than a few hours.
Sampling and testing	The various BS lay down methods of sampling and testing mastic asphalts.
Working space	In tanking to basements, and certain other restricted work, a minimum working space of 2ft. 0in. is required. If this is not available then the work must be described as executed overhand.
Materials	
Natural rock asphalt	There are many BS dealing with asphalt, depending on the type of material and where it is to be used. The correct material should be chosen and specified. Each block of asphalt should bear the BSI 'Kite Mark' certifying that it complies with a particular BS.
Insulating materials and underlays	A suitable underlay for asphalt is one to BS 747, type 4A. The insulating board may be one of many types and it may be covered by a BS. It may be cork board or a glass-fibre board, but it is more likely to be a fibre building board to BS 1142.

Asphalt reinforcement	Asphalt on steeply sloping or vertical surfaces will often be reinforced with expanded metal lathing to BS 1369.
Workmanship Generally	Describe the thickness of the material and the number of coats, the lap between successive layers at joints, and the permitted bay size.
Preparation of surfaces	The asphalter should be responsible for the asphalt he lays, therefore he must not lay asphalt on any vertical or sloping surface if he does not think that there is sufficient keying between the asphalt and the backing. In certain instances the asphalter may be required to prepare the surfaces himself before laying asphalt. All surfaces to receive asphalt must be clean, free from dust and dirt and if it is at all possible, completely dry.
Reinforcing asphalt	If asphalt reinforcement is to be used, the permitted methods of fixing, the laps in sheets and the tolerances in fixing must be stated.
Melting asphalt	The method of preparing the material must be at the discretion of the asphalter, but burnt, charred or 'over-cooked' asphalt will cause a great deal of trouble if allowed to become incorporated into the asphalt work.
Transporting	Asphalt is usually transported in small quantities in buckets dusted out with a fine inert dust. Cement, oil and many other coating materials will damage the asphalt.
Angle fillets	Two-coat internal angle fillets are usually specified between vertical and horizontal work.
Skirtings, curbs, etc.	A minimum height of skirting with a two-coat angle fillet at the base and the top edge turned into a brick joint and chamfered off, is usual. Skirtings are thicker than the horizontal work. Curbs are similar.
Check rolls and edge rolls	Check rolls and edge rolls should be formed in asphalt similar to the base coat and built up on the base to join it. Very hot bitumen poured along the run of the check roll is used before the extra coats are laid.
Collars around pipes etc.	Collars are worked up around pipes in a similar manner to a skirting. The pipe through the roof should be specified as having a luting flange but where this has not been done, the first coat should be clipped with a 'jubilee' or similar clip and subsequent coats run over this.

Finish	The surface of asphalt will be finished in a manner consistent with its use. Roofing will have a layer of white spar chips embedded in the surface or be dusted off with silver sand (state the rate at which they will be used). Floors will be either polished or sanded, tanking will generally be sanded so that subsequent work will key to it.

SECTION M: ROOFING

This section of the Standard Method of Measurement covers all the different types of roof covering except asphalt. These are:

(i) Slate or tile roofing of asbestos cement, stone clayware or timber shingles.

(ii) Corrugated or troughed sheet roofing of asbestos-cement, iron, steel, protected metal or aluminium.

(iii) Thatch of reed, straw, sedge or heather.

(iv) Bitumen felt roofing.

(v) Sheet metal roofing of lead, copper, zinc or aluminium.

Each type and kind of roofing will be measured separately within the bills of quantities and therefore each type will be given separately in the specification.

SLATE OR TILE ROOFING

Generally British Standards and British Standard Codes of Practice	A list of all relevant and current BS and BSCP should be given.
Protection	The contractor is entirely responsible for protecting the work from damage. It may be thought that the roof does not need protection, rather that it is the roof that protects the rest of the work, but parts of the coverings are set in mortar, which needs protection, and a half-completed slate or tile roof is vulnerable to high winds.
Sampling and testing Samples	If the material is in accordance with a BS, samples must be taken and tested in accordance with that BS. Pieces of the roofing material will be deposited with the architect as samples of quality, colour and finish and they will form the standard for the job.

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Materials

Slates or tiles	The kind and quality of the roofing material must be given. If there is a BS it should be used.
Underfelting	BS 747 covers roofing felts. Underfelting to slates and tiles should be of type 3A.
Battens and counterbattens	Reference to the BS will cover most eventualities.
Nails for tiles, slates, underfelt and battens	The battens and counterbattens will be fixed with steel wire nails but the slates and tiles should be held by a non-corroding nail of copper, aluminium or composition.
Mortar for bedding	Reference can be made to Section G: Brickwork and Blockwork.
Hip irons	Hip irons will be of galvanised mild steel bent to shape. Give the substance of the mild steel or alternatively make reference to a standard type shown in a builders merchants' catalogue.

Workmanship

Slating and tiling generally	This clause will deal with the slating and tiling in a general way and specify lap and gauge, even coursing, nailing, proper bonding of units, minimum size of cut units, etc.
Eaves and top edge	The finish to the eaves and top edge depends upon the effect required and the type of unit used. With a plain tile it is general to set a double course at the eaves and top edge; they may be hung on a batten each, and each tile nailed, or both on the same batten. Single-lap fully interlocking tiles do not need an undercloak course – only the best work has this.
Ridge capping	Specify the type of capping and how it is to be bedded and fixed. If the capping is set to pantiles or other deep troughed tiles, specify what is to be used to stop the mortar sloughing out of the trough.
Hips	Hips can be formed in different ways. The most common are (i) Bedding hip capping tiles in mortar over the cut joint between the two planes of the roof. (ii) Setting bonnet or purpose-made hip tiles at the junctions and bonding the general tiling up to them on both sides.
Valleys	Valleys can be swept, laced, open, secret or be formed with purpose-made valley tiles. Describe the conditions by which the workmanship of each will be judged acceptable.

5. *Concrete*

Materials and workmanship. Concrete mixes, con-

CLAUSE HEADINGS AND NOTES FOR SPECIFICATIONS

Verges and abutments	Verges are bedded solid over the brickwork to the gable end or on to a layer board at the barge board. Describe what is meant by bedding solid and the mix of the mortar, specify the number and type of undercloak tiles used and describe the overhang at the verge and the pointing to the edge.
Underfelting	The underfelting is laid across the rafters from the eaves. Each successive course laps over the previous one. The felting is fixed with clout nails and is finally held by the battens. The felt must not be pulled tight but be allowed to sag between the rafters. Specify laps between sheets, end laps and finish at ridge and gutter.
Battening and counter battening	The batten must be properly fixed with nails to every rafter, joints in lengths must be over a rafter.

CORRUGATED OR TROUGHED SHEET ROOFING

Generally

British Standards and British Standard Codes of Practice	A list of all relevant and current BS and BSCP should be given.
Protection	The contractor is entirely responsible for protecting the work from damage. A partly completed roof is generally more vulnerable than a completed one.
Testing	The sheeting will be tested for strength, squareness, water absorption etc. Generally the conditions of test and the tolerances will be given in a BS.

Materials

Sheeting type	Give material, type, section and trade name for the kind of material to be used. If there is a relevant BS use it.
Fitments	This type of sheeting relies on special pieces and fitments to produce the necessary details. Specify that the correct fitment, in accordance with the manufacturer's standard catalogue, is to be used.
Fixing accessories	BS 1494 describes different types and styles of fixings. State the type required.
Hanging and fixing rails	State the type, material and size of the rails.
Mortar	Reference this to Section G: Brickwork and Blockwork.

Mastic sealing	There are many types of mastics for jointing. Specify the type required and, if necessary, give a proprietary brand name.
Sheet metal flashings	If these are a part of the specification for Sheet Metal roofings, leave them to that part, otherwise specify here.
Workmanship	
Generally	BSCP 143 covers the workmanship in roof coverings of this type and full use should be made of its recommendations. It may be possible to condense the whole of the workmanship section by making a statement that 'the roofing shall be carried out in accordance with the recommendations of BSCP 143 part . . .' (the blank being filled in with the number of the relevant part). If this cannot be done then the general layout pattern of the BSCP should be followed.

BITUMEN FELT ROOFING

Generally	
British Standards and British Standard Codes of Practice	A list of all relevant and current BS and BSCP should be given.
Protection	The contractor is responsible for protecting the work from damage. Inclement weather may damage the sub-base and cause consequential damage to the felt. If the sub-base of lightweight concrete screed is left unprotected, it may absorb sufficient water to cause staining on the ceiling below as it dries through the sub-base or it may subsequently lift the covering as it tries to escape through the bitumen felt.
Sampling and testing	BS 747 lays down methods of test of bitumen roofing felts.
Vapour barrier	A vapour barrier may be necessary in the roof construction. This may vary from a sheet of polythene to a skin of aluminium foil with insulation backing. Describe the type of material, substance and, if applicable, a manufacturer's reference.
Felt vents	These are a proprietary means of venting the structural roof to remove surplus moisture. Describe the type and material and quote a manufacturer's reference.
Adhesives	There are many proprietary brands of adhesive for roofing felts and if a particular brand is favoured specify it by name, otherwise use BS 3940.

Workmanship	
Generally	Describe the general standard of work required, the number of layers, and if fully-bonded or edge-bonded, when and where clout nails can be used, and any other matter affecting the general standard of work.
Eaves, curbs, check rolls, drips, etc.	Each of these different situations requires a separate technique and a different class of workmanship for example, in a 3-layer built-up felt roof the drawing will show the felt continued over an edge roll and on to the fascia but how will this be carried out; will all the layers be dressed over or only one? Describe the conditions of work and the standard required.

SHEET METAL ROOFING

Generally	
British Standards and British Standard Codes of Practice	A list of all relevant and current BS and BSCP should be given.
Protection	The contractor is entirely responsible for protecting the work from damage.
Materials	
Sheet metal in coverings and flashings	The more common sheet metals are covered by BS. The substance should be stated in the manner customary for the metal, *e.g.* lb per foot super for lead; swg or oz. per foot super for copper; etc.
Nails and other fixings	Electrolytic action will result if dissimilar metals come into contact. The nails must be of a material unlikely to react with the covering.
Underlay	Building paper or bitumen felt to BS 747 Class 4 is suitable.
Workmanship	
Generally	BSCP 143 covers sheet metal roofing and full use should be made of its recommendations. If the BSCP is inappropriate, the specification should describe the general standard of work, stating maximum sheet size, minimum fall required, the frequency and position of fixing nails and the proper use of fixing tacks.
Fixing the underlay	State the laps, if any, and the method of fixing.
Eaves, curbs, drips, rolls, etc.	Each type of metal requires a different grade of workmanship for these items. Therefore describe each

	situation separately and state if the material is to be bent, cut, dressed or welded into shape and if it is to be fixed and with what.
Sheet metal flashings	State the minimum width and minimum covering to the protected surface. Give the depth of turn in to groove or brick joint and state method and frequency of wedging. Describe pointing to the top edge. If dressed over tiles, glass etc., give details.

SECTIONS N AND P: CARPENTRY AND JOINERY

These two sections are commonly brought together in bills of quantities and specifications as both are facets of the same woodworking trade. Carpenters' work is structural in nature and therefore uses sawn, *i.e.* un-planed, timber, whereas joiners' work is in the nature of a finishing and uses wrought, *i.e.* planed, timber.

Generally

British Standards and British Standard Codes of Practice	A list of all relevant and current BS and BSCP should be given.
Protection	The contractor is entirely responsible for the protection of the work from damage. All timber on site should be stored under cover and out of contact with the ground, but joinery timber and fittings must be put in a weatherproof store. When the timber has been built in, it is up to the contractor to take such precautions as he thinks necessary to protect the carpentry or joinery from damage by the weather or by any mechanical means.
Sampling and testing	The BS are generally very careful not to apply the verb 'to test' to timber but they do suggest methods of assessing the characteristics and calculating the strength of timber.
Nomenclature	Different names are often given to the same species of timber in different parts of the country. BS 881 and 589 give a single standard name for each species and the specification should state that it intends to use these standard names throughout.

Materials

Timber generally	BS 1186 Part 1 lays down the standards for the quality of timber in joinery and in general, these standards will apply to timber in carpentry as well. If

	Materials and workmanship. Concrete mixes, consistence, etc.
	a high grade of structural timber is required use should be made of stress-graded timber.
Softwood	A preferred species may be given for structural work but with joiners' work it is better to make reference to BS 1186, Part 2.
Hardwood	It would be unusual to use a hardwood as a structural timber in this country, so the hardwood could be specified as one given as 'suitable' in BS 1186, Part 2.
Plywood Flooring	BS 1455 gives grades of plywood for various purposes. BS 1297 grades softwood flooring. There is no equivalent BS for hardwood flooring, but the general conditions of this BS could be used to specify hardwood strip flooring (it should be noted that many of the characteristics etc., will have been already included in BS 1186 and so care must be exercised to see that these are not repeated or over-ruled). BS 1187 deals with wood blocks for floors.
Roof boarding	The general tenets of BS 1297 would apply to this also, although the rules would not be so strictly applied.
Boards	There are many types of sheet building board: some are covered by BS and some are not. Those which are covered by BS are best dealt with by reference to the BS, otherwise general requirements for the board should be stated. These should cover type, thickness and tolerances in thickness, surface finish, bonding of the boards, moisture content, etc.
Preservatives	There are many timber preservatives, some are designed for a special purpose and some are for general use. BS 1282 classifies wood preservatives and recommends where each type should be used.
Fixings	The type of nail, screw and fixing used is at the discretion of the contractor, but it is usual to insist that these be of the standard types described in the various BS.
Metalwork	This clause is primarily concerned with carpenter's work and includes bolts, nuts, timber connectors, straps, jibs, cotters and the like. Some of these are covered by BS but in general they are not. Therefore define the material from which they are constructed and give all relevant details as to size, length, etc.
Ironmongery	Ironmongery is generally measured as a PC item for a nominated supplier, whose name will be given, and therefore a specification for the material will not be required.

Workmanship

Storage — The storage of timber before use has been dealt with under the Protection item.

Construction generally — The contractor is responsible for the adequate jointing and framing of the work where it is not shown on the drawing. In general, jointing will be carried out in accordance with BS 1186, Part 2.

Trimmings around openings — When structural timbers are trimmed around openings, it is general practice to increase the size of the trimmers and trimming and to cut and joint the other timbers around. The specification must describe this together with the style of jointing required.

Doors, windows and other joinery and carpentry details — Each part of the work should be mentioned giving details of method of construction and fabrication, standard of jointing and degree of finish required.

Fixing ironmongery — Ironmongery must be fixed neatly and in such a manner as to work efficiently and effectively. On completion, all ironmongery must be oiled and adjusted to provide for any movement in the timber.

SECTION R: METALWORK

Generally

British Standards and British Standard Codes of Practice — A list of all relevant and current BS and BSCP should be given.

Protection — The contractor is responsible for protecting the work.

Samples — The architect may require samples of the different materials and sections used and the contractor must allow for the costs in obtaining and submitting these.

Materials

Metal work generally — State the general quality of all metalwork in terms of being free from all defects, undamaged sections in truly straight lengths, free from sand pits and air blows, etc.

Wrought iron, mild steel, aluminium, etc. — Each type of metal should be mentioned separately with the grade or class of material given. With most types of metal, there will be either a BS, a BSCP or a nationally recognised standard against which to measure the material.

Fabricated metal products — This includes such articles as dustbins, metal windows and doors, dust chutes, etc. In many instances there will be a relevant BS and use can be made of it, but

if there is not one available, a standard product from a reputable manufacturer should be specified. If neither of these alternatives is available, it is advisable to select a standard specification of an article which is similar and follows the pattern of that for the article in question.

Workmanship

Fabrication generally — The general standards of fabrication should be specified and this will probably involve dividing the clause into sections for riveted, bolted, brazed, soldered and welded work. For example, in welded work it will be necessary to say that the work will be fabricated with angles truly square and to the exact shapes and dimensions shown on the drawings. The style of welding can now be dealt with that is either spot welded, butt welded or lap welding for joints the strength of the weld, and the tests that it will be required to undergo.

Sheet metalwork, wire work, etc. — Each basic type of work has its own conditions of workmanship and each should be specified generally in its turn.

Ductwork, balustrading, composite units, windows, doors, matwell frames, etc. — Each part of the work and each article can now be dealt with, describing the standard each is expected to attain.

Finishing — There are many ways of finishing metalwork. It can be burnished and lacquered if it is of copper or bronze; galvanised, enamelled, painted or plastic-coated if it is steel; and anodised if it is aluminium. Each will need its own specification clauses which will generally deal with the method of application of coating, *e.g.* hot dip galvanising, thickness or penetration of coating and surface appearance.

SECTION S: PLUMBING AND ENGINEERING INSTALLATIONS

This is the largest section of the Standard Method of Measurement, containing 122 clauses, and as its title suggests, it contains plumbers' pipe-work of all descriptions in water, gas, oil and air installations. In addition it also includes the ancillary work in connection with the pipe-work in the installation of boilers, calorifiers, sanitary fittings, valves, cocks, meters and

the like. Duct-work and the installation of air conditioning plant is also included.

This gives an extremely wide range of services to be specified in one section and as they will probably be sub-contracted to specialist firms it is advisable to sub-divide the specification into those sections to facilitate the contractor's work. First divide the work into sections according to type, such as:

a. Rainwater disposal
b. Overflows
c. Waste pipes
d. Soil and ventilating pipes
e. Cold-water services
f. Hot-water services
g. Heating system.

etc.,

and within each of these groups sub-divide into:

a. Gutterwork
b. Pipework
c. Ductwork
d. Equipment, i.e. the large items of plant such as boilers, automatic stokers, etc.
e. Appliances, i.e. the small items of sanitary ware and the like, and items generally of a non-mechanical nature.
f. Ancillaries, i.e. the myriad of small items such as bends, tees, valves and thermometers.
g. Thermal insulation to all or any of the previous items.

Notwithstanding this, the clause notes following are for general plumbers' work only, as a specification covering the engineering installations is a matter for a specialist engineer.

General

British Standards and British Standard Codes of Practice	A list of the current and relevant BS and BSCP should be given.
Testing	Each type of pipe, pipe joint, appliance and ancillary will need to be tested. Tests on most of the types of pipe and joint will be covered by BS and these tests should be specified in detail and by name.
By-laws	There is an extensive list of regulations, by-laws and Acts of Parliament which deal with plumbing and water supply work and the contractor must be made

responsible for giving all notices and paying all fees demanded by these laws but he cannot be made responsible for ensuring that the design complies with them. The architect designs and the contractor carries out the design: a good contractor will point out where the *design* deviates from by-law requirements, but he is responsible only for *performing* the work in accordance with the by-laws.

Materials

Gutters	Gutters are made of many materials and are of many types. Describe the material required and state the type of gutter and gauge of material. Many gutters can be specified by reference to a BS and any others would be best specified by giving a manufacturer's catalogue reference.
Pipes	Pipes are made of many materials and there are many grades of pipe within each material; therefore the specification must state the material and the grade or substance of the pipe. The BS will cover most types of pipe and it will generally recommend the grade of pipe to be used for each situation.
Joints and jointing materials	The methods of jointing pipes are even more various than the types of pipes and this clause should detail all the materials necessary to make the joint. For example, a capillary or compression joint will need clauses covering the fitting and the flux, a wiped soldered joint will only have the solder to specify, but a bolted and flanged joint will need separate clauses for bolts, gasket and jointing compound. In general, divide the joint into its constituent materials and specify the type, quality and thickness of each part.
Ancillaries to pipework	The ordinary joints (ancillaries) to pipes have been dealt with previously, but there are other types of ancillaries such as steam-traps, valves, thermostats etc. which need to be treated separately. Each ancillary should be specified separately and where there is no BS for reference give a manufacturer's catalogue number for the article.
Pipe supports	Give the type of pipe support, its material and its substance. Different types, sizes and grades of pipe will need a different type of support so treat each type separately.
Pipe lagging	There are many types of lagging on the market, some for use on hot and others on cold pipes. If a particular

	type is required, specify it by name giving its thickness or weight but if any type will do, providing it maintains the internal temperature, say so and give a 'U'-value for the material.
Equipment and appliances	Equipment and appliances are usually covered by PC sums so the specification need do no more than quote manufacturers' names and catalogue numbers.
Workmanship	
Setting out and alignment of gutters	The general setting out of the work, within the confines of the drawings, must be at the contractor's discretion but there will be a number of salient points that he will be required to observe; not least amongst these is that the alignment of the work is essential for the correct and even flow of water from the gutters.
Gutter brackets and supports	The method of supporting the gutter depends upon the type of gutter used but in general it should be supported on the type of bracket recommended by the gutter manufacturer. If this is not possible, state the material, type, style, size and shape of the bracket and the method of attaching it to the building.
Fittings	Fittings of the type and style to match the gutter must always be used.
Jointing gutters	The jointing material, its use and the method of making the joint, differ with each type of gutter. Describe the materials to be used in the joint and the condition of the finished work.
Setting-out and alignment of pipes	The work should be set out and aligned in accordance with the drawings, and valves, fittings, bends, ancillaries and equipment should all be fixed in the positions shown on the drawings. Where there are no details showing pipe runs and positions, the specification should demand that they are the shortest possible within certain basic conditions. These conditions should provide that pipes shall always be run in the ducts provided, or in chases cut into walls, in positions which will not interfere with other parts of the construction and in horizontal or vertical runs.
Fixing pipework	Pipework should be fixed in the longest possible lengths, avoiding joints wherever possible. State the centres for pipe supports, both for vertical and horizontal runs, and ensure that vertical pipes are vertical and horizontal pipes are truly horizontal (or to the correct fall). In general pipes should always be run in ducts, chases or in positions where they are not obvious.

Bends and bending	Made bends should always be used in preference to a fitting. Pipes which it is possible to bend without collapse or damage should be bent.
Fittings	A pipe fitting such as a bend or tee must always be of an equal or superior quality to the pipe on which it is to be used. It must be properly jointed to the pipe with a full entry of pipe into or up to the joint.
Valves	The principle of equal quality between fitting and pipe applies equally to valves and all other ancillaries. Valves should always be fitted to isolate each section of the work and the contractor should be made responsible for informing the architect when the design falls short of this ideal.
Jointing pipes	The jointing of pipes to carry a multitude of different substances and to withstand various internal pressures is a subject in itself, but in general the joint must retain the contents of the pipe, withstand the internal pressure and not cause undue strain on the pipe whilst being made.
Connections to equipment and appliances	Equipment and appliances should normally be connected to the service via an isolating valve and in such a manner that they can be easily disconnected for servicing or the replacement of parts.
Assembling appliances and equipment	Most items of equipment or appliance will need assembling and/or adjusting before use. This must be done strictly in accordance with the manufacturer's instructions, by a competent plumber or fitter.
Fixing appliances and equipment	Appliances and equipment should be fixed to the structure in accordance with the manufacturer's instructions; where there are none, they should be firmly fixed so as not to damage the article, and with due allowance or provision for expansion and they should be level, and square or parallel to the surrounding construction, and in a position which will allow for any necessary servicing.
Lagging	All pipework liable to damage by extreme weather conditions, or liable to gain or lose heat, should be adequately lagged. Where a particular type of lagging is required, specify the fixing conditions, but when the type is at the contractor's discretion describe the condition of the finished work. In either case the pipe and all the ancillaries must be completely and adequately lagged.
Sterilisation	It may be necessary to sterilise a water system with chlorine after installation. If this is to be done, specify the proportions of chlorine to water, the time it is to remain in the system, and the frequency of flushing before use.

SCHEDULE OF TRADE HEADINGS WITH TYPICAL ITEMS UNDER EACH HEADING

1. *Preliminaries*

5. *Concrete*

Generally — Materials and workmanship. Concrete mixes, control and tests. Cold weather working. Mixing, placing and compacting. Protection and curing

SECTION U: PLASTER WORK AND OTHER FLOOR, WALL AND CEILING FINISHES

This section of the Standard Method of Measurement contains work normally carried out by either the plasterer and tile fixer or the pavior. In addition, the contractor will generally sub-contract each of these sections to a separate sub-contractor. It would therefore appear reasonable to divide the bills of quantities and the specification into these two sections, to facilitate the work of the contractor.

Generally

British Standards and British Standard Codes of Practice — A list of all relevant and current BS and BSCP should be given.

Protection — The contractor is responsible for protecting from damage all the work, whether carried out by himself or by his sub-contractors. This becomes a very important clause in the case of pavings, as these are particularly liable to damage by trucking, from foot traffic or from the erection of scaffolding and the performance of work over them. Where a particularly delicate flooring material is used it may be necessary to insist that a temporary floor be laid to cover and protect it, but care should be taken to specify not the type and construction of the temporary floor—only the fact that the paving must be adequately protected by it.

Sampling and testing — With the wide range of finishing materials available it is impossible to set down general rules for sampling and testing. Nevertheless, tests will be needed and these must be specified and the expected results should be tabulated. A great deal of help on this can be obtained from the BS and the BSCP.

Samples — Samples of manufactured articles such as ceramic tiles, sheet linoleum, etc., will be required by the architect and these will form the standard against which the rest will be judged.

Materials

Internal finishing materials are many and various but in general they can be divided into three main groups. (1) in-situ finishes; (2) tile, slab and block finishes; and (3) plain sheet finishes and it is advisable therefore to

divide the specification into these main groups and, within each of these, to sub-divide the clauses into sections for each individual type of material. As no one contract is likely to contain more than three or four different finishing materials, the task is not as formidable as it first appears.

Manufacturers and supplies — It may be necessary or desirable to specify a manufacturer or supplier of a particular material. If this is done, the full name and address should be given, with an exact description or name of the material written alongside.

In-situ finishes — These include plaster, cement and sand render, granolithic, terrazzo, cement-rubber latex, pitchmastic and all materials which are applied in a fluid or mastic state. Many of these are multi-based materials and each component material must be specified separately. The BS and BSCP deal with many of these and full use should be made of them.

Tile, slab and block finishes — As its title suggests, this includes all slab materials such as precast concrete slabs, precast terrazzo tiles and slabs, clay tiles, glazed tiles, linoleum tiles, thermoplastic tiles etc. The BS and BSCP deal with many of these.

Plain sheet finishes — The list of plain sheet finishes will include some already mentioned under tile slab and block finishes but given here in their sheet form, such as linoleum and thermoplastic sheet, but it must be extended to include such materials as plywood, hardboard, sheet metals, etc. If the material is not dealt with by a BS or BSCP, state its size, thickness and quality. Quality is the most difficult to define and it may be necessary to refer to a standard range of a manufacturer, eg, '. . . to be from Semtex Ltd. range C or of equal quality'. Remember that 'equal' means equal in the eyes of the architect, so in general the contractor will play safe and price Semtex range C.

Beds, backings and adhesives — The type and quality of bed, backing or adhesive will differ with the finishing material, the type of sub-base to which it will be applied, the use to which the finish will be subjected and, in the case of paving, the type of traffic it will carry. If the bedding material is a composite one such as cement mortar, specify each component separately.

Angles and fittings — A number of purpose-made fittings for skirtings, top edges, angles, etc., will be used with tile, slab, block and plain sheet finishes. These must be carefully chosen to combine properly with the type of finish

and, ideally, should be of the range recommended by the manufacturer of the components of the main work.

Lathing and baseboarding — In certain respects this is a parallel item to beds, backings and adhesives in that the type and quality required depends upon the finish to be applied and the use to which the finish will be subjected. If there is no BS or BSCP for guidance give the size, thickness or substance, quality of sheet or lathing and type of jointing.

Hair — Hair is often used in in-situ finishes as a binding material. It is specified by naming the type of hair, i.e. goat, ox or synthetic, defining average length of strand and cleanliness.

Additives — Plasticisers are often used in screeds and renderings to make them 'rounder', more 'fatty' and generally easier to work; other additives are used to enable screeding or rendering to continue during freezing temperatures or to make the material waterproof. The additive is usually a proprietary material or a common chemical compound and should be specified by name or description. The use of any additive must be carefully controlled, as their mis-use can cause damage to the finished work.

Carborundum — Abrasive material, usually in the form of carborundum dust, is often trowelled into the surface of in-situ pavings to give them a non-slip surface. The type, size of grit and cleanliness of the material must be defined.

Workmanship

Storage of materials — All materials specified under this section should be stored under cover and in such a manner that they are not affected by inclement weather or extremes of temperature.

Inclement weather — The finishes inside the building should not be affected by inclement weather or extremes of temperature but this is not so for external pavings or finishes. Many of the processes involving in-situ materials will have to stop when the temperature falls below 2° C and it would be inadvisable to continue with any of these processes during rain or periods of extreme humidity.

Preparation — Each material will require a different preparation to the sub-base before topping is applied. Any in-situ material, including screeds under tiles, will require the base to be clean and free from oil or grease. If the

5. *Concrete* — Materials and workmanship. Concrete mixes, con-

topping is a material containing cement, lime, plaster or a similar material, the sub-base will be hacked to form a key, or a special bonding agent may be applied. For the bitument-based materials a sprayed coat of neat bitumen is advisable.

Proportions and mixing of in-situ materials — A table showing the proportions of the constituent parts of in-situ finishes should be given. Mixing the material will follow the pattern given for mortar in Section G or for concrete in Section F.

Bay size — In-situ work is generally laid in bays or strips, with an expansion joint between. The extreme size of the bay or width of the strip will depend upon the amount the material will shrink in setting.

Temporary screed boards or formwork to edges of bays — Screed boards and formwork are temporary materials and are therefore out of the direct control of the architect except that no material or process should be used which will stain or adversely affect the finish.

Fixing of lathing and base-boarding — There are many types of lathing and base-boarding, many sub-bases to which it can be fixed and many methods of fixing it. Describe the method of fixing and the type of fixings, the centres of the fixings, and the finish at the joints.

Dubbing-out and pricking-up coats — Dubbing-out is a term given to the filling of hollows and irregularities in the sub-base before the main work is applied. This is generally done in layers in a material similar to the main finishing. If this is anticipated, specify the maximum thickness of dubbing-out to be laid on in one coat. Pricking-up is the term used for the first coat applied over lathing (particularly metal lathing); it usually has little or no thickness and is merely to fill in the gaps or holes in the lath.

Placing, spreading and compacting — Most of the in-situ finishes have an initial setting time and a final setting time: the material must be in position before the initial set takes place and should not be disturbed until after final set has taken place. Initial setting time and final setting time for each material must be given. All in-situ finishes must be properly compacted to a dense layer or they will crack or break up under use. The specification must ensure that the finish is adequately compacted and in the case of pavings a compaction factor should be quoted. The material must be worked up to or joints, edges and arrises. run close into all forms,

Period between coats — In a multi-layer in-situ material the time between subsequent coats should be quoted and also the method of keying between coats should be given.

Finishing the surface	Whether the finish be tile, slab, block, sheet or in-situ it must be finished true and level (or to falls if necessary), and no one bay, tile, sheet or part of the work should project or be lower than any other by more than a specified amount. In addition to this, in-situ finishes must be specified as having a particular type of surface finish, *e.g.* trowelled hard and smooth with a steel float; polished, etc.
Laying tiles	The method of laying the tiles must not be specified but such matters as size, joint pattern, regularity, grouting and finish must be specified.
Laying sheet materials	Sheet materials will expand or contract after laying and due allowance must be made for this in the method of working. For example, thermoplastic materials are always warmed before laying, hardboard should be damped down before fixing so that it will shrink as it dries and remain taut, and linoleum will stretch it laid cold and then subjected to foot traffic in a warm room. Many of the sheet materials are impervious and if laid on a damp sub-base will cause mould growth and may eventually rot. In this case a humidity meter reading of the sub-base should be taken and the specification should state the conditions under which it should be taken and the highest reading at which it is considered advisable to lay the finishing.
Curing	Most finishes require a curing period before they can be used and many require certain conditions to effect proper curing and setting (magnesium-oxychloride is such a finish). The specification must therefore state the conditions under which curing is to take place and the minimum time at normal temperatures which is considered as adequate for proper curing.
Cleaning up	All finishes designed to be cleaned should be washed down or cleaned in some manner before the building is handed over to the employer.

SECTION V: GLAZING

Generally

British Standards and British Standard Codes of Practice	A list of all current and relevant BS and BSCP should be given.

Protection	The contractor is responsible for all damage to glass and glazing howsoever caused.
Samples	It is usual to ask the contractor to submit to the architect, for his approval, samples of the quality of glass he proposed to use.
Cleanliness and approval of work	All glass and glazing should be cleaned down and all cracked, broken or damaged panes must be replaced before the architect accepts the work as complete.
Materials	
Drawn sheet glass	The quality of drawn sheet glass is specified by giving an acceptable number of blemishes on any given area and an acceptable distortion due to lines and unequal glass thickness.
Wired cast glass polished plate glass Wired plate glass	The BS gives qualities and acceptable standards, which should be used.
Obscured glass Patterned glass	A type and quality of glass together with the name of the type should be given.
Glazing mastics	The types of mastics to be used must be listed and each dealt with individually. If the mastic complies with a BS, say so.
Sprigs and clips	This clause should require that an adequate number of sprigs or clips be used on all glazing work.
Glazing strips	There are many types of glazing strip; select the one required and specify it by type, quality and acceptable standard.
Leaded and copper lights	These range from a simple square light to the complicated stained glass patterned or picture lights. The cames are the same in all types of light. State the size and substance of the material and the method of jointing to form a casement.
Patent glazing	This is a patent method of glazing generally to roofs and roof lights, and the specification will refer to a particular type of glazing by a specified manufacturer. Failing this, an extensive list of clauses is needed to cover the materials in the bars and glazing, the spans to be covered by the bar, end details, etc.
Workmanship	
Storage of materials	Glass is easily damaged by a sharp blow: it is not nearly as obvious that water will permanently stain glass. Glass must be stored in a weatherproof hut, on edge and supported off the floor. It must be kept upright or it will warp and twist. Other materials used by the glazier, such as the putties and bedding

	cements, are damaged by extreme cold and they will certainly set if brought into contact with air. Patent glazing bars are easily bent or twisted, in fact all the materials should be carefully stored and the specification should be written to this effect.
General glazing	Glass is fixed with putty or beads. In either case the rebates must be clean and free from grit, etc., and they should be sealed with the appropriate solution to prevent damage to the fixing materials, *e.g.* unpainted timber will absorb the linseed oil from putty and leave it brittle. The methods of fixing the glass should be given, *e.g.* '. . . with back putty, sprigs and front putty struck off to a weathered face.'
Glazing leaded or copper lights	These are generally made up on the bench and fitted into the frame as a single unit. The making up of the frame, the quality of the jointing between cames, and the method of fixing the individual glass units should be given.
Labours on sheet glass	Grinding, cutting silvering and blacking of glass should each be dealt with separately, giving the standard of finish required by each.
Re-glazing	The hacking out of glass and cleaning and repainting of rebates should be specified. The fixing of new glass is dealt with as general glazing.
Patent glazing	Patent glazing is generally the subject of a sub-contract and the standard workmanship clauses of the sub-contractor will apply, but if the work is to be specified fully then the following points should be dealt with—wind and weather tight, tolerances in alignment, maximum spans and spacings, flashings and jointing to other types of roofing material, flashings and weatherings.

SECTION W: PAINTING AND DECORATING

Generally

British Standards and British Standard Codes of Practice	A list of all relevant and current BS and BSCP should be given.
Protection	The contractor is responsible for damage to decorations including damage consequent upon the work or the replacement of defective work. The specification usually emphasises painting, but this clause should apply equally to graining, varnishing, wax polishing, french polishing, oil polishing, signwriting and paperhanging.

Testing and sampling	The architect will retain the right to take samples and to have tested and analysed any material he thinks does not comply with the specification. The methods of sampling and testing that he intends to employ must be stated, usually by reference to a BS or BSCP.

Materials

Manufacturers and suppliers	It is common practice for a specific manufacturer to be named to supply all the materials required for the work. Where this is not done the contractor should be required to submit for the architect's approval the name of the materials' manufacturer or supplier he proposes to use, before placing his order. All paint and decorating materials must be delivered to the site in the makers' containers or packages with the seals unbroken.
Colours and tints	There is such a wide range of colours and tints of paint that it is unreasonable to expect the contractor to make every colour available to the architect so it is usual to restrict the choice to a standard range, *e.g.* the BS range.

Workmanship

It is advisable to divide this part into separate sections for Painting, Polishing, Paperhanging and the like; it will naturally fall into these parts so it is better to formalise the matter. Give each section a title.

PAINTING

Storage of materials	Extreme weather conditions affect paint—cold will cause the paint to separate into its constituent parts. It must therefore be stored in weatherproof, insulated or warmed conditions.
Painting in inclement weather	Paint must not be applied in either extremely high or extremely low temperatures or on surfaces which are damp; dust in the atmosphere will not prevent the paint from drying but it will spoil the surface.
Preparation of surfaces	'The better the preparation the better the finish' is a true saying for paintwork. Each different surface—wood, metal, plaster, concrete, etc.—is going to need a different preparation. In many cases the stages of preparation will need to be sub-divided into separate clauses. Do not tell the contractor how to do the job, tell him what is required, *e.g.* 'All surfaces are to be rubbed down until smooth and even, and all blemishes are to be filled with a hard stopping.'

BS 1014 Pigments for cement, magnesium oxychloride and
BS 1047 Blast-furnace slag.
BS 1144 Cold twisted steel bars for concrete reinforcement
BS 1165 Clinker

POLISHING

Preparation of surfaces

In polished work the preparation is even more important than with paintwork, as every blemish in the surface will be magnified by the polish. Finishing the joinery to be polished will be specified in the joinery section, but it will do no harm to repeat it here.

Finishing to surface

Timber can be polished with oil, wax or spirit polishes (french polish) and each can be used to give a number of different kinds of surface. Therefore it is necessary to decide what is wanted, and how it is produced, and with this in mind to describe the standard of finish to be used. Sample panels finished in various grades and densities may be submitted to the architect in order to decide the exact standard required.

PAPERHANGING

Pasting

Pastes will readily go sour causing stains or mould growth on the paper; they must therefore be fresh mixed for each room or job. The paste must be mixed in accordance with the manufacturer's instructions and until smooth. Paste must not be applied too thickly on the paper, as the surplus will cause discolouration of the paper or cause a bulge under the paper after drying.

Hanging

Vertical patterns must be vertical and horizontal ones horizontal. The paper should be hung with butt joints, not lapped, and properly patterned together. Cutting around projections (light switches, etc.), into corners and up to architraves must be neatly and accurately done.

APPENDIX A

BRITISH STANDARDS RELEVANT TO THE CONSTRUCTION INDUSTRY

(Copies of these standards may be obtained from the British Standards Institution, Sales Branch, 101 Pentonville Road, London, N.1.)

The following British Standards have been classified in accordance with the Standard Method of Measurement Work Sections.

The standards printed first in each section are those contained in BS Handbook No. 3 but as this does not include all the standards relevant to the construction industry the list is supplemented by other standards (given in italics) which also have relevance.

An asterisk (*) against the number of a standard indicates that it specifies a product upon which the BSI will grant permission to use the 'Kite mark'.

SECTION D: EXCAVATION AND EARTHWORKS

No relevant standards are given in BS handbook No. 3.

BS 1377 *Methods of testing soils for civil engineering purposes*
BS 1924 *Methods of test for stabilized soils.*
BS 3882 *Recommendations and classification for top soil.*
BS 3969 *Recommendations for turf for general landscape purposes.*
BS 3975 *Glossary for landscape work.*

SECTION F: CONCRETE WORK

BS 12 Portland cement (ordinary and rapid hardening).
BS 146 Portland blast furnace cement.
*BS 340 Precast concrete kerbs, channels, edgings and quadrants.
*BS 368 Precast concrete flags.
BS 785 Rolled steel bars and hard-drawn steel wire for concrete reinforcement.
BS 877 Foamed blast-furnace slag—for concrete aggregate.
BS 882 & 1201 Aggregates from natural sources for concrete (including granolithic).
BS 915 High alumina cement.
BS 1014 Pigments for cement, magnesium oxychloride and concrete.
BS 1047 Blast-furnace slag.
BS 1144 Cold twisted steel bars for concrete reinforcement.
BS 1165 Clinker aggregate for concrete.
BS 1221 Steel fabric for the reinforcement of concrete.

BS 1237 Cast concrete sills.
BS 1239 Cast concrete lintels.
BS 1478 Bending dimensions and scheduling of bars for the reinforcement of concrete.
BS 1521 Waterproof building papers.
BS 1878 Corrugated copper jointing strip for expansion joints.
BS 1881 Methods of testing concrete.
BS 1926 Ready mixed concrete.
BS 2539 Preferred dimensions of reinforced concrete structural members.
BS 2691 Steel wire for prestressed concrete.
BS 2908 Precast concrete eaves, gutters.
*BS 3572 Access fittings for chimneys and other high structures in concrete or brickwork.
BS 3617 Stress relieved 7-wire strand for prestressed concrete.
BS 3797 Lightweight aggregates for concrete.
BS 3798 Coping units.
BS 3809 Wood wool permanent formwork and infill units for reinforced concrete floor and roof slabs.
BS 3892 Pulverized fuel ash for use in concrete.
BS 4027 Sulphate-resisting portland cement.
BS 4074 Metal props and struts.
BS 4132 Winkle clinker for landscape work.
*BS 1129 *Timber ladders, steps, trestles and lightweight stagings for industrial use.*
BS 1139 *Metal scaffolding.*
BS 1305 *Batch type concrete mixers.*
*BS 1308 *Concrete street lighting columns.*
BS 1370 *Low heat portland cement.*
BS 1796 *Methods for the use of BS fine mesh test sieves.*
BS 2482 *Timber scaffold boards.*
BS 2787 *Glossary of terms for concrete and reinforced concrete.*
BS 3148 *Tests for water for making concrete.*

SECTION G: BRICKWORK AND BLOCKWORK

BS 12 Portland cement (ordinary and rapid hardening).
BS 41 Cast iron spigot and socket flue or smoke pipes and fittings.
BS 187 Sand lime (calcium silicate) bricks.
BS 493 Airbricks and gratings for wall ventilation.
BS 567 Asbestos cement flue pipes and fittings, light quality.
BS 715 Sheet metal flue pipes and accessories for gas fired appliances.
*BS 743 Materials for damp-proof courses.
BS 835 Asbestos cement flue pipes and fittings, heavy quality.
BS 890 Building limes.
BS 899 Rolled copper sheet, strip and foil.
BS 990 Steel casement windows and doors.
BS 1014 Pigments for cement, magnesium oxychloride and concrete.
BS 1178 Milled sheet lead and strip for building purposes.
BS 1180 Concrete bricks and fixing bricks.

BS 1181 Clay flue linings and chimney pots.
BS 1200 Sands for mortar for plain and reinforced brickwork; blockwalling and masonry.
BS 1207 Hollow glass blocks.
BS 1236–40 Sills and lintels.
BS 1243 Metal ties for cavity wall construction.
*BS 1251 Open fireplace components.
BS 1289 Precast concrete flue blocks for gas fires and ventilation.
BS 1294 Soot doors for domestic buildings.
BS 1310 Coal tar pitches for building purposes.
BS 1364 Aerated concrete building blocks.
BS 1470 Wrought aluminium and aluminium alloys, sheet and strip.
BS 1521 Waterproof building papers.
BS 2028 Precast concrete blocks.
BS 2503 Steel windows for agricultural use.
BS 2832 Hot applied damp resisting coatings for solums.
BS 2908 Precast concrete eaves gutters.
BS 3416 Black bitumen coating solutions.
*BS 3572 Access fittings for chimneys.
BS 3679 Acid resisting bricks and tiles.
BS 3798 Coping units.
BS 3826 Silicone based water repellants for masonry.
BS 3921 Specification for bricks and blocks of fired brickearth, clay or shale.
BS 4016 Building papers.
*BS 1129 *Timber ladders, steps, trestles and lightweight stagings for industrial use.*
BS 1139 *Metal scaffolding.*
BS 1758 *Fireclay refractories (bricks and shapes).*
BS 2482 *Timber scaffold boards.*

SECTION J & K: RUBBLE WALLING & MASONRY

BS 435 Granite and whinstone kerbs, channels, quadrants and setts.
BS 706 Sandstone kerbs, channels, quadrants and setts.
BS 1217 Cast stone.
BS 1238 Natural stone and slate sills.
BS 1240 Natural stone lintels.
BS 3798 Coping units.
BS 3826 Silicone based water repellants for masonry.
BS 2847 *Glossary of terms for stone used in building.*

SECTION L: ASPHALT WORK

BS 594 Rolled asphalt (Hot Process).
*BS 988, 1097, 1076 & 1451 Mastic asphalt for building (limestone aggregate).
*BS 1162, 1418, 1410 Mastic asphalt for building (natural rock asphalt aggregate).
BS 1324 Asphalt tiles for paving and flooring.

*BS 1446 Mastic asphalt (natural rock asphalt aggregate) for roads and footways.
*BS 1447 Mastic asphalt (limestone aggregate) for roads and footways.
BS 1690 Cold asphalt.
BS 348 *Compressed natural rock asphalt.*
*BS 3262 *Road marking materials.*

SECTION M: ROOFING

BS 402 Clay plain roofing tiles and fittings.
BS 473 Concrete plain roofing tiles.
BS 550 Concrete interlocking roofing tiles.
BS 680 Roofing slates.
BS 690 Asbestos cement slates and sheets.
*BS 747 Roofing felts.
BS 849 Plain sheet zinc roofing.
BS 1178 Milled lead sheet and strip for building purposes.
BS 1202 Wire nails and cut nails for building purposes.
BS 1310 Coal tar pitches for building purposes.
BS 1318 Wood battens and counter battens for slating and tiling.
BS 1424 Clay single lap roofing tiles and fittings.
BS 1494 Fixing accessories for building purposes.
BS 1569 Copper sheet and strip for roofing and other building purposes.
BS 2855 Corrugated aluminium sheets for general purposes.
BS 3083 Hot dipped galvanized corrugated steel sheets.
BS 3428 Troughed aluminium building sheet.
BS 3717 Asbestos cement decking.
BS 4154 Corrugated plastics translucent sheets made from polyester resins (glass fibre reinforced).
BS 4203 Extruded rigid PVC corrugated sheeting.
*BS 1129 *Timber ladders, steps, trestles and lightweight staging for industrial use.*
BS 1139 *Metal scaffolding.*
BS 2482 *Timber scaffold boards.*
BS 2717 *Glossary of terms applicable to roof coverings.*
BS 3712 *Methods of test for building mastics (other than mastic asphalt).*

SECTION N & P: CARPENTRY & JOINERY

BS 144 Coal tar creosote for the preservation of timber.
BS 455 Locks and latches for doors.
BS 459 Panelled and glazed wood doors.
BS 584 Wood trim.
BS 585 Wood stairs.
BS 606 Plaited sash cords made from hemp.
BS 644 Wood casement windows.
BS 745 Animal glue for wood.
BS 881 & 589 Nomenclature of commercial timbers.
BS 913 Pressure creosoting of timber.
*BS 1088 Marine plywood manufactured from selected untreated tropical hardwoods.

SCHEDULE OF TRADE HEADINGS WITH TYPICAL ITEMS UNDER EACH HEADING

1. *Preliminaries*

5. *Concrete*
Generally — Materials and workmanship. C

BS 1105 Unreinforced wood wool building slabs.
BS 1142 Fibre building boards.
BS 1186 Quality of timber and workmanship in joinery.
BS 1195 Kitchen fitments and equipment.
BS 1202 Wire nails and cut nails for building purposes.
*BS 1203 Synthetic resin adhesives for plywood.
*BS 1204 Synthetic resin adhesives (phenolic and aminoplastic) for wood.
BS 1210 Wood screws.
*BS 1224 Electroplated coatings of nickel and chromium.
BS 1226 Draining boards.
BS 1227 Hinges.
BS 1228 Door bolts.
BS 1282 Classification of wood preservatives and their method of application.
BS 1285 Wood surrounds for steel windows and doors.
BS 1292 Storage fitments for living rooms and bedrooms.
BS 1297 Grading and sizing of softwood flooring.
BS 1331 Builders' hardware for housing.
BS 1396 Gas meter cupboards for domestic premises.
BS 1444 Cold setting casein glue for wood.
BS 1455 Plywood manufactured from tropical hardwoods.
BS 1494 Fixing accessories for building purposes.
BS 1567 Wood door frames and linings.
BS 1579 Connectors for timber.
BS 1615 Anodic oxidation coatings on aluminium.
BS 1860 Structural timber. Measurement of characteristics affecting strength.
BS 2088 Performance test for locks.
BS 2572 Phenolic laminated sheet.
*BS 2604 Resin bonded wood chipboard.
BS 2911 Letter plates.
BS 3051 Coal tar oil types of wood preservatives.
BS 3444 Blockboard and laminboard.
BS 3452 Copper/chrome waterborne wood preservatives and their application.
BS 3453 Fluoride/arsenate/chromate/dinitrophenol waterborne wood preservatives and their application.
*BS 3621 Thief resistant locks for hinged doors.
BS 3794 Decorative laminated plastics sheet.
BS 3819 Grading rules for sawn home grown softwood.
BS 3842 Treatment of plywood with preservatives.
BS 3940 Adhesives based on bitumen and coal tar.
BS 4046 Compressed straw building slabs.
BS 4047 Grading rules for sawn home grown hardwood.
BS 4071 Polyvinyl acetate (PVA) emulsion adhesives for wood.
BS 4072 Wood preservation by means of waterborne copper/chrome/arsenic compositions.
BS 4092 Domestic front entrance gates.

BS 4169 Glued laminated timber structural members.
BS 373 *Testing small clear specimens of timber.*
BS 565 *Glossary of terms relating to timber and woodwork.*
BS 647 *Methods of sampling and testing glues.*
BS 826 *Adjustable steel shelving (angle post type).*
BS 844 *Methods of sampling and testing vegetable adhesives.*
BS 871 *Abrasive papers and cloths for general purposes.*
BS 1811 *Methods of test for wood chipboards and other particle boards.*
BS 1990 *Wood poles for overhead lines.*
BS 2018 *Plaited cords made from hemp.*
BS 2504 *Wood doors and frames for milking parlours.*
*BS 3415 *Mechanical performance of venetian blinds.*
BS 3493 *Information about plywood.*
BS 3544 *Methods of test for polyvinyl acetate adhesives for wood.*
BS 3583 *Information about blockboard and laminboard.*
BS 3712 *Methods of test for building mastics (other than mastic asphalt).*
BS 3872 *Glossary of terms relating to builders' hardware.*

SECTION Q: STRUCTURAL STEELWORK

BS 4 Structural steel sections.
BS 15 Mild Steel for general structural purposes.
BS 449 The use of structural steel in building.
BS 916 Black bolts screws and nuts.
BS 968 High yield stress (welding quality) structural steel.
BS 1769 Unified black hexagon bolts, screws and nuts.
BS 3139 High strength friction grip bolts for structural engineering.
BS 3410 Metal washers for general engineering purposes.
BS 18 *Methods of tensile testing of metals.*
BS 1109 *Cold forged mild steel rivets for cold closing.*
BS 1449 *Steel plate, sheet and strip.*
BS 3294 *The use of high strength friction grip bolts in structural steel work.*

SECTION R: METAL WORK

BS 405 Expanded metal (steel).
*BS 792 Mild steel dustbins.
BS 990 Steel casement windows and doors.
BS 1136 Mild steel refuse storage containers.
BS 1161 Aluminium alloy sections.
*BS 1224 Electroplated coatings of nickel and chromium.
BS 1245 Metal door frames (steel).
BS 1246 Metal skirtings, picture rails and beads.
BS 1294 Soot doors for domestic buildings.
BS 1422 Steel sub-frames, sills and window boards for metal windows.
BS 1448 Nomenclature of decorative metallic finishes.
BS 1470 Wrought aluminium and aluminium alloys. Sheet and strip.
BS 1577 Mild steel refuse or food waste containers.
BS 1615 Anodic oxidation coatings on aluminium.
BS 1703 Refuse chutes for multi-storey buildings.
BS 1706 Electroplated coatings of cadmium and zinc on iron and steel.

BS 1787 Steel windows for industrial buildings.
BS 2503 Steel windows for agricultural use.
BS 2569 Sprayed metal coatings.
*BS 2788 Fireguards for solid fuel fires.
BS 2994 Cold rolled steel sections.
BS 3083 Hot dipped galvanized corrugated steel sheets for general purposes.
*BS 3140 Fireguards for solid fuel combination grates.
BS 3248 Sparkguards for solid fuel fires.
BS 3410 Metal washers for general engineering purposes.
BS 3495 Aluminium refuse storage containers.
*BS 3572 Access fittings for chimneys and other high structures in concrete or brickwork.
BS 3706 Mild steel for general engineering purposes.
BS 3830 Vitreous enamelled steel building components.
BS 4076 Steel chimneys.
BS 4092 Domestic front entrance gates.
BS 1109 *Cold forged mild steel rivets for cold closing.*
BS 1249 *Cast iron columns for street lighting.*
BS 1344 *Methods of testing vitreous enamel finishes.*
BS 1840 *Steel columns for street lighting.*
BS 1945 *Fireguards for heating appliances.*
BS 3654 *Galvanized steel dustbins for dustless emptying.*
BS 3712 *Methods of test for building mastics (other than mastic asphalt).*
BS 3987 *Anodised wrought aluminium for external architectural application.*
BS 3989 *Aluminium street lighting columns.*

SECTION S: PLUMBING AND ENGINEERING INSTALLATIONS

BS 41 Cast iron spigot and socket flue or smoke pipes and fittings.
*BS 61 Copper tubes.
*BS 78 Cast iron spigot and socket pipes and fittings.
BS 99 Copper alloy pipe fittings.
*BS 143 Malleable cast iron and cast copper alloy pipe fittings for steam, water, gas and oil.
BS 217 Red lead for paints and jointing compounds.
BS 219 Soft solders.
*BS 416 Cast iron spigot and socket soil, waste and ventilating pipes (sand cast and spun) and fittings.
*BS 417 Galvanized mild steel cisterns and covers, tanks and cylinders.
*BS 460 Cast iron rain water goods.
*BS 486 Asbestos cement pressure pipes.
BS 504 Drawn lead traps.
BS 534 Steel pipes, fittings and specials for water, gas and sewage.
BS 569 Asbestos cement rainwater pipes, gutters and fittings.
BS 582 Asbestos cement soil, waste and ventilating pipes and fittings.
BS 602 Lead pipes.
*BS 659 Light gauge copper tubes (light drawn).
*BS 699 Copper cylinders for domestic purposes.

BS 715 Sheet metal flue pipes and accessories for gas fired appliances.
BS 758 Small domestic hot water supply boilers using solid fuel.
BS 779 Cast iron boilers.
*BS 799 Oil burning equipment.
BS 835 Asbestos cement flue pipes and fittings, heavy quality.
*BS 853 Calorifiers for central heating and hot water supply.
*BS 855 Welded steel boilers.
*BS 864 Capillary and compression fittings of copper and copper alloy.
*BS 1010 Draw-off taps and stop-valves for water services (screwdown pattern).
BS 1091 Pressed steel gutters, rainwater pipes, fittings and accessories.
*BS 1125 WC Flushing cisterns.
BS 1130 Schedule of cast iron drain fittings.
*BS 1143 Special salt-glazed ware pipes.
BS 1178 Milled sheet lead and strip for building purposes.
BS 1182 Cast brass thimbles (spigot and socket) and tail pieces.
*BS 1184 Copper and copper alloy traps.
BS 1185 Guards for underground stop valves.
BS 1188 Ceramic wash basins and pedestals.
BS 1189 Cast iron baths.
BS 1206 Fireclay sinks.
BS 1208 Semi-rotary pumps.
*BS 1211 Centrifugally cast (spun) iron pipes for water, gas and sewage.
*BS 1212 Ball valves (portsmouth type) excluding floats.
BS 1213 Ceramic washdown WC pans.
BS 1229 Fireclay wash-tubs and tub and sink sets.
BS 1244 Metal sinks.
BS 1252 Domestic solid fuel cookers with integral grates.
*BS 1254 WC seats (plastics).
BS 1255 Brackets and supports for lavatory basins and sinks.
BS 1256 Malleable cast iron and cast copper alloy pipe fittings for steam, water, gas and oil.
BS 1291 Ferrous traps for baths.
BS 1329 Metal lavatory basins.
BS 1331 Builders' hardware for housing.
BS 1334 The use of thermal insulating materials for central heating and hot and cold water supply installations.
BS 1358 Colours for vitreous enamel finishes.
*BS 1386 Copper tubes to be buried underground.
BS 1387 Steel tubes and tubulars.
BS 1390 Sheet steel baths.
*BS 1415 Mixing valves.
BS 1431 Wrought copper and wrought zinc rainwater goods.
BS 1494 Fixing accessories for building purposes.
*BS 1565 Galvanized mild steel indirect cylinders annular or saddle-back type.
*BS 1566 Copper indirect cylinders for domestic purposes.
BS 1710 Identification of pipe lines.

BS 1737 Jointing materials and compounds.
*BS 1740 Wrought pipe fittings iron and steel (screwed BSP thread)
BS 1775 Steel tubes for mechanical, structural and general engineering purposes.
BS 1876 Automatic flushing cisterns for urinals.
*BS 1952 Copper alloy gate valves for general purposes.
BS 1968 Floats for ball valves (copper).
BS 1972 Polythene pipe (type 425) for cold water services.
BS 2017 Copper tubes for general purposes.
BS 2081 Portable closets for use with chemicals.
BS 2089 WC seats (wooden).
*BS 2456 Floats for ball valves (plastics) for cold water.
BS 2494 Rubber joint rings.
BS 2580 Underground plug cocks.
BS 2767 Valves and unions for radiators.
BS 2777 Asbestos cement cisterns.
*BS 2845 Coke-burning inset open fires without boiler and without convection.
*BS 2879 Draining taps (screwdown pattern).
BS 2997 Aluminium rainwater goods.
*BS 3128 Inset open fires with boiler and without convection.
*BS 3198 Combination hot water storage units (copper).
*BS 3284 Polythene pipe (type 710) for cold water services.
BS 3376 Open fires with convection.
*BS 3377 Back boilers.
BS 3378 Domestic heating stoves.
BS 3380 Wastes for sanitary appliances.
BS 3402 Quality of vitreous china sanitary appliances.
BS 3416 Black bitumen coating solutions.
BS 3457 Materials for tap washers.
*BS 3461 Surface boxes for waterworks purposes.
*BS 3464 Cast iron wedge and double disk gate valves.
BS 3505 Unplasticized PVC pipe (type 1420).
BS 3506 Unplasticized PVC pipe.
BS 3528 Convection type space heaters operating on steam or hot water.
BS 3590 Sprayed asbestos insulation.
BS 3601 Steel pipes and tubes.
BS 3837 Expanded polystyrene board for thermal insulation purposes.
BS 3867 Dimensions of pipes of plastics materials.
BS 3868 Prefabricated drainage stack units: galvanized steel.
BS 3869 Rigid expanded polyvinyl chloride for thermal insulation purposes and building applications.
BS 3927 Phenolic foam materials for thermal insulation and building applications.
*BS 3931 Hard-drawn thin wall copper tubes.
*BS 3943 Plastics waste traps.
BS 3952 Cast iron butterfly valves.
BS 3954 Asbestos cement ducting.

SCHEDULE OF TRADE HEADINGS WITH TYPICAL ITEMS UNDER EACH HEADING

BS 3958 Thermal insulating materials.
BS 3961 Cast iron screwdown stop valves and check valves.
BS 4127 Light gauge stainless steel tubes.
BS 4135 Sinks for domestic purposes made from acrylic sheet.
BS 4159 Colour marking of plastics pipes to indicate pressure ratings.
BS 4182 Coated carbon steel tubes intended for small bore closed circuit central heating systems.
BS 4213 Polyolefin or olefin copolymer moulded cold water storage cisterns Metric units.
BS 10 *Flanges and bolting for pipes, valves and fittings.*
BS 66 *Copper alloy three piece unions (for low and medium pressure screwed copper tubes).*
BS 138 *Portable fire eqtinguishers of the water type (soda acid).*
BS 336 *Fire hose couplings and ancillary equipment.*
BS 570 *Plug-and-socket gas connectors for portable appliances.*
BS 746 *Gas meter unions and adaptors.*
BS 750 *Underground fire hydrants and dimensions of surface box openings.*
BS 778 *Steel pipes and joints for hydraulic purposes.*
BS 830 *80 oz. and 90 oz. Winchester bottles.*
BS 1113 *Water tube boilers.*
BS 1218 *Sluice valves for waterworks purposes.*
BS 1250 *Domestic appliances burning town gas.*
BS 1306 *Non-ferrous pipes and tubes for steam services.*
BS 1307 *Gas fired boilers and waste heat boilers.*
BS 1333 *Acid resisting silicon iron pipes and pipe fittings.*
BS 1381 *Gas lighting units and fittings for single family dwellings.*
BS 1382 *Portable fire eqtinguishers of the water type (gas pressure).*
BS 1635 *Graphic symbols for fire protection drawings.*
BS 1641 *Cast iron pipe fittings for sprinklers and other fire protection installations.*
BS 1689 *Galvanized mild steel fire buckets.*
BS 1958 *Tools for soldered socket–spigot joints for lead and lead alloy pipes.*
BS 1963 *Pressure operated relay valves for use with town gas.*
*BS 2035 *Cast iron flanged pipes and flanged fittings.*
BS 2815 *Compressed asbestos fibre jointing.*
BS 2972 *Methods of test for thermal insulating materials.*
*BS 3116 *Heat sensitive detectors for automatic fire alarm systems in buildings.*
BS 3251 *Hydrant indicator plates.*
BS 3326 *Portable carbon dioxide fire extinguishers.*
BS 3465 *Dry powder portable fire extinguishers.*
BS 3533 *Glossary of terms relating to thermal insulation.*
BS 3709 *Portable fire extinguishers of the water type (stored pressure).*
BS 3796 *Polythene tube (type 710) for general purposes including chemical and food industry uses.*
BS 3899 *Refrigerated room air conditioner.*
BS 3948 *Cast iron parallel slide valves for general purposes.*
BS 3974 *Pipe supports.*
BS 3980 *Boxes for foam inlets and dry risers.*
BS 4090 *Cast iron check valves for general purposes.*

Generally — Materials and workmanship. Concre
trol and tests. Cold weather wo

SECTION T: ELECTRICAL INSTALLATION

BS 899 Rolled copper sheet, strip and foil for general purposes.
BS 3973 Asbestos cement cable conduits and troughs.
BS 4108 Pitch fibre conduit.
*BS 31 *Steel conduits and fittings for electrical wiring.*
BS 37 *Electricity meters.*
*BS 67 *Two- and three-terminal ceiling roses.*
BS 1249 *Cast iron columns for street lighting.*
*BS 1308 *Concrete street lighting columns.*
BS 1454 *Consumers' electricity control units.*
*BS 1788 *Street lighting lanterns for use with electric lamps.*
BS 1833 *Cooker control units rated 30 amp, 250 volts single phase ac only.*
BS 1840 *Steel columns for street lighting.*
BS 1990 *Wood poles for overhead lines.*
BS 2484 *Cable covers, concrete and earthenware.*
BS 3989 *Aluminium street lighting columns.*

SECTION U: PLASTERWORK AND OTHER WALL AND CEILING FINISHES

BS 12 Portland cement (ordinary and rapid hardening).
*BS 340 Precast concrete kerbs, channels, edgings and quadrants.
*BS 368 Precast concrete flags.
BS 405 Expanded metal (steel).
BS 776 Materials for magnesium oxychloride (magnesite) flooring.
BS 802 Tarmacadam with crushed rock or slag aggregate.
BS 810 Sheet linoleum (calendered types): cork carpet and linoleum tiles.
BS 882 & 1201 Aggregates from natural sources for concrete (including granolithic).
BS 1014 Pigments for cement, magnesium oxychloride and concrete.
BS 1187 Wood blocks for floors.
BS 1191 Gypsum building plasters.
BS 1197 Concrete flooring tiles and fittings.
BS 1198 Sands for internal plastering with gypsum plasters.
BS 1199 Sands for external renderings; internal plastering with lime and portland cement floor screeds.
BS 1230 Gypsum plaster board.
BS 1241 Tarmacadam and tar carpets.
BS 1242 Tarmacadam 'tarpaving' for footpaths, playgrounds and similar works.
BS 1281 Glazed ceramic tiles and tile fittings for internal walls.
BS 1286 Clay tiles for flooring.
BS 1310 Coal tar pitches for building purposes.
BS 1317 Wood laths for plastering.
BS 1324 Asphalt tiles for paving and flooring.
BS 1369 Metal lathing (steel) for plastering.
*BS 1450 Black pitch mastic flooring.
BS 1621 Bitumen macadam with crushed rock or slag aggregate.
BS 1690 Cold asphalt.

BS 1711 Solid rubber flooring.
BS 1863 Felt backed linoleum.
BS 2040 Bitumen macadam with gravel aggregate.
BS 2552 Polystyrene tiles for walls and ceilings.
BS 2572 Phenolic laminated sheet.
BS 2592 Thermoplastic flooring tiles.
BS 3187 Rubber flooring.
*BS 3260 PVC (vinyl) asbestos floor tiles.
BS 3261 Flexible PVC flooring.
BS 3398 Anti-static rubber flooring.
*BS 3536 Asbestos insulating boards and asbestos wall boards.
*BS 3672 Coloured pitch mastic flooring.
BS 3679 Acid-resisting bricks and tiles.
BS 3757 Rigid PVC sheet.
BS 3760 Cast gypsum panels (with core).
*BS 3794 Decorative laminated plastics sheet.
BS 3835 Rigid PVC profiles for fitting sheet lining materials.
BS 3837 Expanded polystyrene board for thermal insulation purposes.
BS 3932 Expanded polystyrene tiles and profiles for the building industry.
BS 3940 Adhesives based on bitumen and coal tar.
BS 4022 Prefabricated gypsum wall board panels.
BS 4036 Asbestos-cement fully compressed flat sheet.
BS 4046 Compressed straw building slabs.
BS 4050 Wood mosaic flooring.
BS 4131 Terrazzo tiles.
BS 4132 Winkle clinker for landscape work.
*BS 1129 *Timber ladders, steps, trestles and lightweight staging for industrial use.*
BS 1139 *Metal scaffolding.*
BS 2482 *Timber scaffold boards.*
BS 4049 *Glossary of terms applicable to internal plastering, external rendering and floor screeding.*

SECTION V: GLAZING

BS 544 Linseed oil putty.
BS 952 Classification of glass for glazing and terminology for glass.
BS 4255 Preformed rubber gaskets for weather exclusion from buildings.

SECTION W: PAINTING AND DECORATING

BS 217 Red lead for paints and jointing compounds.
BS 277–8 Ready mixed paints (oil gloss).
BS 381C Colours for specific purposes.
BS 1053 Water paint and distemper for interior use.
BS 1070 Black paint (tar base).
BS 1215 Oil stains.
BS 1248 Wallpaper.
BS 1282 Classification of wood preservatives and their method of application.
BS 1336 Knotting.
BS 2521 Lead-based priming paint for woodwork.

Generally

trol and tests. Cold
placing and compacting. Protection and curing
Construction joints. Expansion and contraction
Form work.

BS 2523 Lead-based priming paints for iron and steel.
BS 2524 Red oxide–linseed oil priming paint.
BS 2525–32 Ready mixed oil-based undercoating and finishing paints.
BS 2660 Colours for building and decorative paints.
BS 2929 Safety colours for use in industry.
BS 3046 Paper-hanging pastes and powders.
BS 3051 Coal tar oil types of wood preservatives.
BS 3357 Glue size for decorators' use.
BS 3416 Black bitumen coating solutions.
BS 3452 Copper/chrome water-borne wood preservatives and their application.
BS 3453 Fluoride/arsenate/chromate/dinitrophenol water-borne wood preservatives and their application.
BS 3634 Black bitumen oil varnish.
BS 3698 Calcium plumbate priming paints.
*BS 3761 Water rinsable and solvent rinsable paint removers.
BS 3826 Silicone-based water repellants for masonry.
BS 3842 Treatment of plywood with preservatives.
BS 4072 Wood preservation by means of water-borne copper/chrome/arsenic compositions.
BS 239 *White pigments for paints.*
BS 242, 243, 259 *Linseed oil for paints.*
BS 244 & 290 *Turpentine for paints.*
BS 245 *White spirit.*
BS 282 & 389 *Lead chromes and zinc chromes for paints.*
BS 283 *Prussian blue for paints.*
BS 284–6 *Black (carbon) pigments for paints.*
BS 303 *Brunswick or lead chrome greens for paints.*
BS 311 *Gold size for paints.*
BS 318 *Green oxide of chromium for paints.*
BS 332 *Liquid driers for oil paints.*
BS 388 *Aluminium flake pigments for paints.*
*BS 389 *Zinc chrome for paints.*
BS 390 *Oil pastes for paints.*
*BS 1129 *Timber ladders, steps, trestles and lightweight stagings for industrial use.*
BS 1139 *Metal scaffolding.*
BS 1262 *Tins for liquid paints and varnishes.*
BS 1795 *Extenders for paints.*
BS 2029 *White oil pastes for paints.*
BS 2482 *Timber scaffold boards.*
BS 3483 *Methods for testing pigments for paints.*
BS 3599 *Organic pigments for paints.*
BS 3900 *Methods of tests for paints.*
BS 3981 *Iron oxide pigments for paints.*

SECTION X: DRAINAGE

*BS 65 & 540 Clay drain and sewer pipes including surface water pipes and fittings.

*BS 78 Cast iron spigot and socket pipes (vertically cast) and spigot and socket fittings.
BS 217 Red lead.
BS 437 Cast iron spigot and socket drain pipes.
*BS 486 Asbestos cement pressure pipes.
*BS 497 Manhole covers, road gulley gratings and frames for drainage purposes.
BS 534 Steel pipes, fittings and specials for water, gas and sewage.
BS 539 Dimensions of drain fittings.
*BS 556 Concrete cylindrical pipes and fittings.
*BS 1143 Salt glazed ware pipes with chemically resistant properties.
BS 1194 Concrete porous pipes for under-drainage.
BS 1196 Clayware field drain pipes.
*BS 1211 Centrifugally cast (spun) iron pipes for water, gas and sewage.
*BS 1247 Manhole step iron.
*BS 2760 Pitch-impregnated fibre drain and sewer pipes.
BS 3656 Asbestos cement pipes and fittings for sewage and drainage.
BS 4101 Concrete unreinforced tubes and fittings with ogee joints for surface water drainage.
BS 1634 *Dimensions for stoneware pipes and pipe fittings for chemical purposes.*

SECTION Y: FENCING

BS 1485 Galvanized wire netting.
BS 1722 Strained wire fences.
BS 3470 Field gates and posts.
BS 3854 Farm stock fences.
BS 4092 Domestic front entrance gates.
BS 4102 Steel wire for fences.

SUNDRY ITEMS; GENERALLY (THOSE NOT RELATING TO ANY WORK SECTION)

BS 476 Fire tests on building materials and structures.
BS 648 Schedule of weights of building materials.
BS 685 Sequence of trade headings and specification items for building work.
BS 1192 Architectural drawing office practice.
BS 1373 Clothes line posts.
BS 1982 Methods of testing fungal resistance of manufactured building materials.
BS 2053 General purpose farm buildings of framed construction.
BS 2655 Electric lifts part 3 outline dimensions.
BS 3735 Rubber components for steel dustbins.
BS 3778 Storey heights.
BS 4008 Cattle grids on private roads.
BS 4011 Recommendations for the co-ordination of dimensions in building. Basic sizes for building components and assemblies.
BS 4074 Metal props and struts.
BS 4107 Fixed outdoor rotary clothes driers.
BS 4125 Child safety barriers for domestic premises.

BS 4176 Floor to floor heights. Metric units.
BS 4254 Two part polysulphide-based sealing compound for the building industry. Metric units.
BS 1151 *Form of time and wages sheet and pay packet for the building and civil engineering contracting industries.*
BS 1214 *Hessian sandbags and rotproofed hessian sandbags.*
BS 1265–68 *Drawing boards and tee squares.*
BS 1347 *Architects', engineers' and surveyors' scales.*
BS 1439 *Industrial paper towelling and dispensing cabinets.*
BS 1708 *Modular co-ordination.*
BS 1716 *Cycle stands.*
BS 1749 *Alphabetical arrangement.*
BS 1754 *Steel barns with curved roofs.*
BS 1786 *Steel wheelbarrows, general purpose type.*
BS 2750 *Recommendations for field and laboratory measurement of airborne and impact sound transmission in buildings.*
BS 2900 *Modular co-ordination in building.*
BS 3327 *Stationery for quantity surveying.*
BS 3589 *Glossary of general building terms.*
BS 3626 *Recommendations for a system of tolerances and fits in building.*
BS 4035 *Linear measuring instruments for use on building and civil engineering construction works.*

SUNDRY ITEMS: ROADS

BS 63 *Single sized roadstone and chippings.*
BS 76 *Tars for road purposes.*
BS 434 *Bitumen road emulsion (anionic).*
BS 598 *Sampling and examination of bituminous mixtures for roads.*
BS 892 *Glossary of highway engineering terms.*
BS 1573 *Road studs and plates.*
BS 1622 *Winter gritters for roads.*
BS 1623 *Hand rollers for road and constructional engineering.*
BS 1707 *Hot binder distributors for road surface dressing.*
BS 1984 *Single-sized gravel aggregate for roads.*
BS 2542 *Recommendations for the use of bitumen emulsion (anionic) for roads.*
*BS 3049 *Pedestrian guard rails (metal).*
BS 3136 *Emulsion spraying machines for roads.*
BS 3235 *Test methods for bitumen.*
*BS 3262 *Road marking materials.*
BS 3690 *Bitumens for road purposes.*

SUNDRY ITEMS: RAILWAY WORK

BS 9 *Bull head railway rails.*
BS 11 *Flat bottom railway rails.*
BS 47 *Steel fishplates for bull head and flat bottom railway rails.*
BS 64 *Steel fishbolts and nuts for railway rails.*
BS 105 *Light and heavy bridge type railway rails.*
BS 500 *Steel railway sleepers for flat bottom rails.*
BS 751 *Steel bearing plates for flat bottom railway rails.*
*BS 986 *Concrete railway sleepers.*

CP 333 Selection and installation of town gas hot water supplies.
Part 1. Domestic premises.
Part 2. Schools.
CP 337 Flues for gas appliances.
CP 341.300–307 Central heating by low pressure hot water.
CP 342 Centralized domestic hot water supply.
CP 352 Mechanical ventilation and air conditioning in buildings.
CP 402 Fire fighting installations and equipment.
.101 Hydrant systems.
.201 Sprinkler systems.
Part 3. Portable fire extinguishers for buildings and plant.
CP 403 Open fires, heating stoves and cookers burning solid fuel.
.101 Small boiler systems using solid fuel.
CP 407.101 Electric lifts for passengers, goods and service.
.301 Hand-power lifts for passengers, goods and service.
CP 413 Design and construction of ducts for services.
CP 1004 Street lighting.
CP 1013 Earthing.
CP 2001 Site investigations.
CP 2003 Earthworks.
CP 2007 Design and construction of reinforced and prestressed concrete structures for the storage of water and other aqueous liquids.
CP 2008 Protection of iron and steel from corrosion.
CP 2010 Pipe lines.
CP 3002 Oil firing.
Part 1. Installations burning class D fuel oil and CTF 50.
Part 2. Installations burning class C and D fuel oils for vaporizing burners.
Part 3. Installations burning pre-heated fuels class E, F and G fuel oils and CTF 100 to 250.

APPENDIX C

SEQUENCE OF TRADE HEADINGS AND SPECIFICATION ITEMS FOR BUILDING WORK

BS 685:1951, INCORPORATING AMENDMENT ISSUED IN NOVEMBER 1963 (PD 5100)

(Copies of this and other British Standards are obtainable from the British Standards Institution, Sales Branch, 101 Pentonville Road, London, N.1.)

FOREWORD

The first edition of this British Standard, issued in 1937, has been reviewed in the light of the experience gained in its use and as a result some re-arrangement of the trade headings has taken place in the present edition and sections have been added to include new trades and practices.

Following the precedent set in drafting the first edition the revision has been based on the sequence of trade headings given in 'Standard Method of Measurement of Building Works', except where it was considered that divergence from that order would simplify the preparation and clarity of a specification.

This revised British Standard does not purport to include all the items which may appear in a building specification, and has been prepared solely for guidance in the preparation of such a specification. Contract items of a financial and legal nature are therefore excluded.

It is recommended that schedules should be used as a means of clarifying and co-ordinating information.

References to related British Standards have been omitted because the continuous development of standardization would render out of date almost immediately a list such as was included in the first edition. It is suggested that those interested should obtain, from the British Standards Institution, the Sectional List of Building Materials and Components, which is published quarterly.

A fifth edition of the Standard Method of Measurement* came into operation in March 1963 and was amended in March 1964. It is therefore recommended that this British Standard be read in conjunction with that edition, the sequence of section headings in which should now be followed.

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* 'Standard method of measurement for building works' published jointly by the Royal Institution of Chartered Surveyors, 12 Great George Street, Parliament Square, London, SW 1, and the National Federation of Building Trades Employers, 82 New Cavendish Street, London, W 1.

APPENDIX B

BRITISH STANDARD CODES OF PRACTICE RELEVANT TO THE CONSTRUCTION INDUSTRY

(Copies of these codes of practice may be obtained from the British Standards Institution, Sales Branch, 101 Pentonville Road, London, N.1.)

CP 3 Code of basic data for the design of buildings.
- Chapter I Lighting: Part I Daylighting
- Chapter IB Sunlight (houses, flats and schools only)
- Chapter IC Ventilation
- Chapter III Sound insulation and noise reduction
- Chapter IV Precautions against fire
- Chapter IV Part I Fire precautions in flats and maisonettes over 80 ft in height
- Chapter V Loading
- Chapter VII Engineering and utility services
- Chapter VII F Provision of artificial light (houses, flats and schools only)
- Chapter VIII Heating and thermal insulation
- Chapter IX Durability
- Chapter X Precautions against vermin and dirt

CP 11 Farm dairy buildings.
CP 98 Preservative treatment for constructional timber.
CP 99 Frost precautions for water services.
CP 101 Foundations and sub-structures for non-industrial buildings of not more than four storeys.
CP 102 Protection of buildings against water from the ground.
CP 111 Structural recommendations for load-bearing walls.
CP 112 The structural use of timber in buildings.
CP 114 Structural use of reinforced concrete in buildings.
CP 115 The structural use of prestressed concrete in buildings.
CP 116 The structural use of precast concrete.
CP 117 Composite construction in structural steel and concrete.
- Part 1. Simply supported beams in building.
- Part 2. Beams for Bridges.

CP 121.101 Brickwork.
.201 Masonry walls ashlared with natural stone or with cast stone.
.202 Masonry. Rubble walls.
CP 122 Walls and partitions of blocks and slabs.
- Part 1. Hollow glass blocks.

CP 123 Dense concrete walls.
CP 131.101 Flues for domestic appliances burning solid fuel.
CP 142 Slating and tiling.
CP 143 Sheet roof and wall coverings.
- Part 1. Aluminium corrugated and troughed.
- Part 2. Galvanized corrugated steel.
- Part 3. Lead.
- Part 4. Copper.
- Part 5. Zinc.
- Part 6. Corrugated asbestos sheet.
- Part 7. Aluminium.

CP 144 Roof coverings.
.101 Bitumen felt roof coverings.
CP 145.101 Patent glazing.
CP 151 Doors and windows including frames and linings.
CP 152 Glazing and fixing of glass for buildings.
CP 201 Timber flooring.
CP 202 Tile flooring and slab flooring.
CP 203 Sheet and tile flooring (cork, linoleum, plastics, rubber).
CP 204 In-situ floor finishes.
CP 209 Care and maintenance of floor surfaces.
CP 211 Internal plastering.
CP 212 Wall tiling.
- Part 1. Internal ceramic wall tiling in normal conditions.
- Part 2. External ceramic wall tiling and mosaics.

CP 221 External rendered finishes.
CP 231 Painting of buildings.
CP 301 Building drainage.
CP 302.100 Small domestic sewage treatment works.
.200 Cesspools.
CP 303 Surface water and subsoil drainage.
CP 304 Soil and waste pipes above ground.
CP 305 Sanitary appliances.
CP 306 The storage and collection of refuse from residential buildings.
CP 310 Water supply.
CP 321 Electrical installations.
CP 322.102 Electricity supply intake arrangements for flats and other multi-occupier buildings.
CP 324.201 Installation of domestic electric space-heating equipment.
.202 Provision of domestic electric water heating installations.
CP 326 The protection of structures against lightning.
CP 331 Installation of pipes and meters for town gas.
- Part 1. Service pipes.
- Part 3. Installation pipes.

CP 332 Selection and installation of town gas space heating.
- Part 1. Independent domestic appliances.
- Part 2. Central heating boilers for domestic use.
- Part 4. Ducted warm air systems.

SCHEDULE OF TRADE HEADINGS WITH TYPICAL ITEMS UNDER EACH HEADING

1. Preliminaries	
Contract	Drawings. Description and sequence of works. Programme and progress schedules. Notices and fees. Protection of public property. Trespass. Watching and lighting. Welfare and safety provisions. Rates of wages. Working hours. Supervision. Prime costs and provisional sums.
Site	Situation. Access. Inspection by contractor. Any special conditions. Use of roads on site.
Plant	Plant, tools and scaffolding. Offices, stores for material, other temporary structures and relevant facilities. Water and electricity for contractor's use. Facilities to sub-contractors (*e.g.* deliveries, handling, storage and workshops).
Works	Hoarding, enclosures and temporary roofing. Temporary roads or tracks. Casing and protection. Attendance. Cleaning.
2. Demolition, Shoring and Works on Site	
Demolition	Description of works. Materials arising from demolition, including credits and disposal of rubbish.
Shoring	
Works on site	Protection and making good to adjoining property.
3. Excavation and Earthworks	
Generally	Trial holes. Borings. Nature of soil. Use of sand, ballast or other material obtained from excavation. Removal of rock and other obstructions.
Clearance of site	Removal of overgrowth, pavings and debris.
Excavation	Surface. Basements. Trenches. Stanchion bases. Pier holes. Cuttings. Tunnelling. Underpinning. Levelling and ramming bottoms of foundations. Formation of embankments and terraces. Back filling. Disposal of surplus excavated material. Puddling. Planking and strutting. Disposal of water. Hardcore.
Treatment of surfaces	Soiling. Grassing. Tree and shrub planting.
4. Piling	
Generally	Materials and workmanship. Nature of sub-soil. General description. Load bearing capacity of piles.
Driving	Sinking or driving. Treatment of pile caps. Test piles. Recorded data.

5. Concrete	
Generally	Materials and workmanship. Concrete mixes, control and tests. Cold weather working. Mixing, placing and compacting. Protection and curing. Construction joints. Expansion and contraction joints. Hacking or scabbling surfaces. Form work.
Mass concrete	Foundations and stanchion bases. Under-pinning. Surface concrete. Floors. Steps. Machine bases. Walls. Concrete screeds.
Reinforced concrete	Floors. Walls. Columns. Beams and lintels. Staircases and landings. Roofs. Bending, positioning, tying and cover to reinforcement.
Precast reinforced concrete	As for 'reinforced concrete.'
Pre-stressed or post-tensioned concrete	
Sundries	Chases, holes, mortises.
6. Hollow slab and pre-cast unit construction	
Hollow slab and precast unit construction	Materials and workmanship. Type of construction and design data for floors and roofs. Construction joints. Expansion and contraction joints. Loading tests.
7. Brickwork and Block Partitions	
Generally	Materials and general workmanship. Mortar mixes. Wetting bricks. Protection from weather. Bonds. Jointing. Hacking and raking out joints. Pointing.
Under-pinning	
Damp-proof courses other than asphalt and asphaltic compounds	Materials. Bedding. Laps.
Walling	Solid walls and piers. Hollow walls, including ties. Backing to masonry. Bonding to existing work. Reinforcement. Trimmer and rough arches. String courses. Projections. Reveals. Angles. Sills. Copings. Beam filling.
Flues and fires	Flues and parging or lining. Capping. Chimney pots. Rough rendering. Soot doors. Fireplaces. Hearths. Setting stoves.
Facings	Facings generally. Arches. Reveals. Angles. Sills. Copings. Oversailings. Ornamental features.
Block partitions	Block partitions. Jointing. Pinning and bonding.

Glass block panels	Setting, jointing and pointing.
Metal windows	Building in metal windows and bedding and pointing frames.
Boiler settings	Boiler settings. Firebrick flue linings. Shafts.
Sundries	Chases. Bedding plates and frames. Wedging and pointing flashings. Cutting and pinning. Cutting holes. Fixing bricks. Air bricks and vents.
8. *Drainage, Sewerage and Sewage Disposal*	
Generally	Materials and workmanship. Note. Include cross reference to 'Excavation and earthworks' (Section 3), 'Concrete' (Section 5) and 'Brickwork and block partitions' (Section 7) so far as they are applicable.
Laying	Pipe laying and jointing. Concrete beds and surrounds. Agricultural drains. Surface water and soil drains specified according to type of pipe.
Fittings	Fittings and accessories. Rodding eyes. Gullies. Traps. Shoes.
Manholes. Catch pits. Grease traps. Petrol-interceptors	Foundations. Walls. Benching. Channels. Step-irons. Covers. Intercepting traps. Fresh air inlets.
Connections	Connections to public sewer or existing manholes.
Disposal	Septic tanks. Soakaways. Cesspools.
Testing	
9. *Asphalt*	
Generally	Materials and workmanship.
Tanking	Coats. Laps. Fillets.
Damp-proof courses	Horizontal and vertical coats. Laps.
Pavings	Coats. Laps. Falls. Skirtings. Channels.
Roofing	Coats. Laps. Falls. Underlays. Skirtings. Gutters. Kerbs. Outlets.
Sundries	Dressings to pipes and railings.
10. *Pavings*	
Generally	Materials and workmanship. Each material such as granolithic, cement, jointless, terrazzo, rubber, cork, brick, tile, marble, slate, stone, granite setts, concrete, macadam and tarmacadam specified according to requirements.
Internal and external pavings and floor coverings	Pavings and floor coverings. Expansion joints. Treads and risers. Skirtings. Coves. Channels. Special surface treatment. Polishing.

11. *Masonry*	
Generally	Materials and workmanship. Each material, such as natural stone, cast stone, marble and slate, specified according to requirements. Mortar mixes. Jointing. Pointing. Cramps. Dowels. Bolts. Chases, mortice and other cuttings. Slurrying. Cleaning. Stain-proofing.
External	Walling, Ashlar and facings. Quoins and dressing. Arches and lintels. Sills, mullions and transoms. Cornices. Copings. Columns. Pilasters and other ornamental features. Corbels. Padstones. Hinge stones. Spurs.
Stairs	Stairs. Landings. Balustrades.
Internal	Wall linings and other finishes.
12. *Roofing*	
Generally	Materials and workmanship. Each material, such as slates, tiles, shingles, asbestos-cement and bituminous felt, specified according to requirements.
Roofs	Roof slopes. Vertical work, including gables and dormer cheeks. Eaves. Verges. Top edges. Hips. Valleys. Ridges.
Walls	Vertical cladding. Cover pieces. Flashing pieces.
13. *Timber and Hardware*	
Generally	Materials and workmanship. Seasoning. Kilning. Framing up. Fixing.
Formwork	Formwork and centering, erection and striking (with cross reference to 'Concrete' (Section 5) as necessary).
Floors and ceilings	Plates. Joists. Binders. Trimming. Strutting and bridging. Jointing and fixing. False ceilings. Bracketing and cradling to beams. Grounds and backings. Plugging. Sundry labours.
Walls and partitions	Heads. Sills. Braces. Jointing and fixing.
Flat roofs	Plates. Joists. Trimming. Strutting and bridging. Firring to falls. Roof boarding. Fascias. Cheeks. Drips and rolls for lead, etc. Parapet gutters and cesspools. Jointing and fixing.
Pitched roofs	Plates. Roof trusses. Rafters and sprockets. Purlins. Collars. Struts and ties. Ridges. Hips and valleys. Roof boarding. Sarking felt. Battening. Tilting fillets. Parapet gutters and cesspools. Barge boards. Fascias and soffits. Snow gratings. Gangboarding and walkways. Dormers. Turrets and fleches. Jointing and fixing.