	£
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.

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 + 180 mm = 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*	*Plumber and apprentice 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.

	£
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 = £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 = £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 = $\frac{£13.00}{140}$	0.093
Finishing coat	
1 tonne finish at £11.00	
This covers 450 m², 1 m² = $\frac{£11.00}{450}$	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 = $\frac{£16.68}{3}$ =	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 0.50 but not exceeding 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*
2	*£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.

	£
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

		£
	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 $= \frac{27}{23} \times £0.278 = £0.326$

	£
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 $= \frac{£3.88}{200} \times 90 =$		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 33⅓% of the basic rate.

In the 100% scheme add 33⅓%
e.g. 6 h (standard performance) + 33⅓% = 8 h (Target)
In the 50% scheme add 66⅔%
e.g. 6 h (standard performance) + 66⅔% = 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 bonus	£0.50

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	$3\frac{1}{2}$ m²
Fixing metal corner beads	$7\frac{1}{3}$ m
2 coats plaster on lath	$1\frac{7}{8}$ m²
2 coats plaster on brick	$1\frac{1}{3}$ m²
3 coats plaster on concrete	$1\frac{1}{4}$ m²

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*	*÷ 7⅓ 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*

INDEX

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.

Cost of labour per m² $= \dfrac{£11.13}{40} = £0.278.$

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

Gauge $= \dfrac{(355 - 25) - 76}{2} = 127$ *mm*

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

Number of slates per m² $= \dfrac{1\,000\,000}{25\,781} = 39.$

Number of m² per 1 000 $= \dfrac{1000}{39} = 25.6.$

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

SBN 7121 4902 3

*Printed and bound in Great Britain by Tonbridge Printers Ltd,
Peach Hall Works, Tonbridge, Kent*

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

Contents

List of figures

List of tables

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.

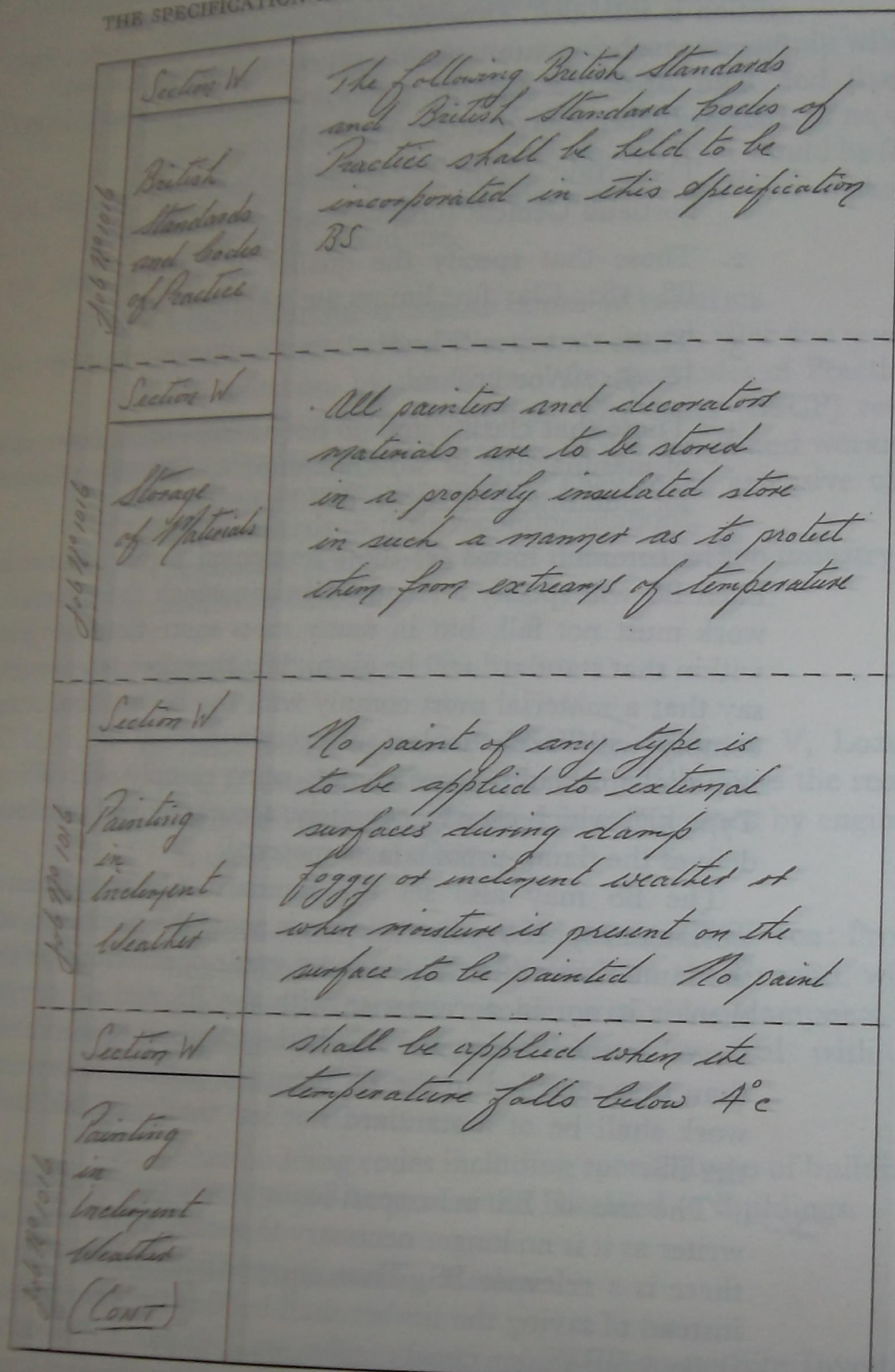

Figure 1 : Layout and use of 'cut and shuffle' paper for specification writing

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 96: 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 suitability 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.