



UWTSD Glyndŵr Development Labour Resource Distribution

It is important to analytically plan the number of laborers that will be on site before programme acceptance for many reasons. Firstly, this approach ensures that the site will not be overcrowded and will not endanger laborers health & safety. This works directly into CABAT's role as the principle contractor to comply with the Construction (Design & Management) Regulations 2015. Conversely, with little labourers on site at one point there could be opportunity for additional trades to be on site to accelerate the programme. The number of labourers on site can also be benchmarked against other projects of similar value and function.

This is contractor excellent practice as this monitoring can act as an incentivisation mechanism to improve productivity. Additionally, the number of weekly labourers and labour costs can be earmarked as a key performance indicator (KPI) to measure how the project is progressing in accordance to what was programmed. This will allow CABAT to make real-time changes to the running of the project to help get the project back on track or to forward-plan any scope-change the discrepancy should cause. These results can thereafter be scrutinised post-project as a means of continuous improvement.

Perhaps the principle reason although is labour cost with the association of material and plant cost. Given the number of laborers on site, their programmed time on site and labour costs, a labour cash flow forecast can be formulated. This tool will permit the principle contractor to have control over redistributing labour and resultantly cost. Presenting this data in this format moreover allows the contractor to visually analyse where costs can be saved, driving higher profits. Illustrated within *Table 1* is the number of labourers and total and daily costs associated with each construction activity. Highlighted in **RED** are the project phases, inclusive of total duration and total cost data.

Table 1: Construction stage (Tasks 15-55) total and daily labour costs.					
Task	Activity	No. of Labourers	Duration	Estimated Cost £	Daily Cost £
15	Stage 5 - Construction	-	45w	/ £2,629,475	= £8,349.5
16	Site Establishment	14	2w	/ £16,050	= £1,146.43
17	Site Hoarding, Office & Welfare Facilities	7	1w	/ £7,800	= £1,114.3
18	Site Clearance	7	1w	£ 8,250	= £1,178.6
19	Substructure	-	11w 2d	/ £562,000	= £7,113.9
20	Excavation	5	1w	/ £7,500	= £1,071.2
21	Piling	5	4w	/ £200,000	= £7,142.9
22	Pile Caps and Ground Beams	7	4w	/ £200,000	= £7,142.9
23	Tower Crane Installation	5	1w	/ £15,000	= £2,142.9
24	RC Slabs	10	2w	/ £100,000	= £7,142.9
25	Excavate Drainage Runs	8	1w	/ £15,500	= £2,214.3

26	Lay Drains, Test, Backfill	8	1w 2d	/ £25,000	= £2,777.7
27	Superstructure	-	9w	/ £721,750	= £11,456.4
28	Steel Frame Erection	15	4w	/ £315,000	= £11,250
29	Metal Decking	10	2w	/ £120,000	= £8,571.4
30	Roofing (Warm Roof)	10	2w	/ £94,500	= £6,750
31	Slabs Upper Floors	15	1w 4d	/ £140,000	= £12,727.3
32	Staircase Installations & Lift Shaft	12	2w	/ £52,250	= £3,732.1
33	Envelope	-	11w 3d	/ £543,175	= £6,789.7
34	SIPS Partitions	8	4w	/ £55,500	= £1,982.1
35	Metsec SFS Weatherboards	8	3w	/ £32,500	= £1,547.6
36	Brick & Blockwork, DPM, Cavity Ties & Fire Stops	20	5w	/ £187,750	= £3,650
37	Windows & External Door	7	2w	/ £90,000	= £5,364.3
Watertight					
39	Cladding Rails & Metal Profiling Cladding Panel Installation and Flashings	12	2w 3d	/ £162,425	= £10,151.6
40	Remove Tower Crane	5	1w	/ £15,000	= £2,142.9
41	Internals	-	15w 4d	/ £467,500	= £4,289
42	Partition 1st Sideboard	7	3w	/ £35,000	= £1,666.6
43	1st Fix M&E	5	3w 4d	/ £65,000	= £2,600
44	Partition 2nd Sideboard	7	2w 3d	/ £35,000	= £1,666.6
45	Tape and Joint	7	3w	/ £35,000	= £1,666.6
46	Decoration	7	2w 2d	/ £25,000	= £1,562.5
47	Ceilings	7	2w 2d	/ £35,000	= £1,666.6
48	FFE	15	2w	/ £100,000	= £7,142.9
49	Final Fix M&E	5	4w	/ £95,000	= £3,392.9
50	Snag & Clean	5	2w 4d	/ £42,500	= £2,361.1
51	Externals	-	9w 4d	/ £261,500	= £4,023.1
52	Road, Footpath & Carpark Construction	25	6w 2d	/ £178,500	= £4,056.8
53	Soft Landscaping	5	3w 2d	/ £83,000	= £3,608.7
54	Testing & Commissioning	-	3w 3d	/ £57,500	= £2,395.8
55	Commissioning (M & E Certification, BREEAM, SAP, Air Tightness)		3w 3d	/ £57,500	= £2,395.8

Following the establishment of the number of laborers required for each task and their associated daily costs, the formulation of weekly labour and labour cost distribution can occur. In reference to the **CABAT Glyndŵr Project Programme** document **Table 1** demonstrates this weekly analysis in tabulated form.

Table 2: Weekly labour and labour costs.						
Week	Weekly Activities	Activity Labourers	Weekly Labourers	Duration	Daily Cost £	Weekly cost
1	Site Hoarding, Office & Welfare Facilities	7	7	1w	X £1,114.3	= £5,571.5
2	Site Clearance	7	7	1w	X £1,178.6	= £5,893
3	Excavation	5	5	1w	X £1,071.2	= £5,356
4	Piling	5	5	1w	X £7,142.9	= £35,714.5
5	Piling	5	5	1w	X £7,142.9	= £35,714.5
6	Piling Pile Caps and Ground Beams	5	13	1w	X £7,142.9	= £57,143.2
		7		3d	X £7,142.9	
7	Piling Pile Caps and Ground Beams	5	13	1w	X £7,142.9	= £71,429
		7		1w	X £7,142.9	
8	Pile Caps and Ground Beams	7	7	1w	X £7,142.9	= £35,714.5
9	Pile Caps and Ground Beams	7	7	1w	X £7,142.9	= £35,714.5
10	Pile Caps and Ground Beams Tower Crane Installation	7	13	2d	X £7,142.9	= £25,000.3
		5		1w	X £2,142.9	
11	RC Slabs	10	10	1w	X £7,142.9	= £35,714.5
12	RC Slabs Excavate Drainage Runs	10	18	1w	X £7,142.9	= £40,143.1
		8		2d	X £2,214.3	
13	Excavate Drainage Runs	8	31	3d	X £2,214.3	= £74,003.7
	Lay Drains, Test, Backfill	8		4d	X £2,777.7	
	Steel Frame Erection	15		1w	X £11,250	
14	Lay Drains, Test, Backfill Steel Frame Erection	8	23	3d	X £2,777.7	= £64,583.1
		15		1w	X £11,250	
15	Steel Frame Erection	15	15	1w	X £11,250	= £56,250
16	Steel Frame Erection	15	15	1w	X £11,250	= £56,250
17	Metal Decking	10	10	1w	X £8,571.4	= £42,857
18	Metal Decking Roofing (Warm Roof)	10	20	1w	X £8,571.4	= £76,607
		10		1w	X £6,750	
19	Roofing (Warm Roof)	10	25	1w	X £6,750	= £97,386.5
				1w	X £12,727.3	

	Slabs Upper Floors	15				
20	Slabs Upper Floors	15	27	4d	X £12,727.3	= £69,569.7
	Staircase Installations & Lift Shaft	12		1w	X £3,732.1	
21	Staircase Installations & Lift Shaft	12	20	1w	X £3,732.1	= £28,571
	SIPS Partitions	8		1w	X £1,982.1	
22	SIPS Partitions	8	8	1w	X £1,982.1	= £9,910.5
23	SIPS Partitions	8	16	1w	X £1,982.1	= £17,648.5
	Metsec SFS Weatherboards	8		1w	X £1,547.6	
24	SIPS Partitions	8	36	1w	X £1,982.1	= £35,898.5
	Metsec SFS Weatherboards	8		1w	X £1,547.6	
	Brick & Blockwork, DPM, Cavity Ties & Fire Stops	20		1w	X £3,650	
25	Metsec SFS Weatherboards	8	35	1w	X £1,547.6	= £42,080
	Brick & Blockwork, DPM, Cavity Ties & Fire Stops	20		1w	X £3,650	
	Windows & External Door	7		3d	X £5,364.3	
26	Brick & Blockwork, DPM, Cavity Ties & Fire Stops	20	27	1w	X £3,650	= £45,071.5
	Windows & External Door	7		1w	X £5,364.3	
27	Brick & Blockwork, DPM, Cavity Ties & Fire Stops	20	27	1w	X £3,650	= £45,071.5
	Windows & External Door	7		2d	X £5,364.3	
28	Brick & Blockwork, DPM, Cavity Ties & Fire Stops	20	27	1w	X £3,650	= £23,249.8
	Partition 1st Sideboard	7		3d	X £1,666.6	

29	Brick & Blockwork, DPM, Cavity Ties & Fire Stops Partition 1st Sideboard 1st Fix M&E	20 7 5	32	1w 1w 4d	X £3,650 X £1,666.6 X £2,600	= £36,983
30	Partition 1st Sideboard 1st Fix M&E Cladding Rails & Metal Profiling Cladding Panel Installation and Flashings	7 5 12	24	1w 1w 1w	X £1,666.6 X £2,600 X £10,151.6	= £69,291
31	Partition 1st Sideboard 1st Fix M&E Cladding Rails & Metal Profiling Cladding Panel Installation and Flashings	7 5 12	24	2d 1w 1w	X £1,666.6 X £2,600 X £10,151.6	= £64,491.1
32	1st Fix M&E Cladding Rails & Metal Profiling Cladding Panel Installation and Flashings	5 12	17	3d 1w	X £2,600 X £10,151.6	= £58,558
33	Remove Tower Crane Partition 2nd Sideboard Road, Footpath & Carpark Construction	5 7 25	42	1w 1w 1w	X £2,142.9 X £1,666.6 X £4,056.8	= £39,331.5
34	Road, Footpath & Carpark Construction Partition 2nd Sideboard Tape and Joint	25 7 7	39	1w 1w 1w	X £4,056.8 X £1,666.6 X £1,666.6	= £36,950
35	Road, Footpath & Carpark Construction Partition 2nd Sideboard Tape and Joint Decoration	25 7 7 7	46	1w 3d 1w 2d	X £4,056.8 X £1,666.6 X £1,666.6 X £1,562.5	= £36,741.8

36	Road, Footpath & Carpark Construction	25		1w	X £4,056.8	= £39,762.7
	Tape and Joint	7		1w	X £1,666.6	
	Decoration	7		1w	X £1,562.5	
	Ceilings	7		2d	X £1,666.6	
37	Road, Footpath & Carpark Construction	25	39	1w	X £4,056.8	= £36,429.5
	Decoration	7		1w	X £1,562.5	
	Ceilings	7		1w	X £1,666.6	
38	Road, Footpath & Carpark Construction	25	47	1w	X £4,056.8	= £64,331.5
	Ceilings	7		1w	X £1,666.6	
	FFE	15		1w	X £7,142.9	
39	Road, Footpath & Carpark FFE	25	45	2d	X £4,056.8	= £60,792.6
	Final Fix M&E	15		1w	X £7,142.9	
		5		1w	X £3,392.9	
40	Final Fix M&E	5	10	1w	X £3,392.9	= £35,008
	Soft Landscaping	5		1w	X £3,608.7	
41	Final Fix M&E	5	10	1w	X £3,392.9	= £35,008
	Soft Landscaping	5		1w	X £3,608.7	
42	Final Fix M&E	5	15	1w	X £3,392.9	= £46,813.5
	Soft Landscaping	5		1w	X £3,608.7	
	Snag & Clean	5		1w	X £2,361.1	
43	Snag & Clean	5	5	1w	X £2,361.1	= £11,805.5

This tabulated data has been transferred to a clustered-line histogram for ease of interpretation (see **Figure 1**). The number of labourers on site each week across the 43-week construction process has been exposed in correlation to the weekly labour costs. Observed is a direct correlation whereas the number of staff on site increased, so does the cost. An “S-curve” is also evident, this is justified by RICS as:

“The construction s-curve is a graphical report which displays the cumulative progress of a project and is a tool which construction companies use to track a specific metric over time”.

This cost S-curve demonstrates steep start-up costs with a “tail-off” as the project nears completion. This is vague in line with the amount of labour on site, except for between weeks 33 and 39 where M&E, decorator and roadwork contractors are all on site at once.

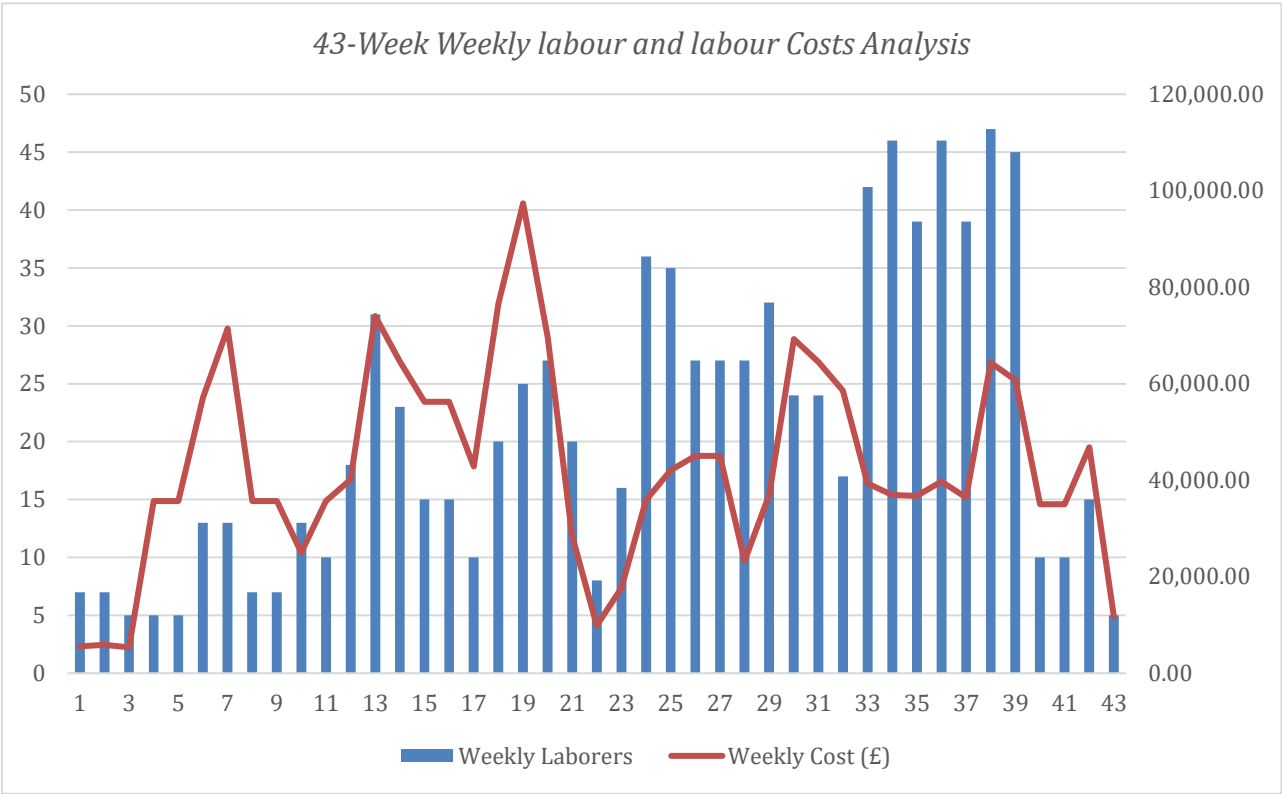


Figure 1: Weekly labour and labour costs at CABAT’s Glyndwr project.