LU8 – BUILDING COST ESTIMATION

PART 1

WHAT IS CONSTRUCTION ESTIMATING?

ESTIMATOR

DETAIL/NOT DETAIL

TECHNICAL PROCESS

BREAKDOWN

CLIENT REQUIREMENT

CONSTRUCTION COST ESTIMATING

DIFFERENT STAGE

COST CONTROL/BUDGET LIMITATION

LOGIC

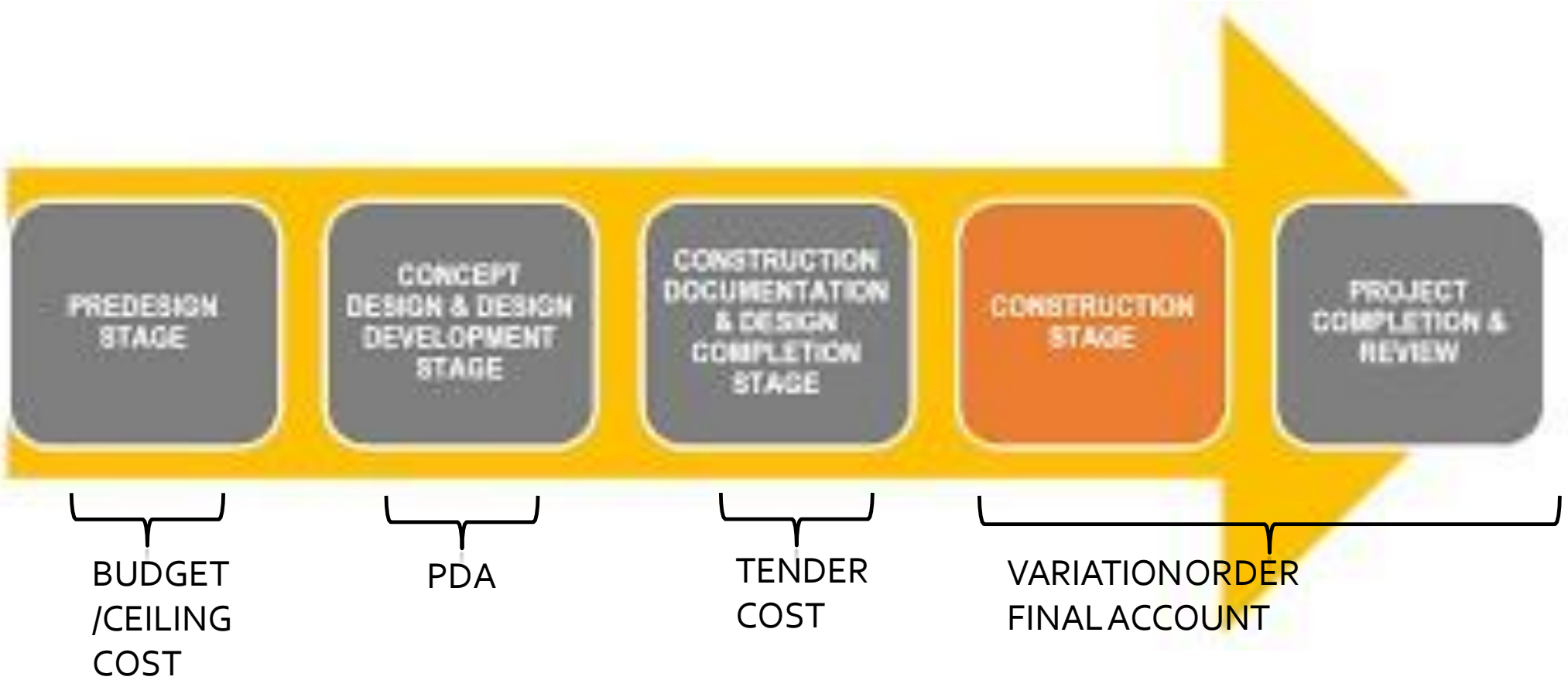
TENDER/CONTRACT

DATA

DIFFERENT METHOD

APPROVAL

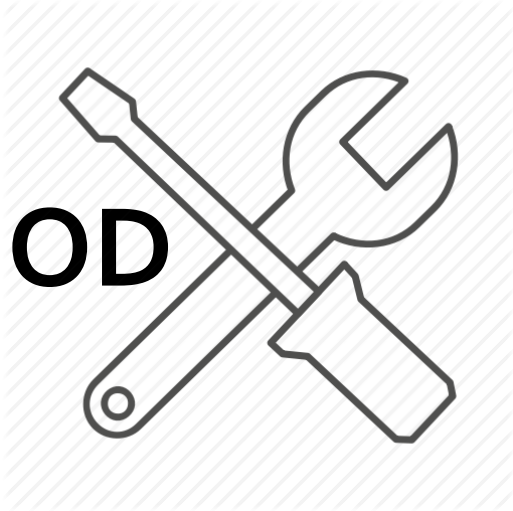
WHERE WILL BE THE COST ESTIMATING?



METHOD OF ESTIMATING

WHOLE BUILDING

COMPONENT



METHOD

DETAILS

WHOLE BUILDING

1) GROSS FLOOR AREA

- 'X' Floor area
- From Elemental Cost Analysis (ECA)
- Latest Data – 3 years back. If less than, need to do some analysis on price increment
- Based on similar or nearest types of project (need to do rationalisation)

	BREAKDOWN OF PRELIMINARY COST ESTIMATE						COST (RM)
1	**PRELIMINARIES (3% of item 2 - 6)**						**1,323,000.00**
a	Insurance & Bond					}	
b	Site Management Cost					}	
c	General Items					}	1,323,000.00
2	**PILING / SPECIAL FOUNDATION (20%)**						**3,376,800.00**
a	Reinforced concrete pile						3,376,800.00
3	**BUILDING**	**Drawing No.**	**Floor Area m2**	**Unit**	**Cost/m2**		**16,883,925.00**
a	Blok Pentadbiran	Preliminary Drawing	4,455	1	925.00		4,120,875.00
b	Bangunan Akademik B	Preliminary Drawing	5,204	1	925.00		4,813,700.00
c	Blok A - Asrama Putera	Preliminary Drawing	2,912	1	925.00		2,693,600.00
d	Blok B-Asrama Puteri	Preliminary Drawing	1,790	1	925.00		1,655,750.00
e	Dewan Makan	Preliminary Drawing	1,570	1	1,100.00		1,727,000.00
f	Astaka	Preliminary Drawing	263	1	700.00		184,100.00
g	Gelanggang Terbuka Berbumbung	Preliminary Drawing	2,017	1	700.00		1,411,900.00
h	Kuarters Kelas C	Preliminary Drawing	277	1	1,000.00		277,000.00
4	**INTERNAL SERVICES**						**6,309,000.00**
a	Electrical & Mechanical Services						6,309,000.00

WHOLE BUILDING (contd')

2) Cubic Content

- Length (L) x Width (w) x Height (H) = m3
- Simple calculation BUT not encountered in detail

3) Unit

- Simple and in early stage
- Based on building function e.g. Hospital, Mosque
- Encounter total of residents e.g RM 1 Million /bed
- Risk – Not accurate

WHOLE BUILDING (contd’)

4) Enclosed storey

- (Wall/Floor/Roof area)X Weightage (Based on work complexity) X cost/m2
- More Accurate
- Based on Specification and Drawing

5) Approximate Quantity

- More detail and accurate
- Require detail drawing

COMPONENT

- By element : WBLFF, Frame, Roof, Staircase, etc by m2
- Distribution estimation on early stage (Cost Plan)

DETAIL

- Estimate on every item in Bill of quantity

THE ELEMENTS FOR ESTIMATING

MATERIAL

- Criteria of material estimation

❖ Material management (Storage, Care, Quality, Quantity,Time.,etc)

❖ All material involved need to encountered

❖ Supplier selection

❖ Purchasing process

❖ Transportation and handling cos

❖ Wastage

❖ Knowledge of estimation

❖ Contribution from overall cost depending on types of work

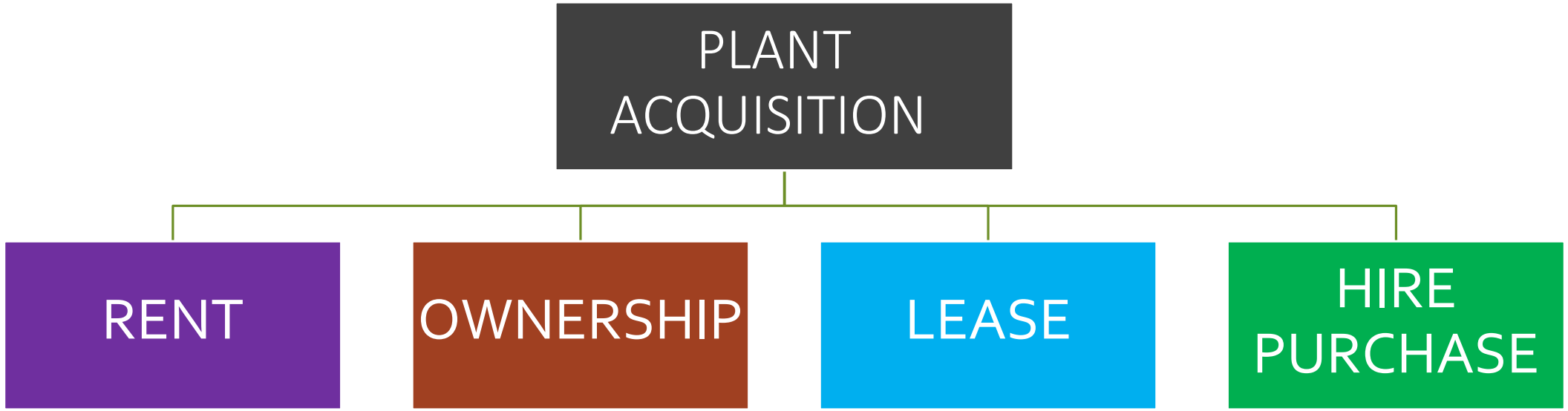
❖ Latest data and analysis

LABOUR

- Criteria of labour estimation
- Priority determination – Types, category, performance, profit
- Proper planning – Work Programme
- Estimator knowledge and experience

TOOLS & MACHINERY

- Criteria of tools&machinery estimation
  - Non-motorized / Motorized
  - Need to include rent or depreciation, maintenance costs, drivers and fuel consumption and water.
  - Estimator knowledge and experience


PLANT ACQUISITION
RENT
OWNERSHIP
LEASE
HIRE PURCHASE

PROFIT & OVERHEAD

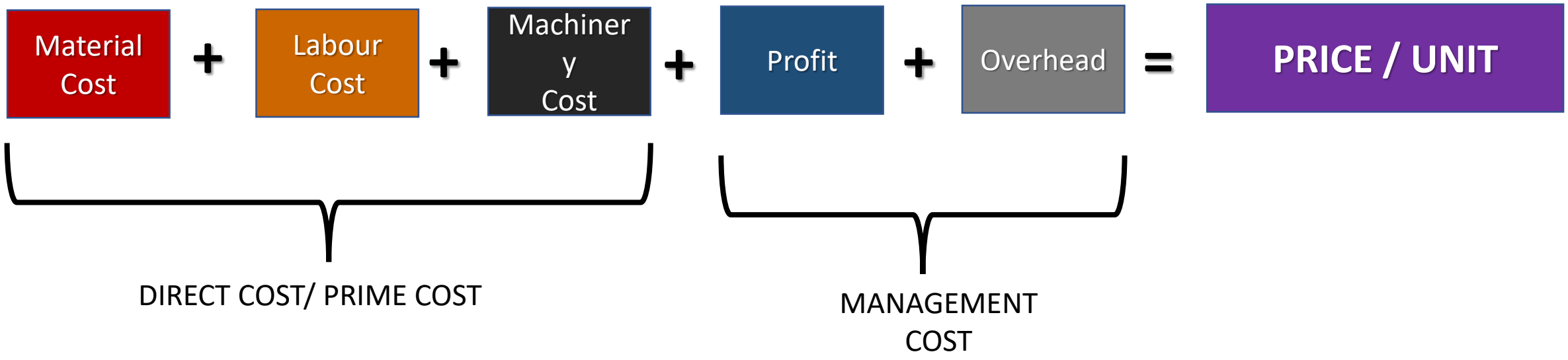
- ***Criteria of profit and overhead estimation***
  - Depends on management style/skill
  - Reasonable
  - Estimator knowledge and experience

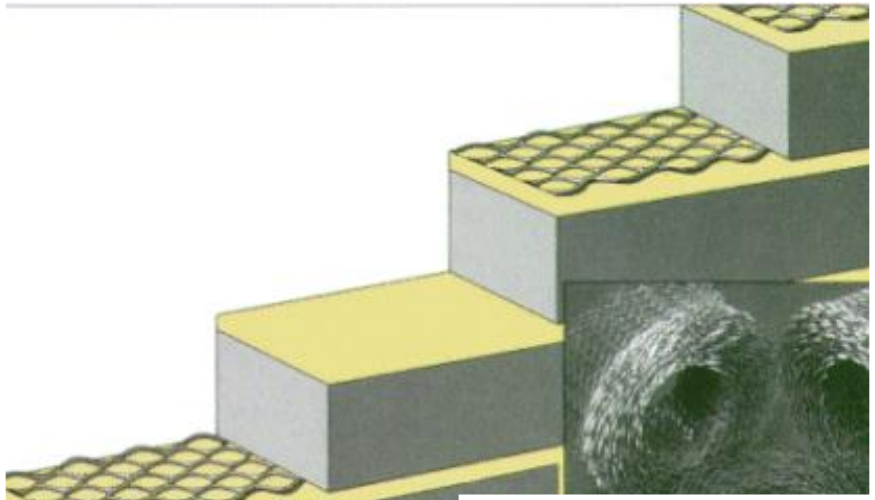
LU8 – BUILDING COST ESTIMATION

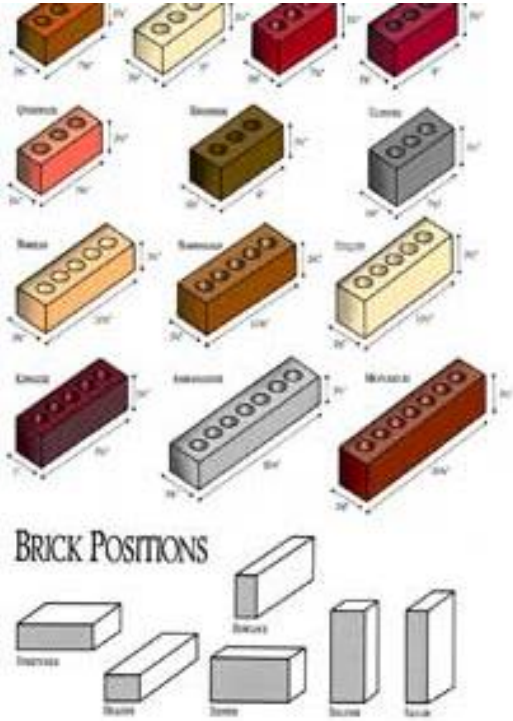
PART 2

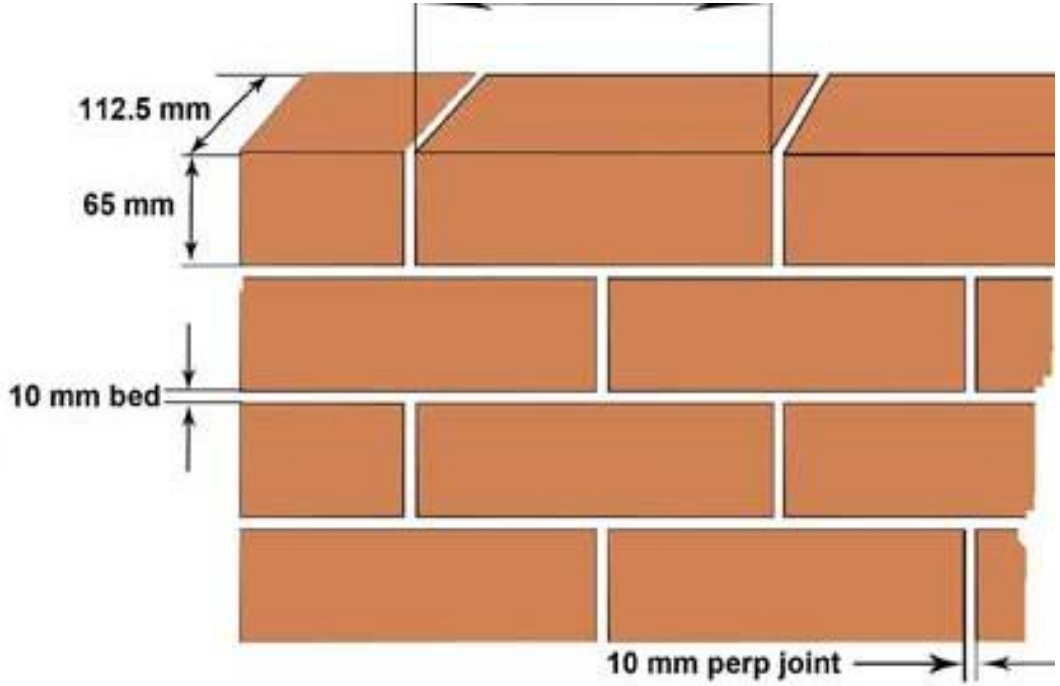
ESTIMATING FOR WALLS

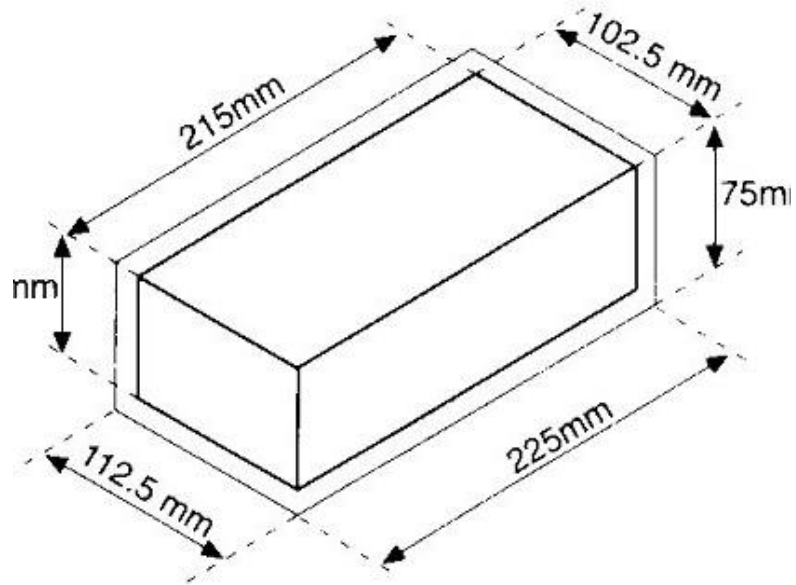
Concept of estimating











-ordinating size
or format:
:k + 10mm joint

Work size:
Brick for manufactur

EXAMPLE OF CALCULATING A BRICKWALL

brick

No of brick/m2 of wall = $\frac{1000mm \times 1000mm}{225mm \times 75mm}$ = 59.26 = 60

Add 5% waste 3

63

Thickness of wall	Mortar (m3)	No of bricks
1/2 bw	0.025	63
1 bw	0.050	125
1 1/2 bw	0.075	188

Source: Abdullah, A (2006), Anggaran Kos Kerja Bangunan

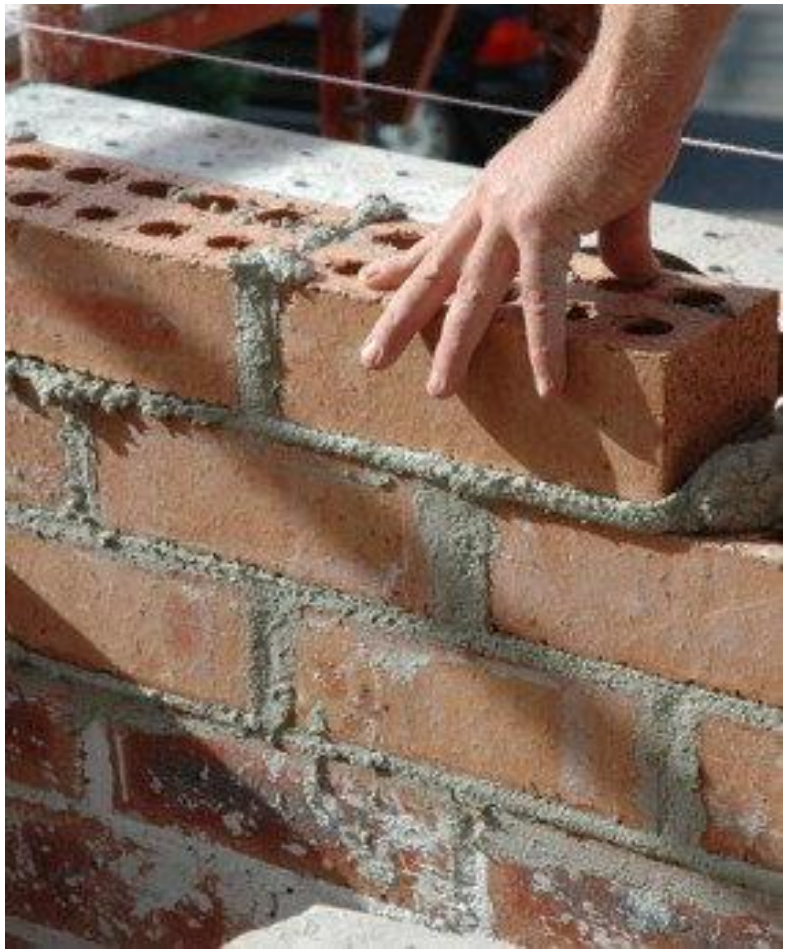
Labour

Thickness of wall	Bricklayer (Hr/m2)	Gen Worker (Hr/m2)
1/2 bw common brick	1.00	0.35
1 bw common brick	1.75	0.70
1/2 bw facing brick	2.00	0.50
1 bw facing brick	3.50	1.00

Source: Abdullah, A (2006), Anggaran Kos Kerja Bangunan

MORTAR

- Consist of cement and sand with ratio of :
  - Substructure - 1:3 or 1:4
  - Superstructure - 1:6
- Also may comprise of lime (*kapur)*
  - Ratio: 1:1:6
- Addition of 33.33% or 1/3 is made for mortar to allow wastage and shrinkage



mortar

Cement Mortar 1:3 - Manual Labour (Hand mixed)

1m3 cement	28 bags	RM	18.00		RM 504.00
3m3 sand	3 m3	RM	38.00		RM 114.00
					RM 618.00
1/3 shrinkage & wastage					RM 206.00
Cost for 4m3					RM 824.00
Material cost /m3	RM 824.00 / 4m3				RM 206.00
Labour	2 hrs	RM	50.00	/8 hours	RM 12.50
Cost mortar/m3					**RM 218.50**

mortar

Cement Lime Mortar 1:1:6 - Manual labour (Hand mixed)

1m3 lime	40 bags	RM 6.00		RM 240.00
1m3 cement	28 bags	RM 18.00		RM 504.00
6m3 sand	6 m3	RM 38.00		RM 228.00
				RM 972.00
1/3 shrinkage & wastage				RM 324.00
Cost for 8m3				RM 1,296.00
Material cost /m3				RM 162.00
Labour	2 hrs	RM 50.00	/8 hours	RM 12.50
Cost mortar/m3				**RM 174.50**

mortar

Cement Lime Mortar 1:1:6 - Concrete mixer

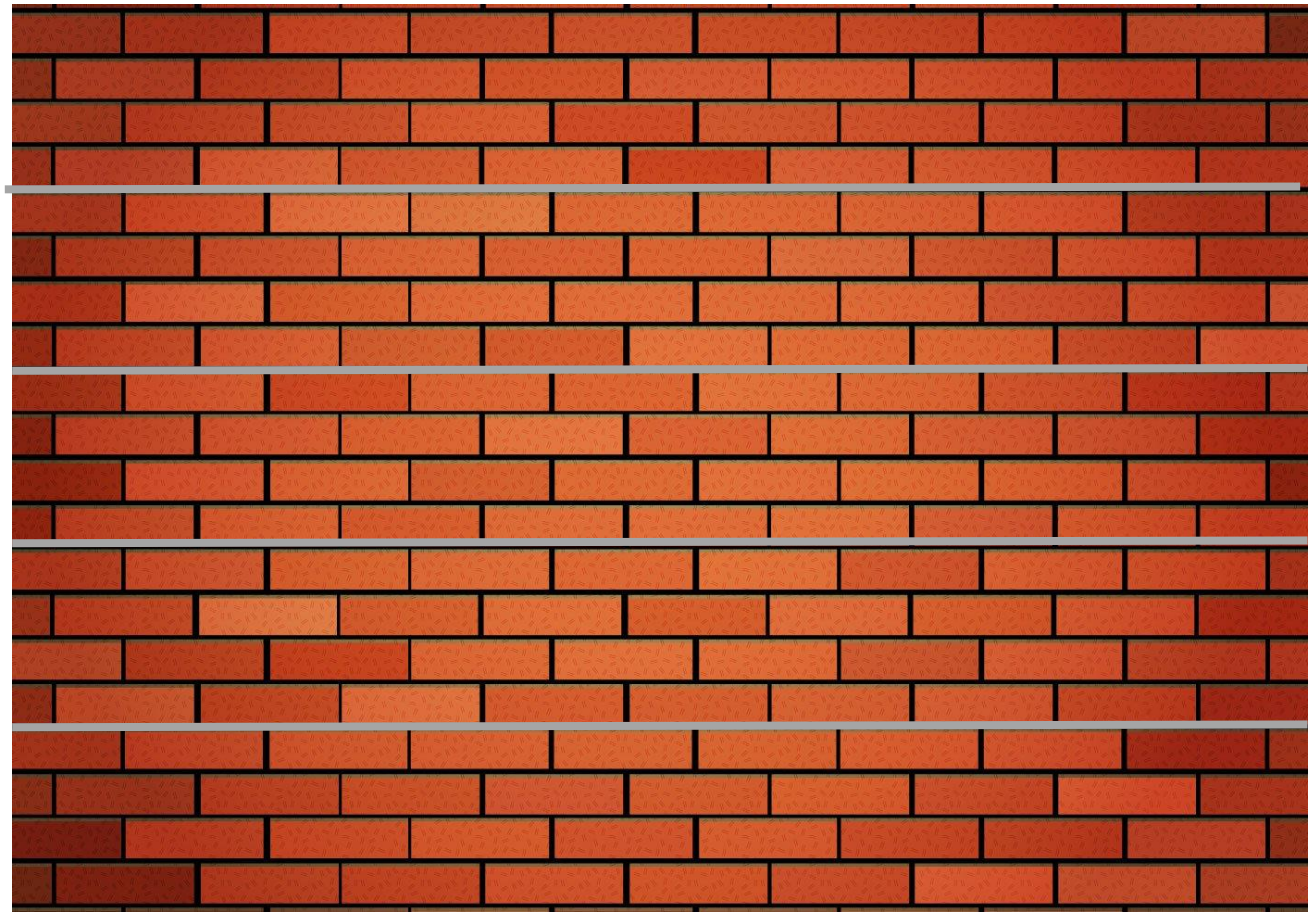
Material cost/m3					RM 162.00
Machine cost/day	RM 380.00		RM 14.62		
	26	days			
Mixer cost/day					
1 operator			RM 90.00		
1 general labour			RM 50.00		
Diesel	1.1 liter x 8 jam x RM2.30		RM 20.24		
Lubricant	0.04 liter x 8 jam x RM 40.00		RM 12.80		
Cost per day			RM 173.04		
Cost per hour			RM 21.63		
Output 1.25m3/hour					
Mixer cost	RM 21.63				RM 17.30
	1.25	m3			
			Mortar cost/m3		**RM 179.30**

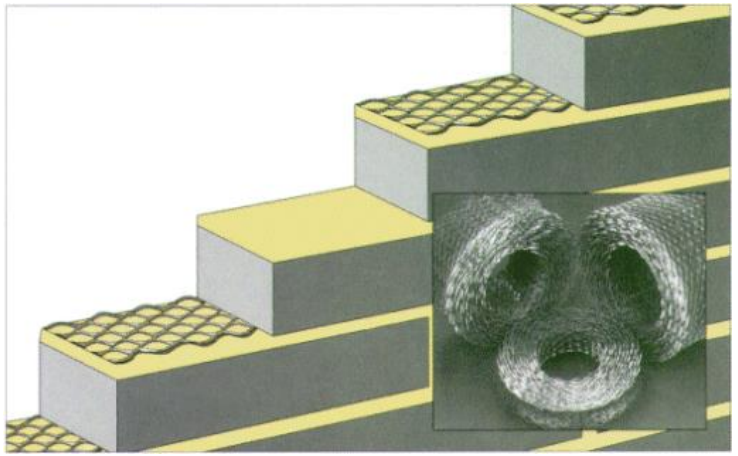
Brick reinforcement

Length of brick reinf/m2 of wall = $\frac{1000mm \times 1000mm}{4 \times 75mm}$ = 3.33 m

Add 8% lapping & waste = 0.27 m

3.60 m





Source:
Abdullah, A (2006), Anggaran Kos Kerja Bangunan (pg 176)

Example

- Half brickwall in common brick in cement lime mortar (1:1:6) in stretcher bond with brick reinforcement at every 4th course, non-load bearing – m2

(Refer page 179)

Source: Abdullah, A (2006), Anggaran Kos Kerja Bangunan

FLOW OF ESTIMATING

Material cost					
Bricks	63 nos	RM	0.24	RM	15.12
Mortar	0.025 m3	RM	112.33	RM	2.81
Brick reinforcement	3.6 m	RM	0.60	RM	2.16
Labour cost					
Bricklayer	1 hrs	RM	7.50	RM	7.50
Gen labour	0.35 hrs	RM	5.00	RM	1.75
				RM	29.34
15% overhead and profit				RM	4.40
Price/m2				RM	33.74

Cost of material

Brick	=	0.24/nos
Brick reinforcement	=	0.60/m
Cement	=	10.50/bag
Sand	=	30.00/m3
Lime	=	3.50/bag

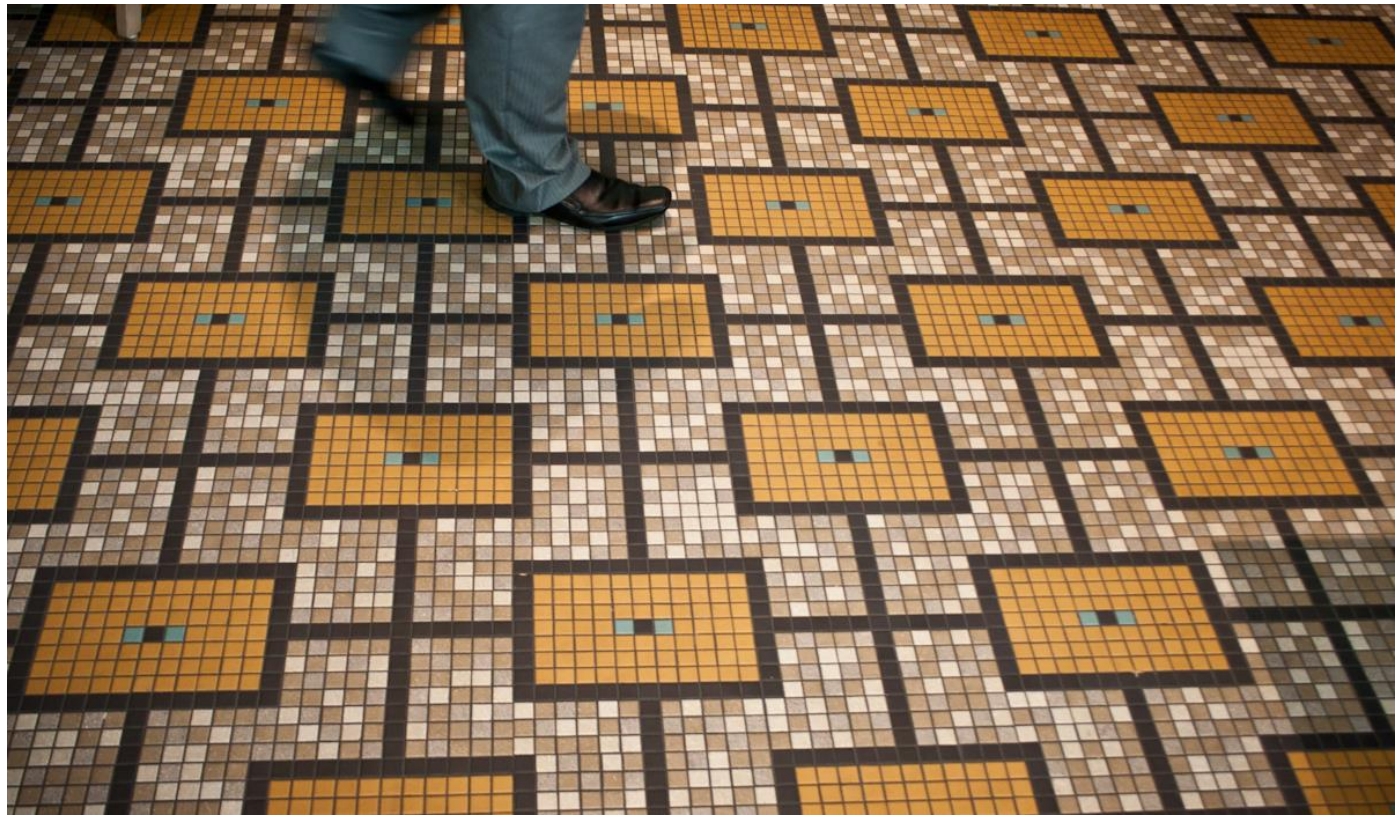
Cost of labour

Bricklayer	=	60.00/day
Gen worker	=	40.00/day

ESTIMATING FOR FLOOR, WALL & CEILING FINISHES

INTERNAL finishes

1. Cement render
2. Screed
3. Finishes
4. Plaster
5. Ceiling panel
6. Painting



Floor finishes

1. Cost of floor finishes will consist of:
   i. Mortar (screed)
   ii. Finishes (e.g tiles etc)
   iii. Labour

Wall finishes

1. Cost of wall finishes will consist of:
   i. Mortar (screed)
   ii. Plaster
   iii. Hard Finishes (e.g tiles etc)
   iv. Painting
   v. Labour

ceiling finishes

1. Cost of ceiling finishes will consist of:
   i. Plaster
   ii. Ceiling panel
   iii. Painting
   iv. Labour

mortar

- General thickness is between 12 mm to 25mm
- The mixture is base on ratio between cement and sand, e.g. (1:3 = 1 part cement & 3 parts sand)
- Mortar can either mix with hand or by a concrete mixer, the former only suitable for small quantity.
- Then, the mortar will be spread and leveled

Labour for spread and leveled of screed

Type of finishes	1 Tiler & 1 General Worker (Hr/m2)
Cement render	0.30
Granolithic pavement	0.35
Screeded bed	0.25
Floated plywood	0.28
Trowelled bed	0.30





Source: Abdullah, A (2006), Anggaran Kos Kerja Bangunan

Example – cement render

- 25mm thick cement and sand (1:3) paving with steel troweled finish to floor level or to falls not exceeding 15^{o} from horizontal on concrete base – m2

25mm cement sand paving

Cement Mortar 1:3 - Manual Labour

1m3 cement	28	bags	RM	18.00	RM	504.00
3m3 sand	3	m3	RM	40.00	RM	120.00
					RM	624.00
1/3 shrinkage & wastage					RM	208.00
Cost for 4m3					RM	832.00
Material cost /m3					RM	208.00
Labour	2	hrs	RM	50.00	RM	100.00
Cost mortar/m3					**RM**	**308.00**

25mm thick mortar	RM	308.00	x	25/1000	**RM**	**7.70**

Cement Mortar 1:3 - Concrete mixer

Material cost/m3				RM	208.00
Machine cost/day	RM 380.00 / 26 hari		RM	14.62	
Mixer cost/day					
1 operator			RM	90.00	
1 general labour			RM	50.00	
Diesel	1.1 liter x 8 jam x RM2.30		RM	20.24	
Lubricant	0.04 liter x 8 jam x RM 40.00		RM	12.80	
Cost per day			RM	173.04	
Cost per hour			RM	21.63	
Output 1.25m3/hour					
Mixer cost	RM 21.63 / 1.25 m3			RM	17.30
		Mortar cost/m3		**RM**	**225.29**
25mm thick mortar	RM 225.29	x 25/1000		**RM**	**5.63**

				Manual		Mixer	
Material cost							
Mortar cost @ 25mm thick screed				RM	7.70	RM	5.63
Labour cost							
Tiler	0.3 hrs	RM	11.25	RM	3.38	RM	3.38
Gen labour	0.3 hrs	RM	6.25	RM	1.88	RM	1.88
				RM	5.26	RM	5.26
15% overhead and profit				RM	1.94	RM	1.63
Price/m2				**RM**	**14.90**	**RM**	**12.52**

Example – screed for tiles

- 20mm thick cement and sand (1:3) screeded bed to receive ceramic tiles to floor or to falls not exceeding 15^{o} from horizontal on concrete base – m2

Example – screed for tiles

Cement Mortar 1:3 - Manual Labour

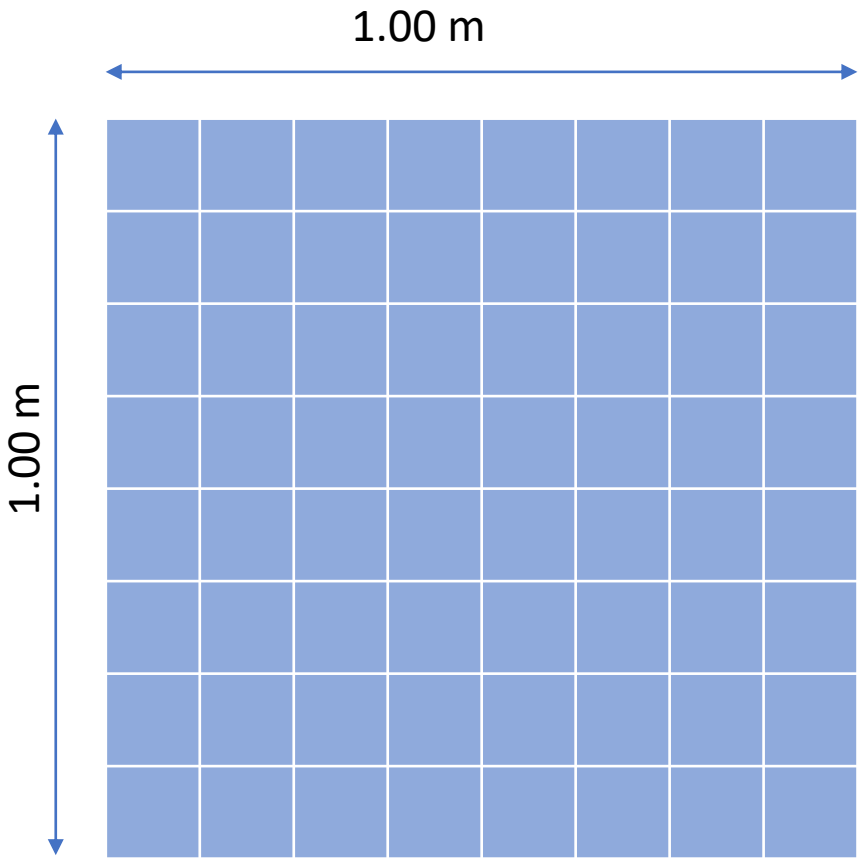
1m3 cement			28	bags	RM	16.50	RM 462.00
3m3 sand			3	m3	RM	38.00	RM 114.00
							RM 576.00
1/3 shrinkage & wastage							RM 192.00
Cost for 4m3							RM 768.00
Material cost /m3							RM 192.00
Labour			2	hrs	RM	6.25	RM 12.50
Cost mortar/m3							RM 204.50
20mm thick mortar	RM	204.50	x	20/1000			**RM 4.09**

Material cost						
Mortar cost @ 20mm thick screed					RM	4.09
Labour cost						
Tiler	0.25 hrs	RM	11.25		RM	2.81
Gen labour	0.25 hrs	RM	6.25		RM	1.56
					RM	8.46
15% overhead and profit					RM	1.27
Price/m2					**RM**	**9.73**

Tutorial 2 – screed for tiles

- 18mm thick cement and sand (1:3) screeded bed to receive ceramic tiles to floor or to falls not exceeding 15^{o} from horizontal on concrete base – m2
- Assumption
  - Cement = RM18.50/bag
  - Sand = RM35/tonne
  - Tiler = RM95/day
  - Gen Worker = RM55/day

tiles



$$\text{No of tiles} = \frac{1\ \text{m2}}{\text{Area of 1 tiles}}$$

Always allow 5% wastage for tiles. Allow 0.02m3 cement paste for 1m2 of tile

Tile Size	No of tiles
100mm x 100mm	100
200mm x 200mm	25
250mm x 250mm	16
300mm x 300mm	11

Source: Abdullah, A (2006), Anggaran Kos Kerja Bangunan

Saiz jubin	1 tukang jubin dan 1 pekerja biasa (Jam/m²)	
	Lantai	Dinding
≥ 150 mm x 150 mm	0.75	1.00
< 150 mm x 150 mm	1.90	1.25

Jadual 15.5: Output buruh pemasangan jubin.

Jadual 15.6 menunjukkan output buruh untuk memasang kam jubin dan kerja ini tidak termasuk penyediaan lapis lepa.

Ketinggian kambi jubin (mm)	1 tukang jubin dan 1 pekerja biasa (Jam/m)
75	0.20
100	0.23
125	0.26
150	0.30

Source: Abdullah, A (2006), Anggaran Kos Kerja Bangunan

Jadual 15.6: Output buruh pemasangan kambi jubin.

Example – Ceramic tile

- 200mm x 200mm x 7mm thick homogenous tile bedded, jointed and pointed in cement past to floor level or to falls not exceeding 15^{o} from horizontal on screeded bed – m2

Ceramic floor tiles

Material cost	25	pcs	RM	4.50			RM 112.50
5% wastage							RM 5.63
Cement paste							
1m3 cement	28	bags	RM	16.50	RM	462.00	
5% wastage					RM	23.10	
Labour cost							
Gen labour	2	hrs	RM	6.25	RM	12.50	
Cement paste 0.02m3					RM	497.60	RM 9.95
Install tiles to floor							
Tiler	0.75	hrs	RM	11.25			RM 8.44
Gen labour	0.75	hrs	RM	6.25			RM 4.69
							RM 141.20
15% overhead and profit							RM 21.18
Price/m2							**RM 162.38**

Tutorial 3 – Ceramic tile

- 100mm x 100mm x 7mm thick homogenous tile bedded, jointed and pointed in cement past to floor level or to falls not exceeding 15^{o} from horizontal on screeded bed – m2
- Assumption
  - Cement = RM18.50/bag
  - Homogenous tile = RM 1.20/piece
  - Tiler = RM95/day
  - Gen Worker = RM55/day

Plastering to wall & ceiling

- In general 16mm thick to wall and 12mm thick to other surfaces
- Normal mixture is 1:6, lime is added to improve the workability and delay the curing process.
- Plaster to ceiling is usually more expensive because it is more difficult to do compare to wall.

Location	1 Plasterer & 1 General Worker (Hr/m2)
Wall	0.40
Ceiling	0.50

Source: Abdullah, A (2006), Anggaran Kos Kerja Bangunan

Example – plaster to wall

- 16mm cement and sand (1:6) plaster to wall with steel troweled finish on brickwork base – m2

16mm cement plaster (1:6)

1m3 cement		28	bags	RM	16.50	RM	462.00
6m3 sand		9.12	tonne	RM	33.00	RM	300.96
						RM	762.96
1/3 shrinkage & wastage						RM	254.32
Cost for 7m3						RM	1,017.28
Material cost /m3						RM	145.33
Labour		2	hrs	RM	6.25	RM	12.50
Cost mortar/m3						**RM**	**157.83**
16mm thick mortar	RM 157.83		x	16/1000		**RM**	**2.53**

Material cost					
Mortar cost @ 16mm thick plaster				RM	2.53
Labour cost					
Plasterer	0.4 hrs	RM	11.25	RM	4.50
Gen labour	0.4 hrs	RM	6.25	RM	2.50
				RM	7.00
15% overhead and profit				RM	1.43
Price/m2				**RM**	**10.96**

Take a look at example in Pg 257 Contoh 15.8 for plaster to ceiling

Tutorial 4 – plaster to ceiling

- 12mm thick cement, lime and sand (1:1:6) plaster to ceiling with steel trowelled finish on concrete base – m2
  - Cement = RM18.50/bag
  - Sand = RM40/m3
  - Lime = RM 4.50/bag
  - Tiler = RM95/day
  - Gen Worker = RM55/day

painting

- Painting is estimated based on 100m2 or area

  1st coat = 8 litres

  2nd coat = 8 litres

  Painting coverage of emulsion paint

Labour for painting - Painter (Hr/100 m2)

Painting undercoat/primer = 8hrs

Painting finishing coat = 9hrs

Allow additional 3% to cover for overhead such as brushes, rollers, bucket etc)

For painting to ceiling, allow 10% increase in labour cost because it is more difficult to paint compare to wall.

Source: Abdullah, A (2006), Anggaran Kos Kerja Bangunan

Example – painting

- Two coats of emulsion paint to general surfaces of plastered wall over 300mm girth internally – m2 (pg 284)

Assumption:

Cost emulsion paint= RM60.00/tin 5 liter

Painting

2 layer of emulsion paint for 100m2	8 liter x 2x	RM 60.00 / 5 liter	RM 192.00

Labour for 100m2

Surface preparation	2	hrs		
Paint 9hrs x 2	18	hrs		
Total	20	hrs		
Painter	20	hrs	RM 11.25	RM 225.00
3% brush wastage				RM 6.75
				RM 423.75
15% overhead and profit				RM 63.60
Price @ 100m2				RM 487.35
Price for 1m2				**RM 4.87**

Tutorial 5 – painting

- Knotting, stopping, one coat primer, two coat undercoat and one coats gloss finish to general surfaces of wood over 300mm girth internally. – m2

- Sand paper RM2.00/piece
  3.00 hour per 100m2
- Filler RM8.00/kg
  6.00 hour per 100m2
- Shellac RM6.00/liter
  4.50 hour per 100m2
- Primer RM60.00/5liter
- Undercoat RM65.00/5liter
- Finishing cost RM90.00/5liter
- Skilled labour RM90.00/day
- Unslilled labour RM50.00/day

Preparing surface for painting

Primering

Applying emulsion paint

Ceiling panel

- Total cost will consist of:
  - Ceiling panel
  - Timber for joist and spacers
  - Nails
  - Labour

INTERNAL CEILING FINISHES

120mm x 600mm x 3.2mm thk asbestos free cement sheet to ceiling and fixing to 50mm x 100mm SPT Grade B timber joist at 1200mm centers and 50mm x 50mm spacer (nogging) fixed parallel with joist at 1200mm centers and across joist at 600mm centers-m^2

Data:

1200mm x 600mm x 3.2mm thk asbestos ceiling – Rm 8.50/sheet
SPT Grade B timber – Rm 650.00/tonne
Nails – Rm 5.00/kg
Carpenter (skilled labour) – Rm 60.00/day
Unskilled labour – Rm 40.00/day

Labour constant

Skilled labour – 1.50 hr/m^2
Unskilled labour – 0.25 hr/m^2

Calculation

i- Total area of ceiling (assume) = 10.00m x 6.00m
= $60m^2$

ii- Total no of ceiling joist = $\frac{10,000}{1200\ c/c}$ = 8 + 1 = 9 nos

Total length of ceiling joist = 9 nos x 6.00m = 54m

iii- Total no of ceiling spacer (nogging) = $\frac{6,000}{600\ c/c}$ = 10 + 1 = 11 nos

Total length of spacer = 11 nos

iv- SPT Grade B timber = $\frac{Rm\ 650.00}{1000kg}$ x $600kg/m^3$
= Rm 390.00/m^3

INTERNAL CEILING FINISHES(cont'd)

Material		
i-SPT ceiling joist (50mm x 100mm)		
(0.05m x 0.10m x 54m)m^3 / $60m^2$ x Rm 390.00/m^3	Rm 105.30/$60m^2$	
ii-SPT ceiling spacer (nogging) (50mm x 50mm)		
(0.05m x 0.05m x 110m)m^3 / $60m^2$ x Rm 390.00/m^3	Rm 107.25/$60m^2$	
iii-Asbestos ceiling sheet		
$\frac{60m^2}{(1.20m \times 0.60m/sheet)}$ x Rm 8.50/sheet	Rm 708.33/$60m^2$	
	Rm 920.88/$60m^2$	
Cost for $1m^2$ = $\frac{Rm\ 920.88/m^2}{60m^2}$	Rm 15.35/m^2	
iv-Nails		
0.15 kg/m^2 x Rm 5.00/kg	Rm 0.75/m^2	
	Rm 16.10/m^2	
Add: 5% wastage	Rm 0.80/m^2	
		Rm 16.90/m^2
Labour		
i-skilled labour		
1.50 hr/m^2 x Rm 60.00/8hr	Rm 11.25/m^2	
ii-unskilled labour		
0.25 hr/m^2 x Rm 40.00/8hr	Rm 1.25/m^2	
		Rm 12.50/m^2
		Rm 29.40/m^2
Add: 15% profit and overhead		Rm 4.41/m^2
		Rm 33.81/m^2


THE
END