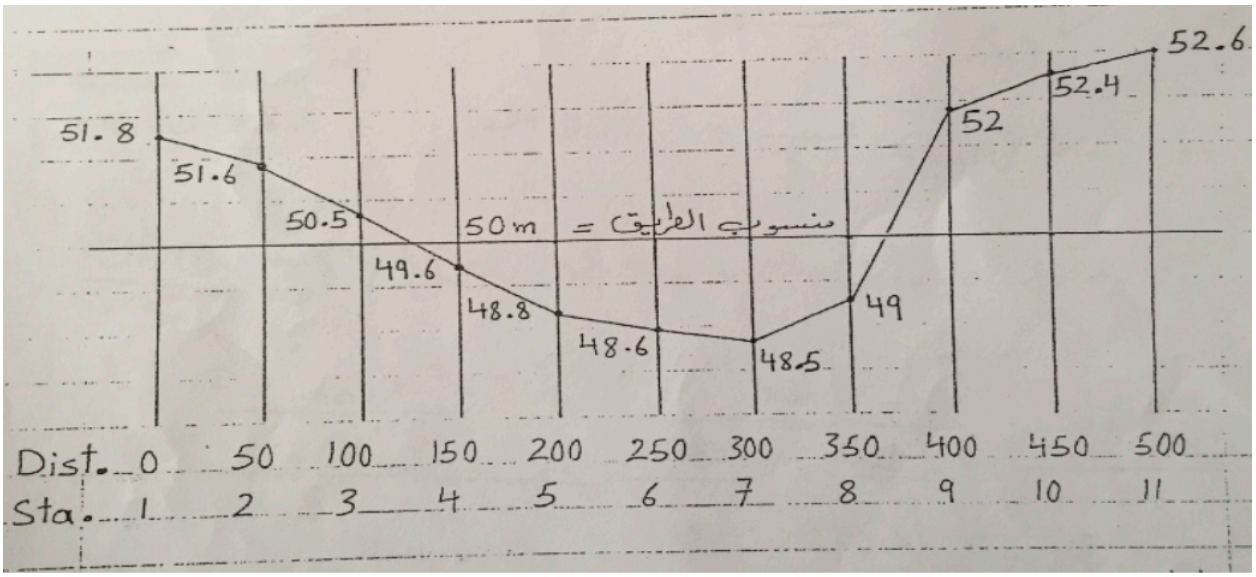
Example 4/ Calculate the size of the earthworks for a part of a road with a width of (12) m, as shown in the figure below, for a distance of (500) m. Consider that the section has the same level for all stations and that the slope of the sides is (1:2).

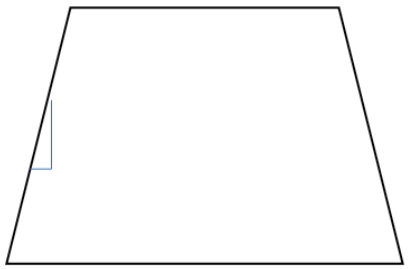
Solution:



1- نستخرج مقدار القطع أوالدفن في كل محطة (أي الارتفاع للقطع أو الدفن عند الخط الوسطي للطريق) وهو يمثل (d) .

d_1= 51.8 – 50 = 1.8 m (cut)
d_2= 51.6– 50 = 1.6 m (cut)
d_3= 50.5– 50 = 0.5 m (cut)
d_4= 49.6– 50 = -0.4 m (fill)
d_5= 48.8– 50 = -1.2m (fill)
d_6= 48.6– 50 = -1.4m (fill)
d_7= 48.5– 50 = -1.5 m (fill)
d_8= 49– 50 = -1 m (fill)
d_9= 52– 50 = 2 m (cut)
d_{10}= 52.4– 50 = 2.4 m (cut)
d_{11}= 52.6– 50 = 2.6 m (cut)

12 m



٢- نحسب مساحة المقاطع العرضية

Area= area of two triangle + area of rectangle

A=(w + d. s)d

A1=(12+ 2*1.8)*1.8= 28.08 m^2 cut

A2=(12+ 2*1.6)*1.6= 24.32 m^2cut

A3=(12+ 2*o.5)*0.5= 6.5m^2 cut

A4=(12+ 2*0.4)*0.4= 5.12 m^2 fill

A5=(12+ 2*1.2)*1.2= 17.28 m^2 fill

A6=(12+ 2*1.4)*1.4= 20.72 m^2 fill

A7=(12+ 2*1.5)*1.5= 22.5 m^2 fill

A8=(12+ 2*1)*1= 14 m^2 fill

A9=(12+ 2*2)*2= 32 m^2 cut

A10=(12+ 2*2.4)*2.4= 40.32 m^2 cut

A11=(12+ 2*1.8)*1.8= 44.72 m^2 cut

٣- يتم حساب الحجوم لكل مقطع

section	area		Vol.= area * length	
	cut	fill	Cut(-)	Fill(+)
0+00	28.08	0	=(28.08+24.32)/2*50=1310	
0+50	24.32	0	(24.32+6.5)/2*50=770.5	=1/3*5.12*50=85.33 =(5.12+17.28)/2*50=650
1+00	6.5	0	=1/3*6.5*50=108.3	=(17.28+20.72)*50=950
1+50	0	5.12		=(20.72+22.5)/2*50=1080.5
2+00	0	17.28	0	=(22.5+14)/2*50=913
2+50	0	20.72	0	=1/3*14*50=233.33
3+00	0	22.5	0	
3+50	0	14	=1/3*32*50=533.33	
4+00	32	0	=(32+40.32)/2*50=1808	
4+50	40.32	0	=(40.32+44.72)/2*50=2126	
5+00	44.72	0		
Sum			-6655.525	+4771.667

يتم حساب الحجوم النهائية للأعمال الترابية = حجم الاملاءات – حجم القطع

-6655.525+4771.667 = -1883.858334=m^3

The pricing

Any project includes two types of costs (Direct Cost and Indirect Cost), namely:

Total Cost = Direct Cost + Indirect Cost

- Direct Costs include:

1- Labor costs 2- Material costs 3- Equipment costs 4- Subcontractor costs.

- Indirect costs include:

1- Fees and taxes. 2- Supervisors' wages. 3- Indirect wages of workers. 4- Transportation. 5- Housing.

***Generally: **Price = total cost + profit**

The factors that effect on project cost:

1. The location of the project and the availability of services such as water, electricity and roads.
2. Availability of skilled and unskilled labor.
3. Availability of materials, equipment, and machinery.
4. The economic situation and the state of supply and demand.
5. Weather conditions.
6. Deprecation of devices and equipment.
7. Duration of work execution.

1. Average wages: wages vary according to work and are calculated on the basis of one hour or one day.
2. Productivity: It is the amount produced by the worker or work team over a specific period of time.
3. Depreciation of devices and equipment: depreciation is the amount of loss of devices and equipment of their original value after Used for a period of time due to wear.
4. The amount of profit: It is the amount of the net amount after subtracting the cost of work, materials and all expenses from the amounts received until the end of the maintenance period and the final receipt of the work.

The cost of raw materials = the price of one material * its quantity.

Labor cost = ∑ (his cost ∗ worker) * number of days

The cost of the vehicles =∑ (its cost ∗ the vehicle) * the number of days.

Cost of sub-contractors =∑ (cost ∗ contractor) * number of days

Direct costs = cost of materials + cost of workers + cost of machinery and equipment + cost of subcontractors.

⇒ Indirect cost = taken as a percentage of direct costs.

⇒ Productivity of the work team = number of workers * number of the day *labor productivity

Number of days = Paragraph / Team Productivity

Example 5/ It is required to price the item for the earthwork excavations for the foundations if you know that the excavation work will be done by one worker manually and that

The productivity of the worker per day is (1/2) m^3/day, assuming that the indirect costs constitute (10)% of the direct costs and the profit is (20)% of the total cost, and that the wage of the worker per day is (25000) dinars, the number of working days (2 days).

Solution :

Team wage = 25,000 dinars/day. Team productivity = 1 m^3/day

Direct costs = team wages * a number of days = 25,000 dinars/day * 2 days = 50,000 dinars.

Indirect costs = 10% * Direct costs = 5000 dinars.

Total cost = direct cost + indirect cost

= 50,000 + 5,000 = 55,000 dinars.

Profit = 20% * Total cost = 11,000 dinars.

Price = profit + total cost = 55,000 + 11,000 = 66,000 dinars.

Example 6/ paragraph excavations with a volume of (50) m^3, and we have (4) workers, the productivity of one worker is (0.2) m^3/hour, the worker's wage is (30000) dinars/day, the number of working hours per day is (8) hours, what is the price of this paragraph?

Solution /

team productivity = 4 x 8 hours x 0.2 m^3/hour = 6.4 m^3

A number of days = 50 = 7.8 ≈ 8 days. 6.4

Labor cost = 4 x 8 days x 30,000 dinars/day = 960,000 dinars. Direct cost = 960,000 dinars Indirect cost: none

Total cost = direct cost + indirect cost = 960,000 dinars.

Profit = 20% x 960,000 = 192,000

The price of this paragraph = 960,000 + 192,000 = 1,152,000 dinars.

Example 7 / Find the price of (1) m^3 of building with bricks and cement and sand mortar at a mixing ratio of (3:1) if the wall width is (24) cm and the administrative expenses are (7%) and the profits are (12%) and the costs are as follows:

1- Cement material costs (130,000) dinars per ton.

Sand (10,000) dinars / m3, bricks (750,000) dinars / 4,000 bricks.

2- Work wages Skilled worker (successor) = 60,000 dinars / day Unskilled worker (ordinary) = 25,000 dinars / day

Note that the team consists of (skilled workers + 5 unskilled workers) and the productivity of the team = (5) m^3

the solution/

Estimate the cost of raw materials:

⇒ the amount of mortar = total volume - number of bricks per m3 * dimensions of bricks without mortar

$$\text{كمية المونة في (١) م}^3 = 1 - \frac{1}{0.24*0.08*0.12} * 0.23*0.07*0.11 = 0.23 \text{ m}^3$$

$$\text{VOL.} = 0.75(\text{C:S})$$

$$0.23 = 0.75\ (C+3C)$$

C cement volume = 0.077 m3

3C sand volume = 0.231 m^3

cement weight = 0.077 x 1400 = 108 kg.

108 kg / 1000 = 0.108 tons

permission :

The cost of cement = 130,000 dinars/ton x 0.108 ton = 14,040 dinars.

Sand cost = 0.23 m3 x 10,000 dinars / m^3 = 2,300 dinars.

The cost of bricks = 750,000 dinars/ 4000 bricks = 187.5 dinars/brick.

The number of bricks in (1) m^3 = 435 bricks.

So the cost of bricks = 187.5 x 435 = 81,562 dinars.

The cost of raw materials = the cost of cement + the cost of sand + the cost of bricks = 97902 dinars.

Estimating labor costs:

Number of days = 1/5 = 0.2 days

Work team cost = (worker * his cost) * number of days

(60000 + 5 * 25000) * 0.2 = 37000 dinars / m^3.

Direct costs = material cost + labor cost = 97902 + 37000 = 134902 dinars.

Indirect costs = (7)% x direct costs = 0.07 x 134902 = 9443 dinars.

So: Total cost = direct costs + indirect costs = 144,345 dinars.

Profit = (12)% x 144345 = 17321 dinars.

The final price = 161,666 dinars ≈ 162,000 dinars.