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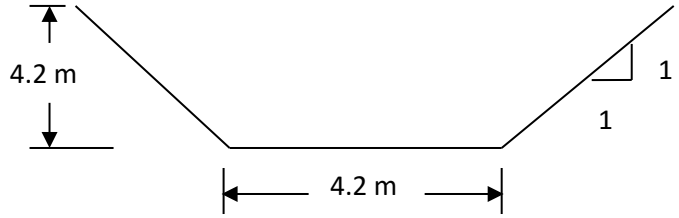
Calculating Operation & Ownership Costs for Construction Equipment

إحتساب كلف التشغيل و الإمتلاك للمعدات الإنشائية

❖ ***Examples***

Ex 1/ for a project of a fine tune channel, as shown in figure below, if you use a standard equipment, the cost is 0.35 $/m2. If you use a special equipment, the cost of it is 92000 $ which can be used for 4 years with 1600 hrs per year. Make a decision to find which of the two ways mentioned above you choose to fine the tune channel. Consider the speed of special equipment is 15 m/hr. Also fuel, oil and other costs = 7 $/hr and labour cost = 24 $/hr



Channel width (including bottom and sides) = 16 m

Solution:

Calculating costs for the special equipment

Each hour, the area done of the channel = 15 × 16 = 240 m2 /hr.

$$\text{Average Investment Cost P} = \frac{P(N+1)}{2N} = \frac{92000(4+1)}{2\times4} = 57500\ \$$$

Investment cost = 0.1 × 5750 $

Depreciation cost = 92000 / 4 = 23000 $

Maintenance cost = 100% × 23000 = 23000 $ (Assuming it is 100% of depreciation cost)

Fuel, oil and other costs = 7 × 1600 = 11200 $

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Ownership and operation costs per year = 62950 $

Ownership and operation costs per hour = 62950 / 1600 = 39.3 $

Total cost (including labour cost) per hour = 39.3 + 24 = 63.3 $

The cost for each square meter of the channel = 63.3 / 240 = 0.26 $

So, using the special equipment is the best choice

Ex 2/ Determined the expected ownership cost and operation cost of 1.5 m3 crawler power shovel with the following specifications:

- Diesel engine with 160 hp (fuel cost is 0.053 $/lit)

- Lubrication tank capacity is 22.71 lit (Oil cost is 0.32$/lit)

- Time of changing oil for the engine is 100 hours

- Operation factor is 60%

- Economic life for equipment is 6 years

- The equipment is working for 2000 hours per year

- The weight of equipment is 61700 kg (shipping cost is 2448 $, unloading and installation cost is 220 $)

Solution:

Fuel amount = F * Hp * [0.15 for diesel engine] = 160 × 0.69 × 0.15 = 14.4 lit/hr

$$\text{Oil amount} = \frac{160 \times 0.6 \times 0.0027}{0.89} + \frac{22.71}{100} = 0.52 \text{ lit/hr}$$

Initial cost:

Price = 82260 $

Shipping cost = 2448 $

Unloading and installation costs = 220 $

So, the total initial cost p = 82260 + 2448 + 220 = 84928 $

Average Investment Cost *P* = 84928 × 0.5833 = 49538.5 $

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The ownership costs:

Investment cost = 0.12 × 49538.5 = 5945 $

Depreciation cost = 84928 / 6 = 14155 $

Maintenance cost = 100% × 14155 = 14155 $ (Assuming it is 100% of depreciation cost)

The total ownership cost = 34255 $ /year

So, the ownership cost = 34255 / 2000 = 17.13 $ /hr

The operation costs:

Fuel cost = 14.4 × 0.053 = 0.76 $ / hr

Lubrication cost = 0.52 × 0.32 = 0.17 $/hr

So, the total operation costs = 0.93 $/hr

Then, the total cost (excluding labor cost) = 18.06 $/hr

Ex 3/ Calculate the ownership cost and the operation cost for a truck of 20 m3 which has 6 rubber tires using the following formation:

- **Diesel engine with 250 hp. (fuel cost is 0.053 $/lit)**
- **Lubrication tank capacity is 53 lit. (Oil cost is 0.32$/lit)**
- **Time of changing oil for the engine is 80 hours.**
- **Operation factor is 60%.**
- **Economic life for equipment is 5 years.**
- **Working hours is 2000 hours per year.**
- **Maintenance and repair cost is 50% for depreciation cost.**
- **Economic life for tires is 5000 hours.**
- **The total cost of equipment is 47640$.**
- **The cost of tires is 9360$.**

Solution:

Fuel amount = 250 * 0.60 * 0.15 = 22.5 lit/hr

$$\text{Oil amount} = \frac{250 \times 0.6 \times 0.0027}{0.89} + \frac{53}{80} = 1.12 \text{ lit/hr}$$

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Equipment cost excluding tires = 47640 – 9360 = 38280 $

Average Investment Cost (*P*) for complete equipment = $\frac{47640\,(5+1)}{2\times5}$ = 28584 $

The ownership costs:

Investment cost = 0.12 × 28584 = 3430 $

Depreciation cost = 38280 / 5 = 7656 $

Maintenance cost = 50% × 7656 = 3828 $

The total ownership cost = 14914 $ /year

So, the total ownership cost per hour = 14914 / 2000 = 7.46 $/hr

The tires costs:

Depreciation cost = 9360 / 5000 = 1.87 $/hr

Maintenance cost = 0.15 × 1.87 = 0.28 $/hr (Maintenance for the tires is 15% of the depreciation cost)

Fuel cost = 22.5 × 0.053 = 1.2 $/ hr

Lubrication cost = 1.12× 0.32 = 0.36 $/hr

So, the total operation costs = 3.71 $/hr

Then, the total cost per hour (excluding labor cost) = 11.17 $/hr

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Cost of equipment stopping: **- It is the cost of stopping the equipment for repairing. The duration of stopping increased with the increase of using the equipment. Usually this cost is percentage of operation time (e.g. if the equipment stopped for 5% that's mean it is ready for 95% of time).**

كلفة توقف الآلية: هي كلفة توقف الماكنة لإجراء الصيانة عليها، حيث أن زيادة فترة توقف الآلية للصيانة يكون نتيجة زيادة إستخدامها. عادة تكون هذه الكلفة كنسبة من كلفة التشغيل (مثلاً إذا توقفت الآلية ل5% من الوقت للصيانة خلال إستخدامها، تكون فقط جاهزة خلال 95% من عمرها الإقتصادي)

Ex: if the operation cost of equipment is 6 $ per hour and its stopping percentage 5%, so the stopping cost per hour = 6 * 0.05 = 0.3 $

If the equipment used for 2000 hours per year, the total cost per year = 0.3 * 2000 = 600 $.

Obsolescence cost: **- it is the decreasing of equipment value when new equipment doing the same job can decrease the production cost 10% comparing with current equipment. That's mean the current equipment has decreasing value of 10%.**

كلفة تقادم الآلية: هي كلفة إنخفاض قيمة الماكنة نتيجة تقادمها، حيث أن الآلية الحالية ستصبح ذات كفاءة أقل للعمل إذا تم مقارنتها بماكنة أخرى جديدة تقوم بنفس الوظيفة، أي بمعنى أن الماكنة الحالية نتيجة تقادمها بنسبة 10% ستنخفض نسبة إنتاجها بمقدار 10%