

# Equipment Cost

## Chapter 12

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# Objectives

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**Objectives include:**

- Calculation of ownership cost**
- Calculation of operating cost**
- An understanding of the advantages and disadvantages associated with direct ownership, renting, and leasing machines**

# Equipment Procurement

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## **OBJECTIVE:**

**Provide the right equipment at the right time and place so the work can be accomplished at the lowest cost.**

# Questions!!

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- **How much does it cost to operate the machine on a project?**
- **What is the optimum economic life and optimum manor to secure a machine?**

# Equipment Costs

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- **The only reason for purchasing equipment is to perform work that will generate a profit for the company**
- **Data on both machine utilization and costs are the keys to making rational equipment decisions**

# Total Equipment Cost

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**\$ Depreciation 25%**

**\$ Operating 23%**

**\$ Repair 37%**

**\$ Overhead 15%**

# Equipment O&O Costs

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- **Ownership cost**
  - **the cumulative result of those cash flows an owner experiences whether or not the machine is productively employed on a project.**

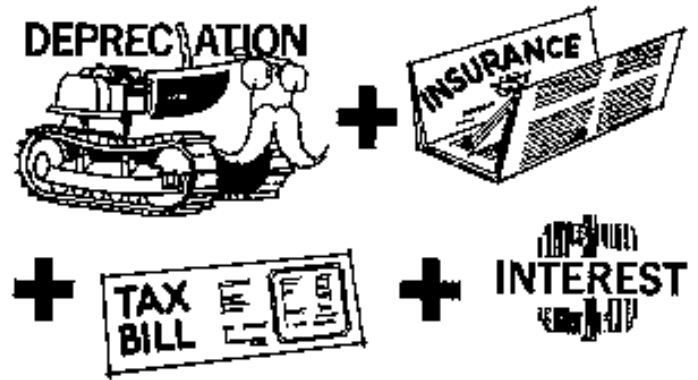
# Equipment O&O Costs

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- **Operating cost**
  - **the sum of those expenses an owner experiences by working a machine on a project**

# Ownership Cost

-  **Depreciation (Purchase expense)**
-  **Major repairs and overhauls**
-  **Property Taxes**
-  **Salvage value**
-  **Insurance**
-  **Shop expenses and storage**



# Ownership Cost

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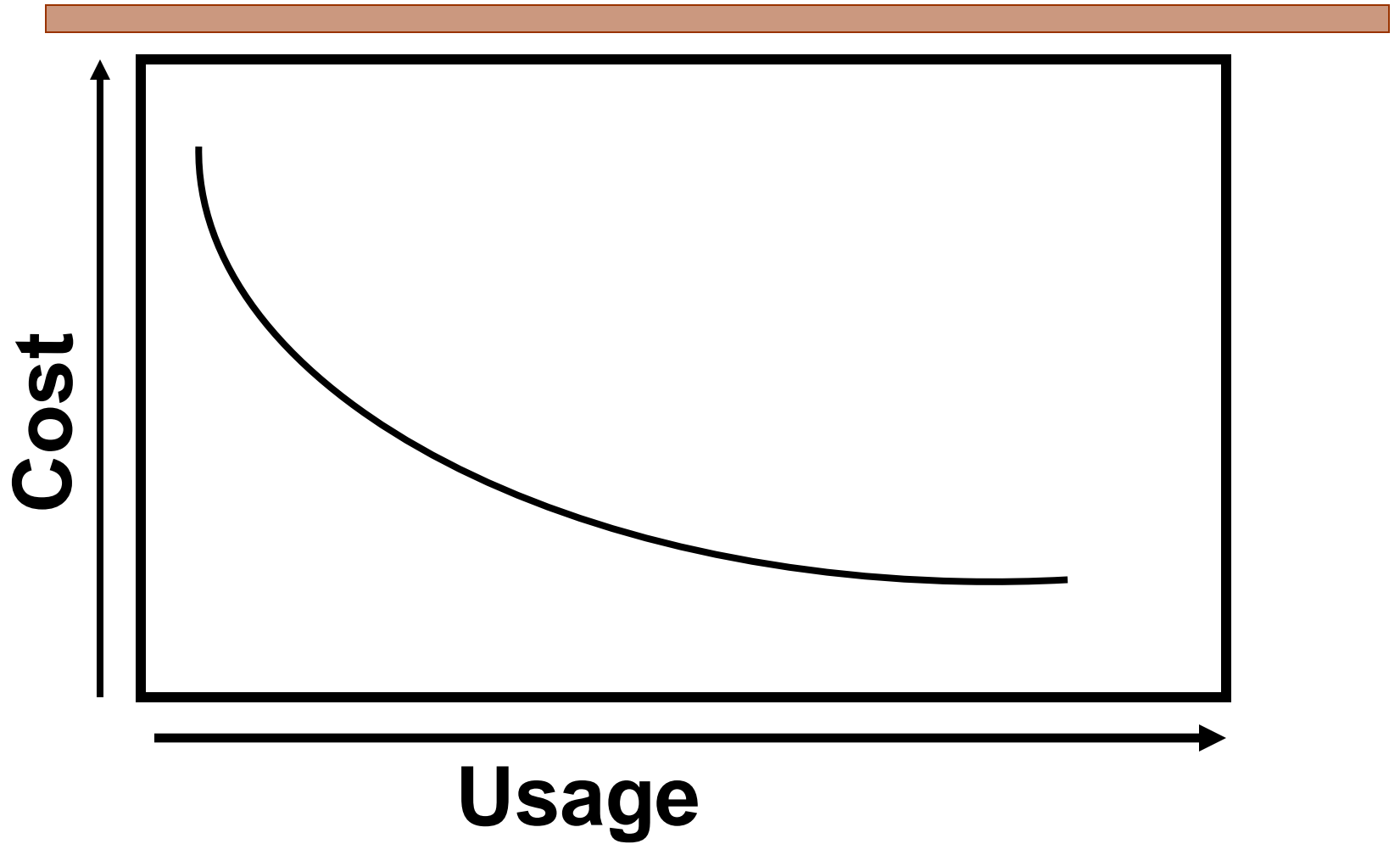
$$\begin{aligned} & \text{Purchase price}^* \\ & \quad - \text{Salvage} \\ & \quad + \text{Overhead} \end{aligned}$$

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$$= \text{Ownership expense}$$

\* A fixed cost, occurs if the machine works 1,000 or 17,000 hrs

# Ownership Cost



# Ownership Cost

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**New**



**\$110,000**

**4 Years  
Later**



**\$60,000**

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**Ownership expense = \$50,000**

# Ownership Cost

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**New**



**\$110,000**

**8 Years  
Later**



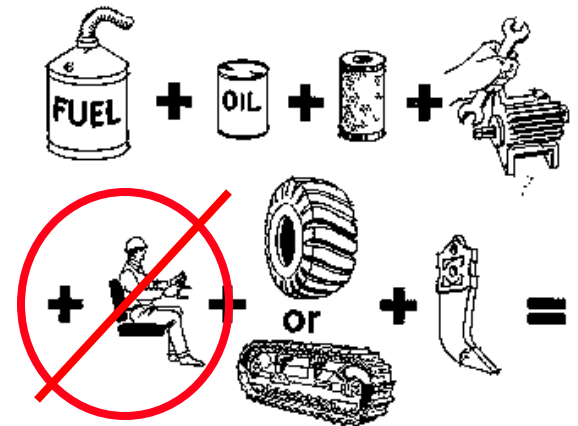
**\$0**

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**Ownership expense = \$110,000**

# Operating Cost

- **Consumables - fuel, oil, & grease (FOG)**
- **Repair**
- **Maintenance**
- **Tires or tracks**
- **High wear items – cutting edges, teeth**
  - *Operator wages* (usually kept separate)

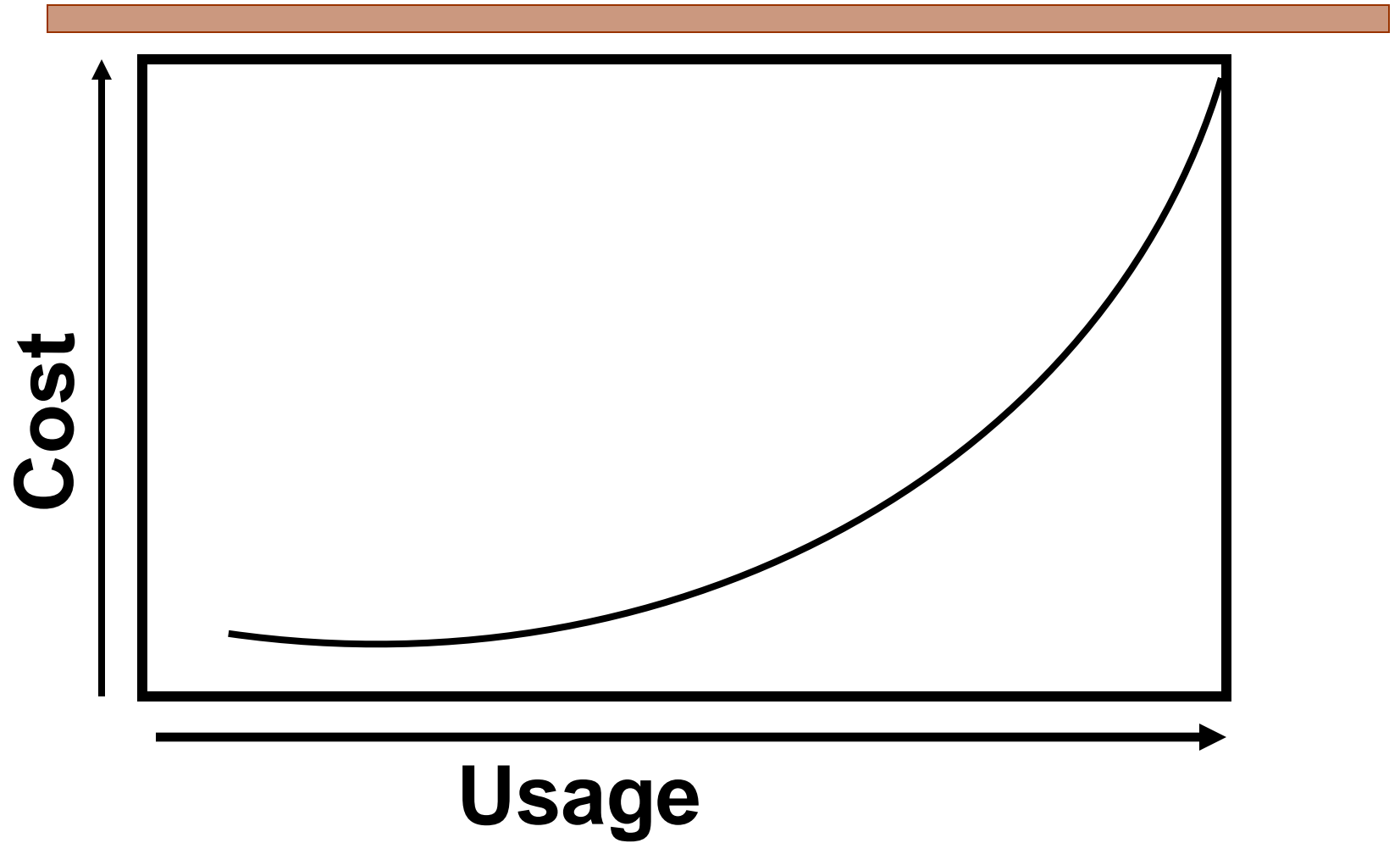


# High Wear Items

- **cutting edges**
- **ripper tips**
- **bucket teeth**
- **body liners**
- **cables**



# Operating Cost



# Practical Exercise

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**Determine the probable cost per hour of owning and operating a scraper given the following conditions.**

- **Engine 350HP diesel**

# Ownership Cost

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- **Overall cost of money 10%**
- **Useful life 5 years**
- **Hours used per year 2000**
- **Initial cost \$470,000**
- **Cost of tires \$30,000**
- **Estimated salvage value \$60,000**

# Ownership Cost Time Value Method

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**Deduct tire cost from the delivered price for large machines.**

**Tires are considered a wear item and are treated as an operating cost.**

# Ownership Cost Time Value Method

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**Initial cost      \$470,000**

**Cost of tires      \$30,000**

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**\$440,000**

**Need to calculate the uniform series required to replace a present value of \$440,000**

*Uniform series capital recovery factor*

# Ownership Cost Time Value Method

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Overall cost of money 10%

$$A = \$440,000 \left[ \frac{0.10(1 + 0.10)^5}{(1 + 0.10)^5 - 1} \right]$$

# Ownership Cost Time Value Method

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$$\begin{array}{r} \$440,000 \\ \times 0.2637975 \\ \hline = \$116,071 \text{ per yr.} \end{array}$$

# Ownership Cost Time Value Method

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**Estimated salvage value \$60,000**

**Need to calculate the uniform series required to replace a end of period amount of \$60,000**

*Uniform series sinking fund factor*

# Ownership Cost Time Value Method

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$$A = \$60,000 \left[ \frac{0.10}{(1 + 0.10)^5 - 1} \right]$$

# Ownership Cost Time Value Method

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$$\begin{array}{r} \$60,000 \\ \times 0.1637975 \\ \hline = \$9,828 \text{ per year} \end{array}$$

# Ownership Cost Time Value Method

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$$\frac{\$116,071 - \$9,828}{2,000 \text{ hr / yr}} =$$

**\$53.12 / hour**

# Ownership Cost

## Average Annual Investment Method

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$$AAI = \frac{P(n + 1) + S(n - 1)}{2n}$$

**P = purchase price**

**S = salvage value**

**n = life in years**

# Ownership Cost

## Average Annual Investment Method

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$$= \frac{\$440,000(5 + 1) + \$60,000(5 - 1)}{2 \times 5}$$

$$P = \$440,000$$

$$S = \$60,000$$

$$n = 5 \text{ years}$$

# Ownership Cost

## Average Annual Investment Method

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$$= \frac{\$440,000 (6) + \$60,000 (4)}{10}$$

$$\text{AAI} = \$288,000/\text{yr}$$

## Investment Cost

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$$\frac{\$288,000 / \text{yr} \times 10\%}{2,000 \text{ hr} / \text{yr}} =$$

**\$14.40 / hour**

# Depreciation

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$$\begin{array}{r} \$470,000 \\ - \$30,000 \text{ tires} \\ - \$60,000 \text{ salvage} \\ \hline = \$380,000 \end{array}$$

# Hourly Depreciation

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$$\frac{\$380,000}{5 \text{ yr} \times 2,000 \text{ hr} / \text{yr}} = \underline{\underline{\$38.00 / \text{hr}}}$$

# Ownership Cost

## Average Annual Investment Method

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$$\text{\$14.40} + \text{\$38.00} =$$

**\\$52.40/hr**

# Ownership Cost

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**Time Value Method    \$53.12/hr**

**Average Annual**

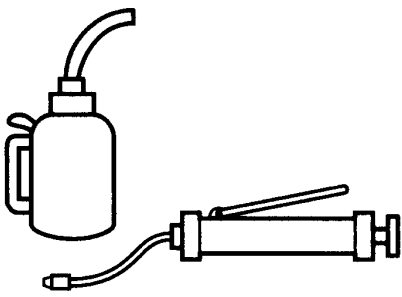
**Investment Method    \$52.40/hr**

**Difference between the methods \$0.72**

# Operating Cost

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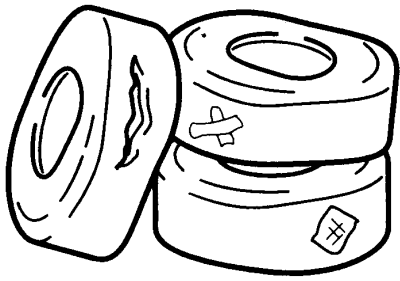
- **Annual cost of repairs equals 70% of str. Line depreciation**
- **Operating factor, 0.5**
- **Cost of fuel \$1.02 per gal**



# Operating Cost

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- **Crankcase capacity, 14 gal**
- **Time between oil changes, 200 hr**
- **Cost of lube oil \$2.50 per gal**
- **Cost of other oils and grease \$0.45 per hour**



## Operating Cost

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- **Repairs to tires 14% of tire depreciation**
- **Life of tires 4,000 hours**

# Operating Cost Repair

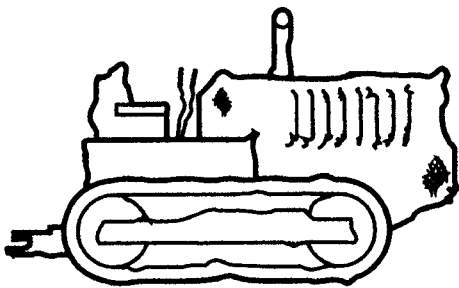
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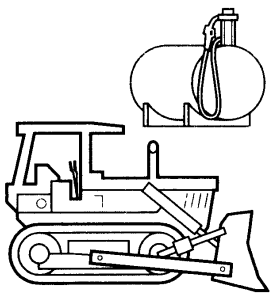


**Hourly depreciation \$38.00**

**\$38.00 X 70% =**

**\$26.60 per hour**





# Operating Cost Fuel

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- Operating factor, 0.5
- Cost of fuel \$1.02 per gal

$$0.04 \times 350 \text{ hp} \times 0.5 = 7 \text{ gal/hr}$$

$$7 \text{ gal} \times \$1.02/\text{gal} = \$7.14/\text{hr}$$

# Operating Cost Oil & Grease

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## Equ. 12-8

$$q = \frac{\text{What the engine burns}}{\text{7.4}} + \frac{\text{Oil changes}}{\text{200 hr}}$$
$$q = \frac{350\text{hp} \times 0.5 \times 0.0006}{7.4} + \frac{14 \text{ gal}}{200 \text{ hr}}$$

$$q = 0.1418919 + 0.070 = 0.212 \text{ gal/hr}$$

# Operating Cost Oil & Grease

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- Cost of lube oil \$2.50 per gal
- Cost other oils and grease \$0.45/hr

$$0.212 \text{ gal/hr} \times \$2.50/\text{gal} = \$0.53/\text{hr}$$

$$\text{Other oils and grease} = \$0.45/\text{hr}$$

$$\text{Total cost O\&G} = \$0.98/\text{hr}$$

# Tires

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**Tires are a major operating cost because they have a short life in relation to the “iron” of a machine**



# Operating Cost Tire Repair

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- Tire repairs 14% of tire depreciation
- Life of tires 4,000 hours

$$\frac{\$30,000}{4,000 \text{ hr}} = \$7.50 \text{ per hour}$$

$$\$7.50 \times 14\% = \$1.05 \text{ per hour}$$

# Operating Cost Tire Depreciation

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How many tire replacements

- Life of tires 4,000 hours

$$\frac{5 \text{ yr} \times 2,000 \text{ hr / yr}}{4,000 \text{ hr}} = \cancel{2.5} \text{ sets}$$

Therefore **3 sets**

# Operating Cost Tire Depreciation

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**First set: (purchased at time 0)**

*Uniform series capital recovery factor*

$$(A/P, 10, 5) = 0.2637975$$

$$\frac{\$30,000 \times (A/P, 10, 5)}{2,000 \text{ hr}} = \underline{\underline{\$3.96/\text{hr}}}$$

# Operating Cost Tire Depreciation

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**Second set: (purchased at time 2 yrs) must first calculate value at time zero.**

*Present worth compound amount factor*

$$P = \frac{\$30,000}{(1 + 0.10)^2} = \$24,793$$

# Operating Cost Tire Depreciation

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**Second set: (purchased at time 2 yr) must first calculate value at time zero.**

$$\frac{\$24,793 \times (A/P, 10, 5)}{2,000 \text{ hr}} = \underline{\underline{\$3.27/\text{hr}}}$$

# Operating Cost Tire Depreciation

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**Third set: (purchased at time 4 yr)  
must first calculate value at time  
zero.**

*Present worth compound amount factor*

$$P = \frac{\$30,000}{(1 + 0.10)^4} = \$20,490$$

# Operating Cost Tire Depreciation

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**Third set: (purchased at time 4 yr) must first calculate value at time zero.**

$$\frac{\$20,490 \times (A / P, 10, 5)}{2,000 \text{ hr}} = \underline{\underline{\$2.70 / \text{hr}}}$$

# Operating Cost Tire Depreciation

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**First set:                    \$3.96/hr**

**Second set:                \$3.27/hr**

**Third set:                    \$2.70/hr**

**Total Tire Dep. \$9.93/hr**

# Operating Cost

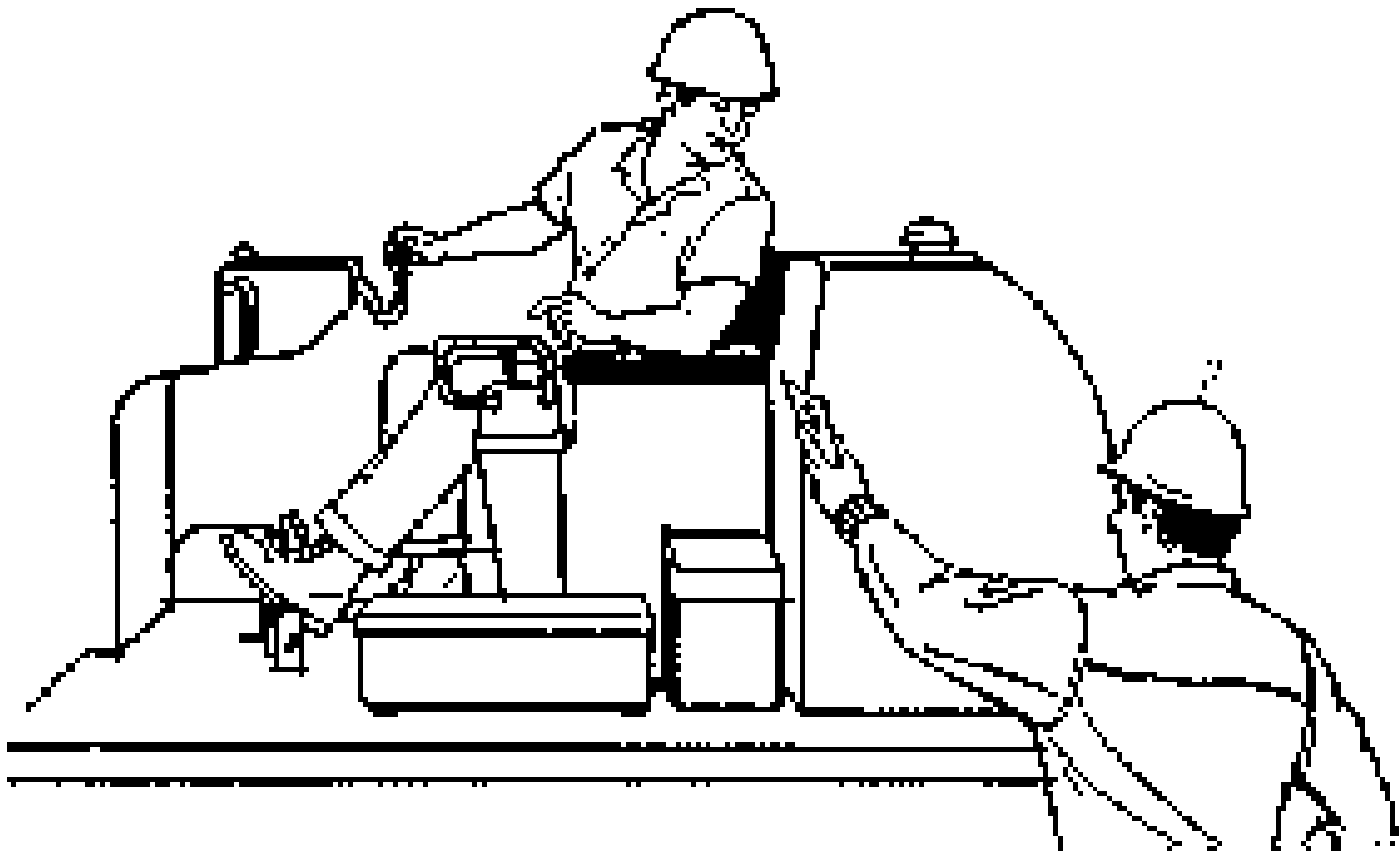
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<b>Repair</b>	<b>\$26.60/hr</b>
<b>Fuel</b>	<b>7.14</b>
<b>Lube Oils</b>	<b>0.98</b>
<b>Tire repair</b>	<b>1.05</b>
<b>Tire dep.</b>	<b>9.93</b>
<b>Total Oper</b>	<b>\$45.70/hr</b>

# Operating Cost Operator Wages

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- *Operator wages* (usually kept separate)



# Procuring Equipment

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- **When???**
- **How???**
  - **Buy**
  - **Rent**
  - **Lease**



# Buy, Rent, Or Lease

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- **Buy**
  - **Guarantees machine availability**
  - **Must have work to keep machine busy**

# Buy, Rent, Or Lease

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- **Rent**
  - **Advantageous if the job is of short duration or if the company does not foresee a continuing need for the machine in question**
  - **Rental charges are higher than *normal* direct ownership expense**

# Buy, Rent, Or Lease

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- **Lease**
  - **Leasing company (lessor) always owns the equipment and the user (lessee) pays the owner to use the equipment**

# Chapter 12 Homework

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**Due next class**

- **12.1**
- **12.4**
- **12.6**