CHAPTER

3c

Construction Planning, Equipment, and Methods

Sixth Edition

# EQUIPMENT COST

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**ENCE 420 – Construction Equipment and Methods**

**Spring 2003**

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## EQUIPMENT COST

- The money a company spends for equipment is an investment which must be recovered as the machine is utilized on projects.

# DEPRECIATION TAX SHIELD

- Ownership Cost
  - Ownership cost accrue whether or not the equipment is used
    - Capital cost (purchase price)
    - Salvage value
    - **Depreciation tax shield**
    - Overhead expenses



# DEPRECIATION TAX SHIELD

- **Under the tax system of U.S., an owner can reduce the company's tax burden and thereby lessen net machine cost by depreciating a machine's loss in value with age.**

# TAX TERMS

- **Depreciation** is used to recover capital expenses for most tangible business assets.
- **Tangible property** is property that can be felt or touched. Its physical features are what make it useful to you - a machine.



# TAX TERMS

- **Basis** is a way of measuring your investment in an asset for tax purposes.

# COST BASIS

- Ownership cost or cost basis includes amounts paid for:
  - Purchase
  - Sales tax on purchase
  - Freight
  - Installation and testing



# COST BASIS

## Like-kind Exchange

- You exchange a machine having a book value of $50,000 for a new machine having a fair market value of $80,000.
- The basis of the new machine is $50,000.
- This is the basis (value) for tax depreciation purposes.

# COST BASIS
## Property Plus Cash

- If you **trade** a machine and pay money, the basis of the machine you receive is the basis of the machine you traded increased by the money paid.



# COST BASIS
## Property Plus Cash

- If you **trade** a machine and pay money:
- Basis (**new**) machine =

basis old machine + money paid

+ $

# COST BASIS

## Sale and Purchase

- If you **sell** a machine as a separate transaction you would pay tax on the cash received which is **greater** than the basis (book value).



# COST BASIS

## Sale and Purchase

- If you **sell** a machine as a separate transaction and the amount received is **less** than the basis (book value), it is your lost.

# COST BASIS

## Sale and Purchase

- If your **sale** of the old machine and purchase of the new are dependent on each other, the transactions are considered an exchange.



# COST BASIS

## Repairs

- If a repair increases the value of your machine, makes it more useful, or lengthens its life, **the repair cost** must be capitalized and depreciated.

# COST BASIS

## Repairs

- The **repair cost** must be capitalized and depreciated.
- You increase the basis of the machine by the cost of the repair.



# DEPRECIATION TAX SHIELD

- The tax saving from depreciation is influenced by
  - the disposal method
  - the value received for the old machine
  - the initial value of the new machine
  - class life
  - the tax depreciation method

# TAX SHIELD FORMULAS

- For situation where there is no gain on the exchange:

$$\text{Total tax shield} = \sum_{n=1}^{N} t_c D_n \quad \textbf{(4)}$$

Where

$N$ = individual yearly time periods within a life assumption of $N$ years

$t_c$ = corporate tax rate

$D_n$ = annual depreciation amount in the $n$th time period



# TAX SHIELD FORMULAS

- For situation where a gain results from exchange:
  a. like-kind exchange, Eq. 4 is applicable.
  b. Third-party sale:

$$\text{Total tax shield} = \sum_{n=1}^{N} t_c D_n - \text{gain} \times t_c \quad \textbf{(5)}$$

**Gain is the actual salvage amount received at the time of disposal minus the book value.**

# DEPRECIATION TAX METHOD

- The Modified Accelerated Cost Recovery System (MACRS) is the US tax code depreciation rule. It applies to all tangible property placed in service after 1986.



# Property Classes

- Property classes & Recovery periods
  - ❖ 5 year property - automobiles and trucks
  - ❖ 7 year property - any property that does not have a class life

# DEPRECIATION METHOD

- 200% declining balance or straight line method for 3, 5, 7, and 10 year property
- 150% declining balance method or straight line method for 15, and 20 year property



# DEPRECIATION RATES

- Table 1 (Table 3.1 Text)

Tax code specified depreciation rates

| Year of life | 3-yr property | 5-yr property |
|---|---|---|
| 1 | 0.33 | 0.20 |
| 2 | 0.45 | 0.32 |
| 3 | 0.22 | 0.24 |
| 4 | | 0.16 |
| 5 | | 0.08 |

Cars and light-duty trucks are classified as 3-yr property. Most other pieces of construction equipment are 5-yr.

# Example 8

- A 5-yr life class machine is purchased for $125,000. It is sold in the third year after purchase for $91,000. What are the depreciation amounts and what is the book value of the machine when it is sold? Will there be income tax, if so in what amount?



# Example 8 (cont'd)

Using tax rates of Table 1:

$125,000 × 0.20 = $25,000 depreciation at end of first year

$125,000 × 0.32 = $40,000 depreciation at end of second year

$65,000

Value when sold = $125,000 - $65,000 = $60,000

Amount of gain (There will tax) = $91,000 - $60,00 = $31,000

# Example 9

A company having a cost of capital rate of 8% purchases a $300,000 tractor. This machine has an expected service life of 4 years and will be used 2,500 hr per year. The tires on this machine cost $45,000. The estimated salvage value at the end of 4 years is $50,000. Calculate the hourly tax saving resulting from depreciation. Assume that the machine is a 5-yr type property and that there



# Example 9 (cont'd)

had been no gain on the exchange that procured the machine. The company's tax rate is 37% under the tax code.

First calculate the annual depreciation amounts for each of the years. In this case, the tax code depreciation rate must be used to calculate depreciation:

# Example 9 (cont'd)

- Annual Depreciation amounts of all for each of the years

| Year | 5-yr property rates | $BV_{n-1}$ | $D_n$ | $BV_n$ |
|---|---|---|---|---|
| **0** | | $ 0 | $ 0 | $300,000 |
| **1** | 0.20 | 3000,000 | 60,000 | 240,000 |
| **2** | 0.32 | 240,000 | 96,000 | 144,000 |
| **3** | 0.24 | 144,000 | 72,000 | 72,000 |
| **4** | 0.16 | 72,000 | 48,000 | 24,000 |
| **5** | 0.08 | 24,000 | 24,000 | 0 |



# Example 9 (cont'd)

- Using Eq. 4, the tax shielding effect for the machine's service life would be

| Year | $D_n$ | Shielded amount* |
|---|---|---|
| **1** | $60,000 | $22,200 |
| **2** | 96,000 | 35,520 |
| **3** | 72,000 | 26,640 |
| | 48,000 | 17,760 |
| | **Total** | **$102,120** |

* $D_n \times 37\%$

$$\text{Tax saving from depreciation} = \frac{\$102,120}{4\text{yr}(2,500\ \text{hr/yr})} = \$10.21/\text{hr}$$

# PRACTICAL EXERCISE

- This exercise illustrates how to calculate the a machine cost using the methods and approaches discussed in this chapter.



# PRACTICAL EXERCISE

- Determine the probable cost per hour of owning and operating a scraper given the following conditions:
  - Engine 350HP diesel
  - Overall cost of money 10%

# PRACTICAL EXERCISE

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



# PE-COST OF MONEY (INTEREST RATE)

## Sources of capital funds:

- ✓ Borrow
- ✓ Earnings
- ✓ Equity

# PE - Ownership Cost
# Time Value Method

- Deduct tire cost from the delivered price for large machines.
- Tires are considered a wear item and are treated as an operating cost.



# PE - Ownership Cost
# Time Value Method

- **Initial cost $470,000**
- **Cost of tires $30,000**

**$440,000**

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

***Uniform series capital recovery factor***

# PE - Ownership Cost
# Time Value Method

- Overall cost of money 10%
- Time 5 years
- Uniform series capital recovery factor

$$A = P\left[\frac{i(1+i)^n}{(1+i)^n - 1}\right]$$



# PE - Ownership Cost
# Time Value Method

- Overall cost of money 10%
- Time 5 years

$$A = \$440{,}000\left[\frac{0.10(1+0.10)^5}{(1+.10)^5 - 1}\right]$$

$$A = \$116{,}071 \text{ per year}$$

# PE - Ownership Cost
# Time Value Method

- 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*



# PE - Ownership Cost
# Time Value Method

- **Overall cost of money 10%**
- **Time 5 years**
- ***Uniform series sinking fund factor***

$$A = F\left[\frac{i}{(1+i)^n - 1}\right]$$

# PE - Ownership Cost
## Time Value Method

- Overall cost of money 10%
- Time 5 years

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

$$A = \$9{,}828 \text{ per year}$$



# PE - Ownership Cost
## Time Value Method

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

**$53.12 / hour**

# PE - Ownership Cost

## AAI

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

***AAI*** = average annual investment method
***P*** = purchase price
***S*** = salvage value
***n*** = life in years



# PE - Ownership Cost

## AAI

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

***P*** = $440,000
***S*** = $60,000
***n*** = 5 years

# PE - Ownership Cost

## AAI

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

***AAI*** **= $288,000/yr**



# PE - Ownership Cost

## AAI

◆**Investment Cost**

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

**$14.40 / hour**

# PE - Ownership Cost

## AAI

◆Depreciation

$470,000
- $30,000 tires
- $60,000 salvage
= $380,000



# PE - Ownership Cost

## AAI

◆Hourly Depreciation

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

# PE - Ownership Cost

## AAI

- Hourly Depreciation

$14.40 + $38.00 =

**$52.40/hr**



# PE - OWNERSHIP COST

- Comparison

**Time Value Method** $53.12/hr

**Average Annual Investment Method** $52.40/hr

Difference between the methods $0.72

# PE - OPERATING COST

- Annual cost of repairs equals70% of straight Line depreciation
- Operating factor, 0.5
- Cost of fuel $1.02 per gal.



# PE - OPERATING COST

- 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

# PE - OPERATING COST

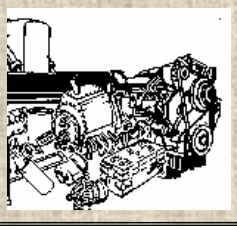
- Repairs to tires 14% of tire depreciation
- Life of tires 4,000 hours



# PE - OPERATING COST

## Repair

- Hourly depreciation $38.00
- $38.00 X 70% =



$26.60 per hour

# OPERATING COST

## Fuel

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

0.04 X 350*hp* X 0.5 = 7 gal/hr

7 gal X $1.02/gal = $7.14/hr



# OPERATING COST

## Oil & Grease

$$q_{oc} = \frac{\text{hp} \times f \times 0.006 \text{ lb/hp - hr}}{7.4 \text{ lb/gal}} + \frac{c}{t}$$

**What the engine burns** **Oil changes**

$$q_{oc} = \frac{350\text{hp} \times 0.5 \times 0.006}{7.4} + \frac{14 \text{ gal}}{200 \text{ hr}}$$

$q_{oc}$ = 0.1418919 + 0.070 = 0.212 gal/hr

# OPERATING COST

## Oil & Grease

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

0.212 gal/hr X $2.50/gal = $0.53/hr

Other oils and grease = $0.45/hr

Total cost O&G = $0.98/hr



# OPERATING COST

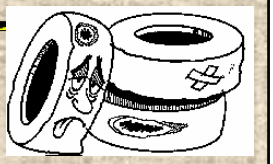
## Tire Repair

- 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 X 14% = $1.05 per hour

# OPERATING COST
## Tire Depreciation



How many tire replacements?

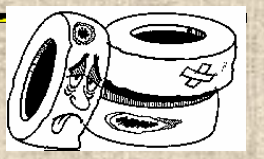
- Life of tires 4,000 hours

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

Therefore 3 sets



# OPERATING COST
## Tire Depreciation



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

Spread the cost over the live of the machine

-- *Uniform series capital recovery factor*

$$\frac{\$30{,}000 \times \left[\dfrac{0.10(1+0.10)^5}{(1+0.10)^5 - 1}\right]}{2{,}000\ \text{hr}} = \$?\ /\ \text{hr}$$

# OPERATING COST
## Tire Depreciation

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

$$\frac{\$30{,}000 \times 0.2637975}{2{,}000\ \text{hr}} = \$3.96/\text{hr}$$



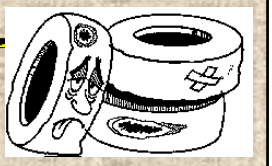
# OPERATING COST
## Tire Depreciation

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

$$P = \frac{\$30{,}000}{(1+i)^n}$$

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

# OPERATING COST
## Tire Depreciation



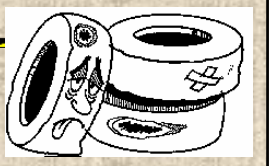
**Second set:** (purchased at time 2 yr)

Spread the cost over the live of the machine
-- *Uniform series capital recovery factor*

$$\frac{\$24{,}793 \times 0.2637975}{2{,}000 \text{ hr}} = \$3.27/\text{hr}$$



# OPERATING COST
## Tire Depreciation

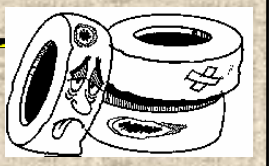


**Third set:** (purchased at time 4 yr)
must first calculate value at time zero.

$$P = \frac{\$30{,}000}{(1+i)^n}$$

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

# OPERATING COST
## Tire Depreciation



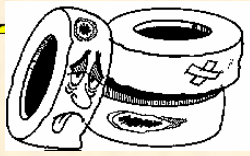
**Third set:** (purchased at time 4 yr)

Spread the cost over the live of the machine
-- *Uniform series capital recovery factor*

$$\frac{\$20{,}490 \times 0.2637975}{2{,}000\ \text{hr}} = \$2.70/\text{hr}$$



# OPERATING COST
## Tire Depreciation



| | |
|---|---|
| First set: | $3.96/hr |
| Second set: | $3.27/hr |
| Third set: | $2.70/hr |
| Total Tire Dep. | $9.93/hr |

# PE Operating Cost

| | |
|---|---|
| ◆ Repair | $26.60/hr |
| ◆ Fuel | 7.14 |
| ◆ Lube Oils | 0.98 |
| ◆ Tire repair | 1.05 |
| ◆ Tire dep. | 9.93 |

◆ Total Oper $45.70/hr



# PE – SCRAPER COST

■ **Total Scraper Cost**

**COST = Ownership Cost + Operating Cost**

$$\text{Scraper Cost} = \$53.12/\text{hr} + \$45.70/\text{hr} = \$98.82/\text{hr}$$