

# ANNUAL COST

## PURPOSE

For investments (purchases) of buildings and equipment, which are expected to last several years, it is reasonable to place their cost on an annual basis over several years, rather than a single year. Viewing cost on an annual basis allows easy comparison to anticipated changes in income or productivity that will be required to pay for the item. For instance, if annual cost of a mix wagon is \$3,000, then an equivalent increase in net milk income will cover its cost. For 100 cows at a rate of \$8/cwt of milk, that would be 350lbs/cow/year or slightly more than 1 lb/cow/day in milk. Furthermore, annual costs allow comparison or joint consideration of items having differing lengths of life.

## CALCULATION CONCEPT

The annual cost includes charges for depreciation (purchase price minus salvage value), interest on the money invested, repairs for normal use, property taxes, and insurance. Repairs, property taxes, and insurance are usually rough estimates by percentage of price, with increases in repairs assumed to offset decreases in the other two. Interest is often loosely accounted for by multiplying an average value of the item by an interest rate (discount, opportunity, MARR). This is crude and can be improved by using time value of money to convert price and salvage to an annual cost, which includes automatically both depreciation and interest.

## INFORMATION TO BE INCLUDED

1. Purchase Price – to be annualized
2. Salvage Value – also to be annualized. Can be figured several ways, guessed, or ignored entirely if years of life are extended long enough. This does not require that one plans to actually sell the item in the end. Fortunately, salvage, when converted from future value to annual value, becomes quite small and often insignificant.
3. Repairs – estimated as a percentage of purchase price, therefore already annualized. This is in reality a variable cost, but is treated as fixed for the annual cost calculation because it will be necessary if the item receives normal use. It will admittedly, increase in amount over time, but be offset by decreasing taxes and insurance. If there are few moving parts, use 1 or 2%, otherwise up to 5 or 6% of price.
4. Property Taxes and Insurance – not always associated directly with the item. There may be no property taxes on it or the insurance currently in effect will cover the item at no additional cost, but both together are usually included at 1.5% of price.

5. MARR and Years of Life – MARR is the interest rate used to annualize the price and salvage. It normally is the rate, which could be earned, in an alternative safe investment. Higher rates could be used to make the annual cost look larger (more conservative approach). Years of life should be reasonable, with any real-life extensions for excellent care or good luck being a bonus beyond what was expected. Remember, years of life are also curtailed by obsolescence. One technique of calculation is to extend the years of life and ignore the salvage value, particularly on long-lived items.

**Relating the DIRT15 to Annual Cost**

Depreciation

Interest

Repairs

Taxes

Insurance

Important Point – Annual Value of Purchase Price minus Annual Value of Salvage takes care of depreciation and interest.

**Annual Cost Example**

Price:	\$10,000
Years of Life:	10
MARR:	10%
Repairs:	3%
Taxes and Insurance:	1.5%
Salvage:	Double Declining Balance

Purchase Price: Amortize over 10 years at 10% interest  
 $\$10,000 \times (0.1627) = \$1,627$

Salvage Value: Find a salvage value  
 $\$10,000 \times (1 - 0.2)^{10} = \$1,074$

Convert to annual value  
 FV to PV =  $\$1,074 \times (0.0627) = \$67$

Repairs: Already on annual basis  
 $\$10,000 \times 0.03 = \$300$

Property Taxes/Insurance: Already on annual basis  
 $\$10,000 \times 0.015 = \$150$

**Summary of Annual Cost**

Item	Annual \$
Initial Price	1,627
Salvage Price	-67
Repairs	300
Taxes/Insurance	150
<b>Total Annual Cost</b>	<b>\$2,010</b>

## SALVAGE VALUE

1. Straight Line – Equal amount each year. Either determine salvage to find depreciation or use depreciation to find salvage.

Example: For 10 years of \$600 depreciation per year  
 $\$10,000 - 10 \times \$600/\text{yr} = \$4,000$  salvage value  
or  
\$4,000 salvage value at the end of 10 years  
 $(\$10,000 - \$4,000)/10 \text{ years} = \$600$  depreciation per year

2. Declining Balance – The Book Value at the end of any year is a fixed percent of the value in the prior year, where loss in value each year is  $1/n$ .

$$\text{BookValue}_t = \text{Price} \left[ 1 - \frac{1}{n} \right]^t$$

where:  $n$  = years of life, and  $t$  = year for which we want the book value.

Example: For salvage value,  $n = t = 10$ . Since  $n = 10$ , the value each year is 90% of the previous year ( $1 - 1/10$ ).  
 $\$10,000 \times 0.9^{10} = \$3,487$  salvage or book value at end of 10 years

3. Double Declining Balance – Fixed percent of prior year, where loss in value each year is  $2/n$  instead of  $1/n$ .

$$\text{BookValue}_t = \text{Price} \left[ 1 - \frac{2}{n} \right]^t$$

where:  $n$  = years of life, and  $t$  = year for which we want the book value.

Example: For salvage value,  $n = t = 10$ . Since  $n = 10$ , 20% is lost each year; 80% is retained.  
 $\$10,000 \times 0.8^{10} = \$1,074$  salvage or book value at end of 10 years

4. Educated Guess – From used item, sale, classified ad, or expertise.