

Research Pays Off



Determining the Value of Research for Transportation in Indiana

Research on transportation is performed with the intent that successful findings, if implemented, will result in significant cost savings to the public. These cost savings will generally exist because of increases in operating and maintenance efficiencies, reductions in investment in cost, improvements in health and safety or reductions in damage to the environment. Transportation research in Indiana has always had such a goal.

In combining benefits and costs of research, one must account for the time-value of money. This is done in the following manner:

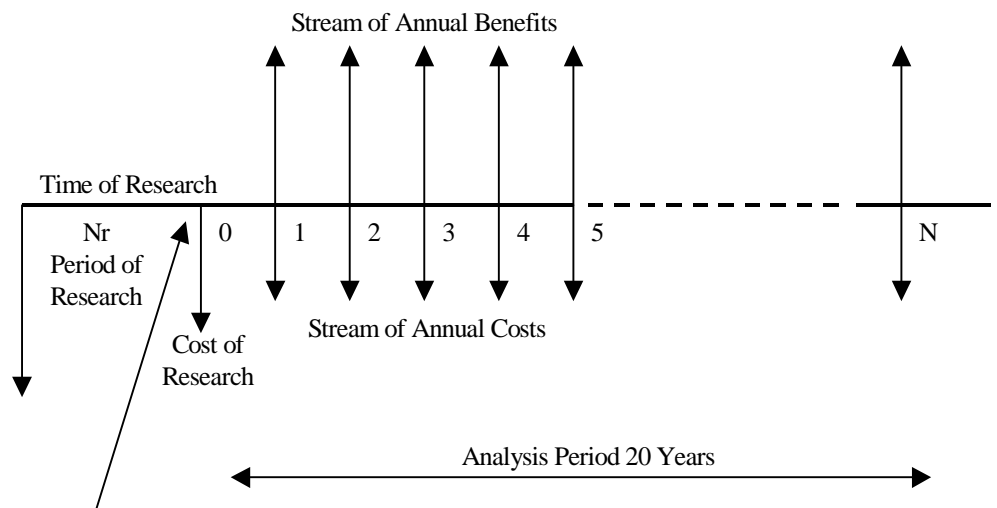
- The cost of research is the initial cost and occurs at the beginning of the analysis.
- The cost of implementation can be expressed as a uniform annual cost.
- The benefits, which derive from the

system improvements, occur annually.

Each annual cost and benefit is discounted by a discount rate, which can vary from 4% to 8%. Thus the benefits that occur 10 years from now are worth less in today's dollars. This is called Net Present Worth. When the annual benefits are the same from year to year, the discount sum or Present Value of the benefits is obtained by dividing the annual benefit by the capital recovery factor. Uniform annual costs are handled in an identical manner.

Unless specified, the discount rate of 5% over 20 years is used in the benefit analyses, which is equivalent to a discount rate of 7% for 30 years (which is the discount rate INDOT used for the Southwest Corridor Study).

Calculation of Benefits



Effective start of the program implementation occurs at completion of the research phase

Benefit Analysis

To convert a single present benefit (or cost) value (P) into the equivalent annual benefit (or cost) value (A) over N-year period with a discount rate i:

$$A = P \frac{i(1+i)^N}{(1+i)^N - 1}$$

Example: If the research cost of a study was \$100,000 in the current dollar value, the equivalent annual cost over 20-year period (the current year is year 0) at 5% discount rate is calculated as follows:

$$A = 100,000 \frac{0.05(1+0.05)^{20}}{(1+0.05)^{20} - 1} = 100,000 \times 0.080243 = \$8,024.3$$

To convert the annual benefit (or cost) value (A) over N years into a single present benefit (or cost) value (P) with a discount rate i:

$$P = A \frac{(1+i)^N - 1}{i(1+i)^N}$$

Example: If research resulted in an annual benefit of \$100,000, the equivalent present worth of the annual benefit over a 20-year period at 5% discount rate is calculated as follows:

$$P = 100,000 \frac{(1+0.05)^{20} - 1}{0.05(1+0.05)^{20}} = 100,000 \times 12.46221 = \$1,246,221$$

To convert a single future benefit (or cost) value (F) at year N into the equivalent annual benefit (or cost) value (A) over the N-year period with a discount rate i:

$$A = F \frac{i}{(1+i)^N - 1}$$

Example: If the benefit on the 20th year is estimated as \$100,000, the equivalent annual benefit over the 20-year period at 5% discount rate is calculated as follows (distributing the single year benefit to uniform annual benefit over 20 years):

$$A = 100,000 \frac{0.05}{(1+0.05)^{20} - 1} = 100,000 \times 0.030243 = \$3,024.3$$

To convert the annual benefit (or cost) value (A) over N years into a single future benefit (or cost) value (F) at year N with a discount rate i :

$$F = A \frac{(1+i)^N - 1}{i}$$

Example: If research resulted in an annual benefit of \$100,000, the equivalent future benefit on the 20th year at 5% discount rate is calculated as follows (the future dollar value at year 20):

$$F = 100,000 \frac{(1+0.05)^{20} - 1}{0.05} = 100,000 \times 33.06595 = \$3,306,595$$