

Cost-Benefit Analysis: The Hiawatha Light Rail

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Outline

- What is required by Federal and State Law
- How to conduct Cost-Benefit Analysis
- A Cost-Benefit analysis of the Hiawatha Light Rail

Federal and State Law

- Executive Order 12866 (1993) on Regulation
 - Clinton administration: “Each agency shall assess both the costs and the benefits of the intended regulation and...propose or adopt regulation only upon a reasoned determination that the **benefits of the intended regulation justify its costs**”
 - OMB interpretation: “The proposed action will **maximize net benefits to society...unless** a statute requires another regulatory approach”
“Where a statute requires a specific regulatory approach, the proposed action will be the most **cost effective**”
- For costs and benefits of projects, rules differ by agency
- Generally speaking, most agencies require that costs and benefits of projects be considered but do not require a strict cost-benefit rule to be followed.

Measures used in Cost-benefit analysis

- Maximize “net benefits to society” means

Maximize (Total benefits – total costs)

This is the condition for “allocative efficiency”

- A project is said to be “feasible” if

Total benefits/Total costs > 1

- A project is “cost-effective” if it is implemented so that

Total costs are minimized

Conducting a Cost-benefit analysis: The Hiawatha Light Rail

A light rail car (source: <http://www.dot.state.mn.us/metro/lrt/>)



Hiawatha Light Rail Transit (LRT)

(source: <http://www.dot.state.mn.us/metro/lrt/>)

Map of route



Conducting a Cost-benefit Analysis*

- Step 1: Establish Timeframe
 - Over what time period will costs and benefits be incurred?
 - For LRT: Cars last 25 years
 - In MNDOT analysis, costs began in 1999, benefits began in 2003

*Numbers in this presentation were taken from *Final Hiawatha Corridor LRT Benefit-Cost Analysis*, Minnesota Department of Transportation Office of Investment Management, November 4, 1999

Conducting a Cost-benefit Analysis

Step 2: List Benefits and Costs

- Costs

- Rail
- Cars
- Costs of Relocating Utilities
- Parking
- Operating Costs
- Bus Line Changes

- Benefits

- Travel Time Savings
- Reduced Crashes
- Reduced Auto Operating Costs
- Reduced Pollution
- Remaining capital value of parking, highways, other investments at end of period

Step 3: Monetize Costs and Benefits

- Costs

(Previous experience, engineers, preliminary bids)

- Rail
- Cars
- Costs of Relocating Utilities
- Parking
- Operating Costs
- Bus Line Changes

- Benefits

- Travel Time Savings
(Value of time)
- Reduced Crashes
(Number of crash reductions, likelihood of injury or fatality, value of life)
- Reduced Auto Operating Costs (dollars per mile)
- Reduced Pollution
(Value of pollution reduction)
- Remaining capital value of parking, highways, other investments at end of period

Step 4: Deflate Costs and Benefits

- If future costs and benefits are given in **nominal** terms, deflate to get **real** values

$$\text{Real Value} = (\text{Nominal Value}) / (1+p)^t$$

where p is the inflation rate.

LRT analysis assumed $p = 3 \% (.03)$

Step 5: Take Present Value of Costs and Benefits

- Value of a dollar is not constant over time
 - Money today is more valuable than the same amount of money in the future.

$$\text{Future Value} = (\text{Present value}) \cdot (1+r)^t$$

- To make sure we compare apples with apples, calculate the **present value** of each future year's costs and benefits.

$$\text{Present Value} = (\text{Future Value}) / (1+r)^t$$

LRT analysis assumed $r = 3.3$ percent (.033)

Steps 6 and 7

- Step 6: Add up Present Value of Costs, Benefits for years in time frame

LRT PVCosts = \$765.4 million

LRT PVBenefits = \$318.1 million

- Step 7: Assess Feasibility

PVBenefits/PVCosts = 0.42 (infeasible!)

Step 8: Conduct sensitivity analysis

Source: *Final Hiawatha Corridor LRT Benefit-Cost Analysis*,
Minnesota Department of Transportation, Office of Investment Management,
November 4, 1999

Sensitivity Analysis: LRT cost-benefit study (Numbers below are benefit-cost ratios)			
Base case assumptions		0.42	
Discount Rate, 2% or 7%	0.48		0.27
Value of travel time, $\pm 20\%$	0.45		0.38
Avoid auto operating costs, $\pm 20\%$	0.43		0.40
Pollution reduction benefits, +100%, +900%	0.45		0.72

Potential Omitted Benefits and Unforeseen Circumstances

- The Hiawatha LRT signals commitment to regional mass transit, which when completed may have Benefit/Cost > 1
- LRT not opened until 2004
- Ridership has greatly exceeded expectations—first three months were 96% greater than goal (almost double!)
- Expenses also higher
- Complaints about congestion and parking in neighborhoods