



Benefit-Cost Analysis

A Vital Decision Support Tool for Today's World

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Benefit-Cost Analysis (BCA)

- ✓ Overview
- ✓ BCA process
- ✓ Route 96 and 14 Intersection Redesign

What is Benefit-Cost Analysis?

USDOT definition

A **systematic process** for identifying, quantifying, and **comparing expected benefits and costs** of a potential infrastructure project. A BCA provides estimates of the anticipated benefits that are expected to accrue from a project **over a specified period** and compares them to the anticipated costs of the project.

- ◆ Broadly encompassing – includes “social value”
- ◆ Structured and quantified
- ◆ Compare alternatives



Why is BCA Important?

- ◆ Funding: USDOT order, January 2025
- ◆ Decision support
- ◆ Emphasis on value with limited public funding



U.S. Department
of Transportation

Office of the Secretary
of Transportation

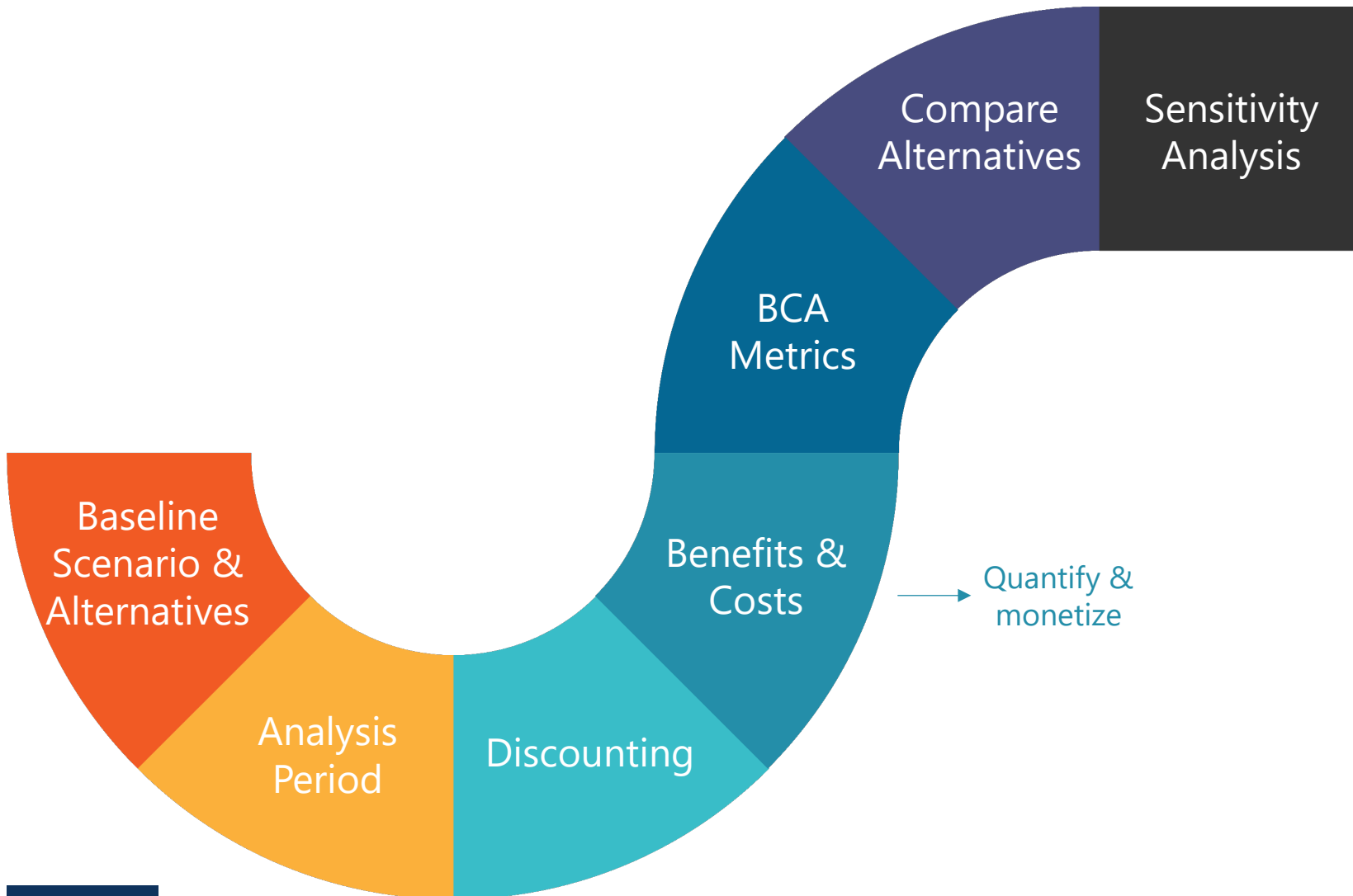
SUBJECT: ENSURING
RELIANCE UPON SOUND
ECONOMIC ANALYSIS IN
DEPARTMENT OF
TRANSPORTATION POLICIES,
PROGRAMS, AND ACTIVITIES

DOT Order

1. PURPOSE

This Order updates and resets the principles and standards underpinning U.S. Department of Transportation (Department or DOT) policies, programs, and activities to mandate reliance on rigorous economic analysis and positive cost-benefit calculations and ensure that all DOT grants, loans, contracts, and DOT-supported or -assisted State contracts bolster the American economy and benefit the American people.

The BCA Process



U.S. Department
of Transportation

Benefit-Cost Analysis Guidance for Discretionary Grant Programs

Office of the Secretary
U.S. Department of Transportation
November 2024

Benefit and Cost Categories

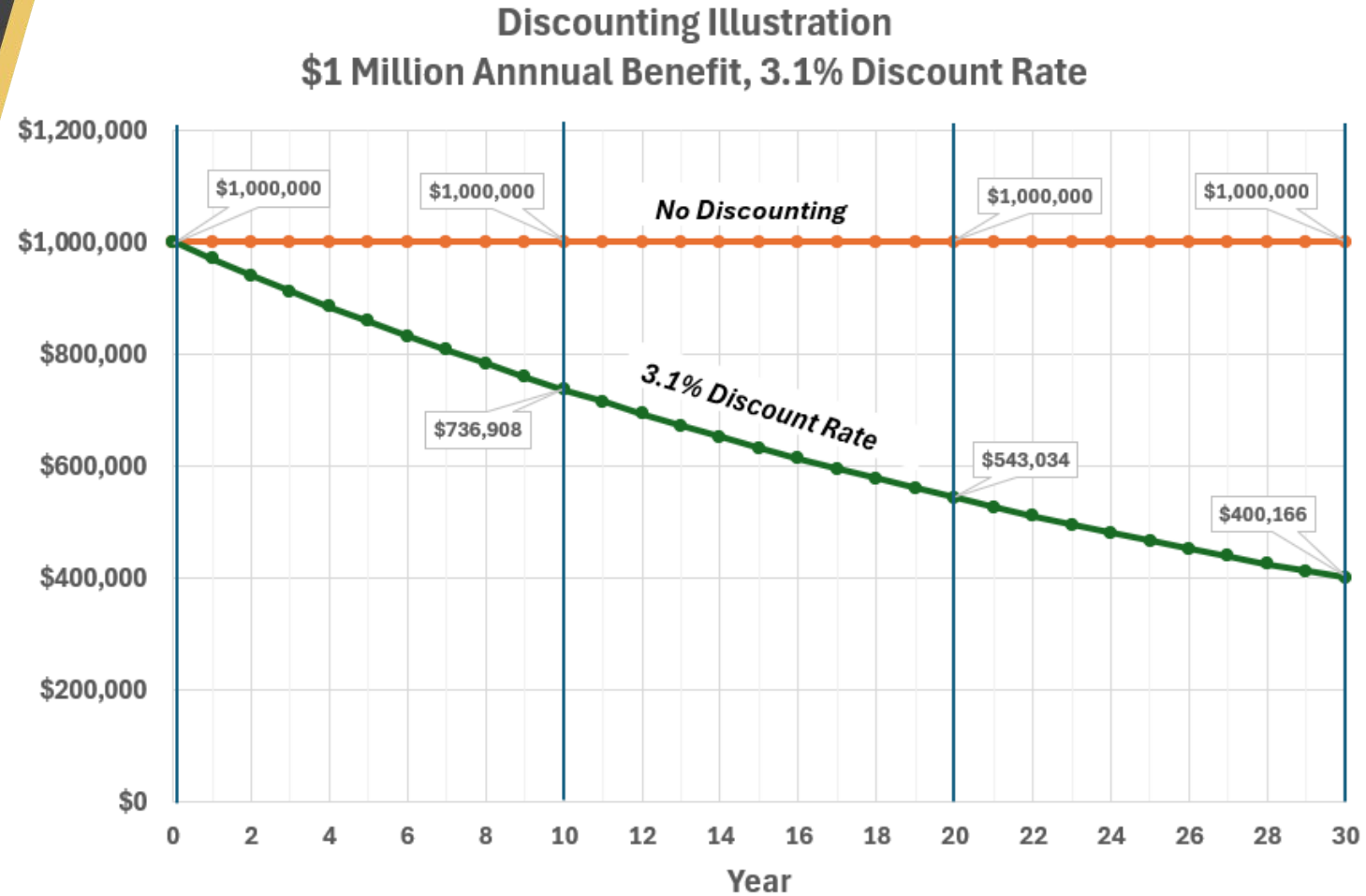
Costs	Benefits
Initial construction	Safety
Maintenance schedule <ul style="list-style-type: none">◆ Assumed future costs◆ Extend throughout a project's useful life	Travel time
	Operating costs
	Emissions reduction
	Others <ul style="list-style-type: none">◆ Land value◆ Comfort◆ Health◆ Noise reduction◆ Residual value◆ Etc.



****In BCA, all benefits and costs for an alternative are **compared against the baseline scenario******

Discounting

- ◆ The value of a dollar in the future is less than its value now.
- ◆ Example:
 - ◆ 30-year analysis period
 - ◆ \$1 million annual benefit
 - ◆ 3.1% discount rate
- ◆ Present Value
 - ◆ No discounting: \$30,000,000
 - ◆ Discounted at 3.1%: \$19,350,000



BCA Metrics

- ◆ **Net Present Value (NPV)**

- ◆ [All Benefits] *minus* [All Costs]

- ◆ Interpretation

- ◆ ***NPV > 0 means an alternative's overall value is greater than the baseline***

- ◆ "Economically advantageous"

- ◆ NPV < 0 means the baseline is economically advantageous to an alternative

Benefit-Cost Ratio (BCR)

- [All Benefits] divided by [All Costs]

- Interpretation

- ***BCR > 1 means an alternative's benefits outweigh its costs***

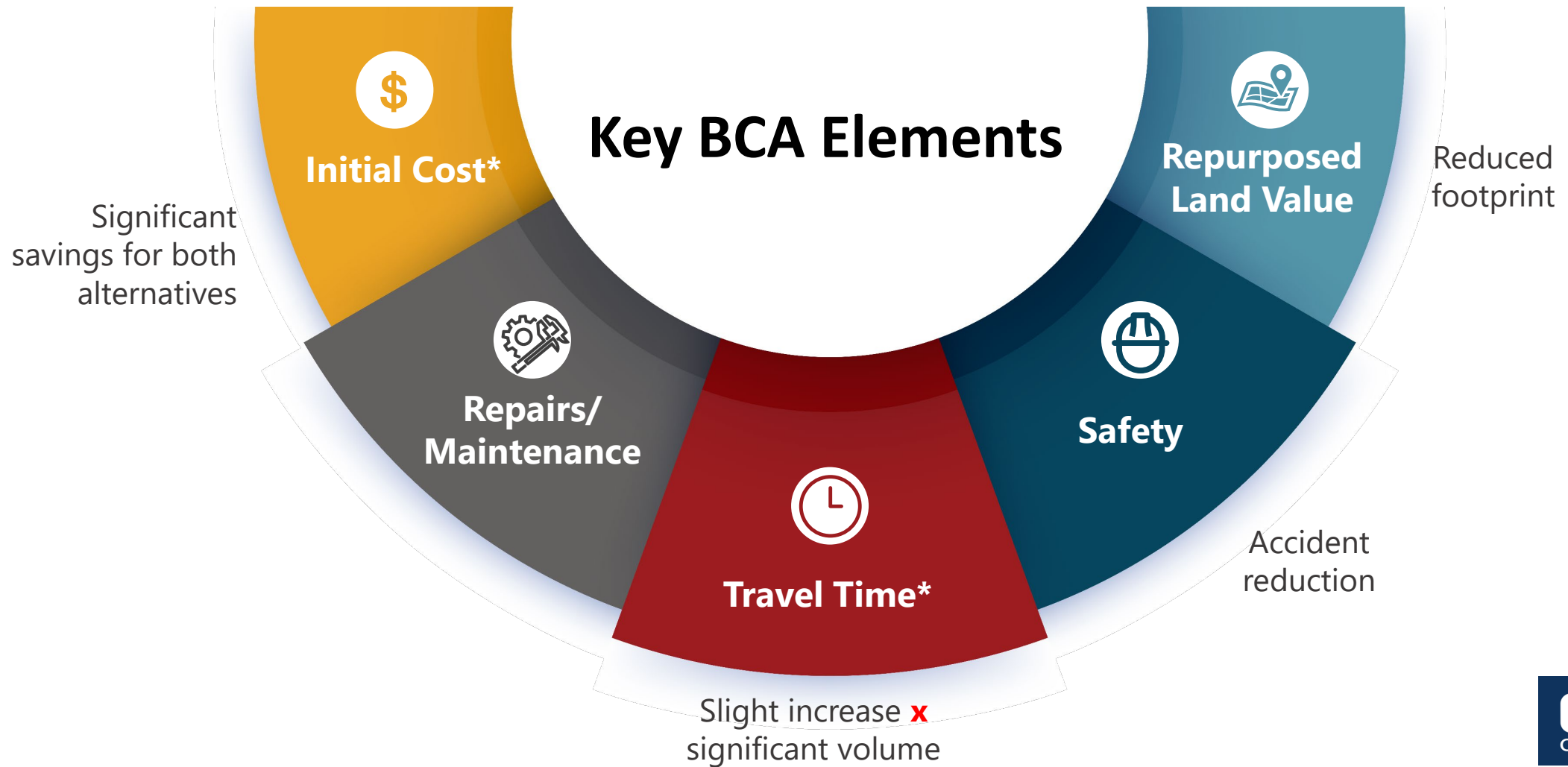
- *BCR < 1 means an alternative's costs outweigh its benefits*

Example: Routes 14 and 96 Intersection Redesign

- ◆ GTC Project, C&S partnered with Stantec
- ◆ Baseline Alternative: Maintain Existing Infrastructure
- ◆ Alternative 1: Signalized Intersection
- ◆ Alternative 2: Roundabout



Example: Routes 96 and 14 Intersection Redesign



ROUTE 96 OVER ROUTE 14 INTERSECTION REDESIGN
BENEFIT-COST ANALYSIS RESULTS
--- ROUNDABOUT ALTERNATIVE ---



Year	Construction	Repairs	Maintenance	Travel Time	Operating Costs	Safety	Emissions	Repurposed Land	Residual Value
2030	0	\$	-	\$	-	\$	-	2,014,646	\$
2031	1	\$	55,023	\$	(570,442)	\$	26,900	-	\$
2032	2	\$	53,368	\$	(553,567)	\$	26,100	-	\$
2033	3	\$	51,764	\$	(537,191)	\$	25,335	-	\$
2034	4	\$	50,207	\$	(521,299)	\$	24,585	-	\$
2035	5	\$	48,697	\$	(505,878)	\$	23,858	-	\$
2036	6	\$	47,233	\$	(490,912)	\$	23,152	-	\$
2037	7	\$	45,813	\$	(476,390)	\$	22,467	-	\$
2038	8	\$	44,436	\$	(462,297)	\$	21,802	-	\$
2039	9	\$	43,099	\$	(448,621)	\$	21,157	-	\$
2040	10	\$	41,804	\$	(435,349)	\$	20,532	-	\$
2041	11	\$	40,547	\$	(422,470)	\$	19,924	-	\$
2042	12	\$	39,327	\$	(409,972)	\$	19,335	-	\$
2043	13	\$	38,145	\$	(397,844)	\$	18,763	-	\$
2044	14	\$	36,998	\$	(386,075)	\$	18,208	-	\$
2045	15	\$	35,886	\$	(374,653)	\$	17,669	-	\$
2046	16	\$	34,807	\$	(363,570)	\$	17,146	-	\$
2047	17	\$	-	\$	-	\$	9,512	-	\$
2048	18	\$	-	\$	-	\$	9,226	-	\$
2049	19	\$	-	\$	-	\$	8,949	-	\$
2050	20	\$	-	\$	-	\$	8,680	-	\$
2051	21	\$	-	\$	-	\$	8,419	-	\$
2052	22	\$	-	\$	-	\$	8,166	-	\$
2053	23	\$	-	\$	-	\$	7,920	-	\$
2054	24	\$	-	\$	-	\$	7,682	-	\$
2055	25	\$	-	\$	-	\$	7,451	-	\$
2056	26	\$	-	\$	-	\$	7,227	-	\$
2057	27	\$	-	\$	-	\$	7,010	-	\$
2058	28	\$	-	\$	-	\$	6,799	-	\$
2059	29	\$	-	\$	-	\$	6,595	-	\$
2060	30	\$	2,016,067	\$	22,701	\$	11,261	-	\$
2061	31	\$	(5,473)	\$	22,018	\$	10,928	-	\$
2062	32	\$	9,566	\$	21,356	\$	10,605	-	\$
2063	33	\$	9,129	\$	20,714	\$	10,291	-	\$
2064	34	\$	8,999	\$	20,091	\$	9,987	-	\$
2065	35	\$	10,305	\$	19,487	\$	9,691	-	\$
2066	36	\$	8,466	\$	18,901	\$	9,405	-	\$
2067	37	\$	(373,927)	\$	18,333	\$	9,126	-	\$
2068	38	\$	7,965	\$	17,782	\$	8,856	-	\$
2069	39	\$	(3,572)	\$	17,247	\$	8,594	-	\$
2070	40	\$	729,662	\$	16,728	\$	8,340	-	\$
2071	41	\$	(4,033)	\$	16,225	\$	8,093	-	\$
2072	42	\$	13,985	\$	15,738	\$	7,854	-	\$
2073	43	\$	-	\$	15,264	\$	7,622	-	\$
2074	44	\$	14,461	\$	14,805	\$	7,396	-	\$
2075	45	\$	-	\$	-	\$	-	-	\$
2076	46	\$	-	\$	-	\$	-	-	\$
2077	47	\$	-	\$	-	\$	-	-	\$
2078	48	\$	-	\$	-	\$	-	-	\$
2079	49	\$	-	\$	-	\$	-	-	\$
2080	50	\$	-	\$	-	\$	-	-	\$
Totals		\$ 20,943,013	\$ 4,629,955	\$ 1,432,292	\$ (14,986,547)	\$ 706,783	\$ 403,568	\$ 85,909	\$ 2,014,646

Cost Categories

Benefit Categories

50 Year Analysis Period

ALL ANNUAL VALUES ARE RELATIVE
TO THE BASELINE SCENARIO
AND
DISCOUNTED AT 3.1%

Net Present Value
Alternative
Signalized Intersection
\$7.3 million
Benefit-Cost Ratio
Alternative
Signalized Intersection
1.30

Cost Categories

Benefit Categories

ALL ANNUAL VALUES ARE RELATIVE
TO THE BASELINE SCENARIO
AND
DISCOUNTED AT 3.1%

Totals = Sum of all Discounted Annual Values
"Present Value" – Expressed as Current \$

Net Present Value (NPV)

Alternative 1
Signalized Intersection
\$7.3 million

Alternative 2
Roundabout
\$13.4 million

Benefit-Cost Ratio (BCR)

Alternative 1
Signalized Intersection
1.30

Alternative 2
Roundabout
1.81

Net Present Value \$ 13,383,800
Benefit-Cost Ratio 1.81

BCA Metrics

Takeaways



- ✓ Current emphasis on BCA
 - ◆ Funding
- ✓ Flexible—all project types
- ✓ Integrated and interactive
- ✓ Effective decision making
 - ◆ Objective
 - ◆ Comparison of alternatives
 - ◆ Return on public investment

A large graphic with the words 'THANK YOU' in a bold, sans-serif font. The letters are colored in a gradient of blue, red, and yellow. The text is framed by a decorative border consisting of horizontal and vertical lines with small colored segments.

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