US Department of Transportation

Preparing a Benefit-Cost Analysis for the RAISE Discretionary Grant Program

January 26, 2023

Webinar Information

Audio

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Technical Support

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Questions for Presenters

- Please type your questions in the Q&A box

More Information

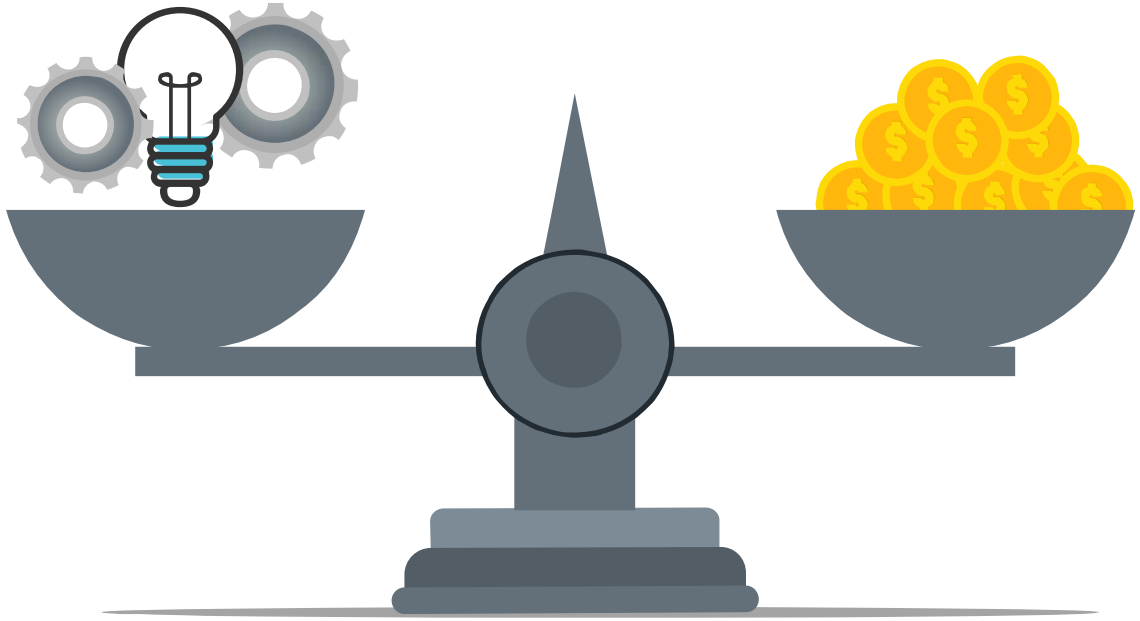
- This webinar is being recorded and will be posted on the RAISE Grants website at https://www.transportation.gov/RAISEgrants

Today's Presenters

- **Darren Timothy, Chief Economist, USDOT**
- **Jordan Riesenberg, Economist, USDOT**

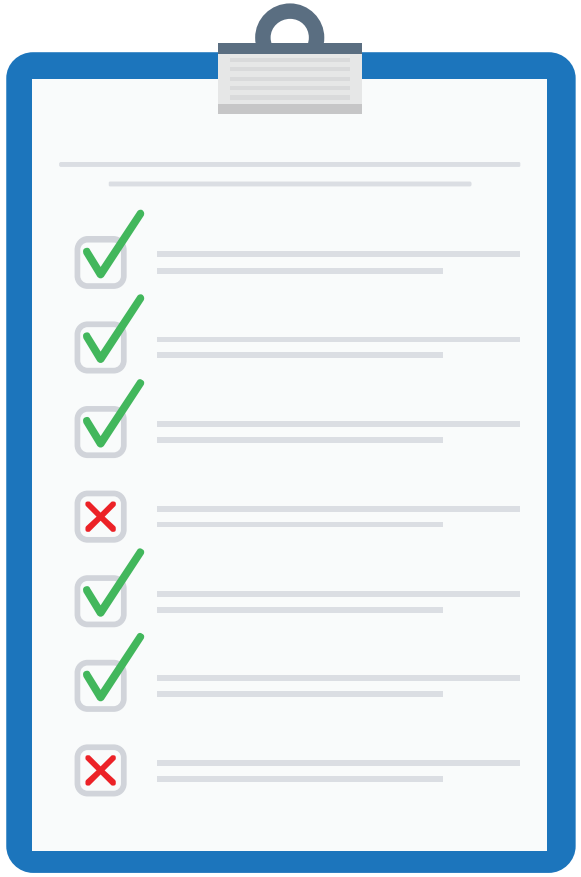
What is BCA?

- Benefit-cost analysis (BCA) is a systematic process for identifying, quantifying, and comparing expected economic benefits and costs of a proposed infrastructure project.



Why do we do BCA?

- Provides a useful benchmark from which to evaluate and compare potential transportation investments
- Adds a degree of rigor to the project evaluation process



BCA and RAISE

- All sponsors of capital projects should submit a benefit-cost analysis (BCA) as part of their RAISE grant application
- Use of the BCA in RAISE
  - Consider the extent to which the project is cost effective
- Sponsors of planning grant applications **do not need** to submit a benefit-cost analysis

Use of the BCA in Project Evaluation

- USDOT will consider the relative magnitude of estimated project benefits and costs in its evaluation
- Assign projects one of two ratings
  - Positive net benefits (benefits exceed costs)
  - Negative net benefits (costs exceed benefits)
- Projects with a negative BCA rating will not be selected for an award, unless the project has unquantified benefits that demonstrate clear outcomes for underserved communities.

USDOT BCA Review

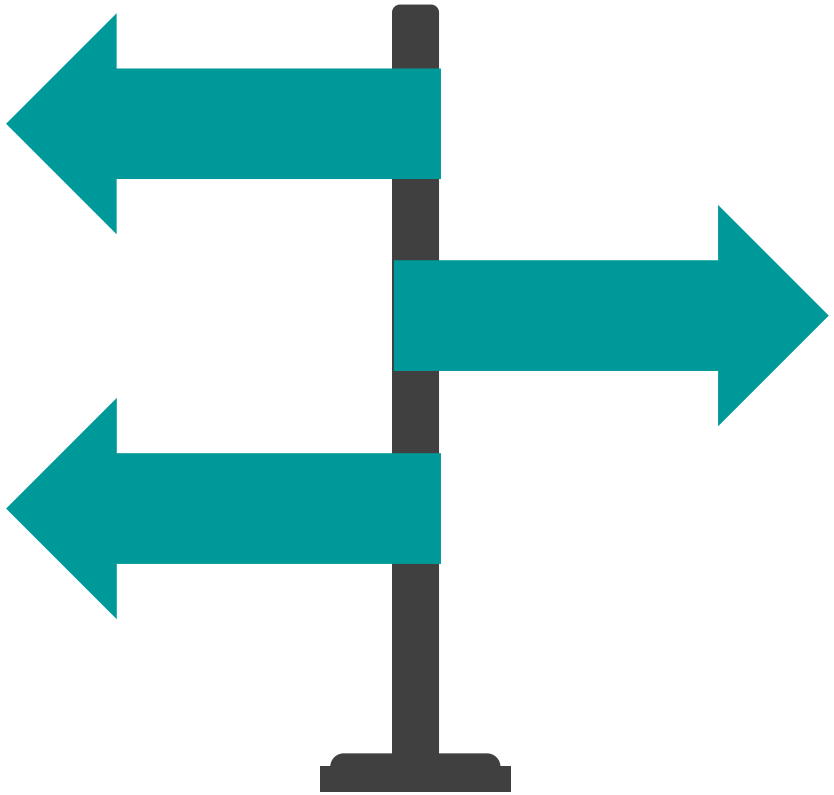
- USDOT economists will review the applicant's BCA
  - Examine key assumptions
  - Correct for any technical errors
  - Perform sensitivity analysis on key inputs
  - Consider any unquantified benefits

What do I need to do BCA?

- Clear understanding of the problem the project is intended to solve (baseline conditions) and how the project addresses the problem (measures of effectiveness)
- Well-defined project scope and cost estimate
- Monetization factors for key project benefits

What do I need to do BCA?

- Sources of information may include:
  - Project planning and engineering documents
  - Industry technical references and analytical tools
  - DOT BCA Guidance
  - Partners

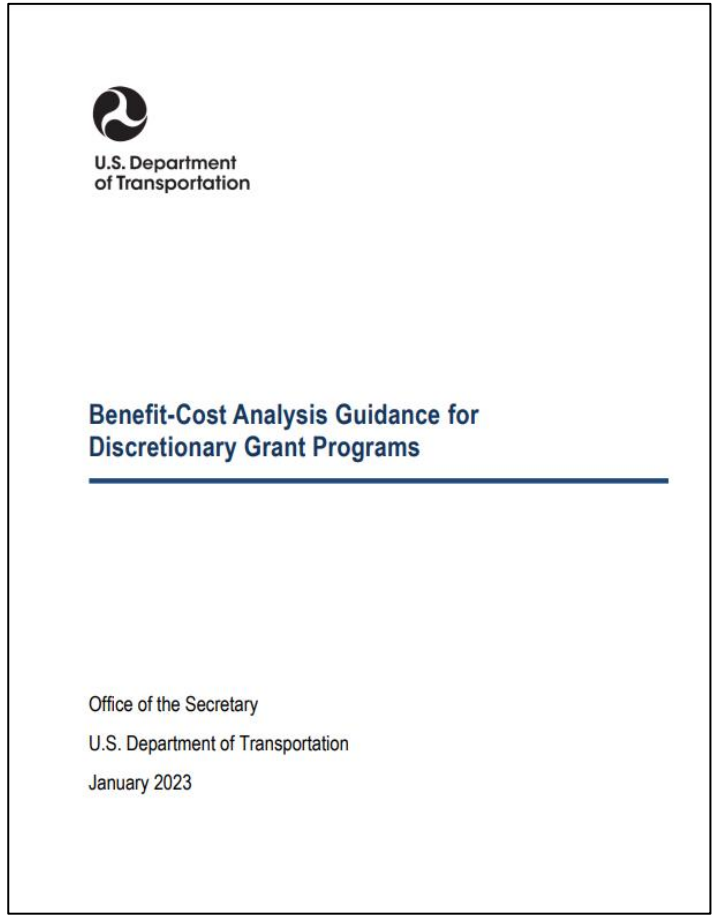


What should my BCA submission include?

- Technical memo/discussion describing the analysis, including any unquantified benefits, and documenting sources of information used (assumptions and inputs)
  - If provided as an appendix, does not count against page limit for the application narrative
- An unlocked spreadsheet (e.g., an Excel workbook) showing the calculations used to produce the estimates of benefits and costs

USDOT BCA Guidance

- Covers all USDOT discretionary grant programs
- Available at https://www.transportation.gov/mission/office-secretary/office-policy/transportation-policy/benefit-cost-analysis-guidance


U.S. Department of Transportation

Benefit-Cost Analysis Guidance for Discretionary Grant Programs

Office of the Secretary

U.S. Department of Transportation

January 2023

What's new for 2023?

- **The 2023 update to the BCA Guidance includes:**
  - Additional background information on BCA
  - New and updated monetization values
  - Additional guidance and new examples on
    - Valuing pedestrian and transit infrastructure improvements
    - Valuing the benefits of transit transfer reduction
  - Additional guidance on valuation of right-of-way being made available for other purposes

Baselines

- **Should measure costs and benefits of a proposed project against a baseline alternative (“base” or “no build”)**
- **“Do’s”**
  - Factor in any projected changes that would occur even in the absence of the requested project
  - Factor in ongoing routine maintenance
  - Consider the full long-term impacts of the no build
  - Explain and provide support for the chosen baseline
- **“Don’t’s”**
  - Assume that the same (or similar) improvement will be implemented later
  - Use unrealistic assumptions about alternative traffic flows or travel

Demand Forecasts

- **Most benefit estimates depend on ridership or usage, including for walking and cycling projects**
- **Provide supporting info on forecasts**
  - Geographic scope, assumptions, data sources, methodology
- **Provide forecasts for intermediate years**
  - Or at least interpolate –don't apply forecast year impacts to interim years
- **Exercise caution about long-term growth assumptions**
  - Consider underlying capacity limits of the improved and/or replacement facility

Analysis Period

- **Should cover both initial development/construction and a subsequent operational period**
- **Generally tied to the expected service life of the improvement or asset**
  - I.e., the number of years until you would anticipate having to take the same action again
  - Lesser improvements should have shorter service lives
  - Recommend 20 years maximum for capacity expansion or other operational improvements
- **Avoid excessively long analysis periods (over 30 years of operations)**
  - Use residual value to cover out-years of remaining service life for long-lived improvements

Inflation and Discounting

- **Inflation Adjustments**
  - Recommend using a 2021 base year for all cost and benefit data
  - Index values for the GDP Deflator included in the BCA guidance
- **Discounting**
  - Use a 7% discount rate for all benefits and costs (except CO_2)
  - Recommend using a 2021 base year for discounting

Scope of the Analysis

- **Project scope included in estimated costs and benefits must match**
  - Don't claim benefits from an entire project, but only count costs from the grant-funded portion
- **Scope should cover a project that has independent utility**
  - May need to incorporate costs for related investments necessary to achieve the projected benefits
- **Project elements with independent utility should be individually evaluated in the BCA**
  - BCA evaluation will cover both independent elements and the submitted project as a whole

Benefits

- **Should be presented on an annual basis**
  - Don’t assume constant annual benefits without a good reason to do so
- **Negative outcomes should be counted as “disbenefits”**
  - E.g., work zone impacts
- **Avoid double-counting benefits**

Safety Benefits

- **Typically associated with reducing fatalities, injuries, and property damage**
- **Projected improvements in safety outcomes should be explained and documented**
  - Justify assumptions about expected reductions in crashes, injuries, and/or fatalities
  - Document any crash modification factors (CMFs) used
  - Show clear linkage between project and improved outcomes
  - Use facility-specific data history for baseline where possible
- **Crash-related injury and fatality data may be available in different forms**
  - KABCO injury scales
  - Fatal/Injury crashes vs. fatalities/injuries
  - BCA Guidance provides values covering all of these

Travel Time Savings

- **Recommended monetization values found in BCA Guidance**
  - See footnotes for discussion of value of time for walking, cycling, waiting, standing, transfers, long-distance travel, business travel
- **Can be a function of both changes in travel speed and/or travel distance (e.g., new connections across a highway allowing for shorter walking or cycling trips)**
- **Consider vehicle occupancy where appropriate**
  - Local/facility-specific values preferred
  - National-level values provided in BCA Guidance
- **If valuing travel time reliability:**
  - Carefully document methodology and tools used
  - Show how valuation parameters are distinct from general travel time savings

Operating Cost Savings

- **Avoid double counting operating savings and other impacts**
  - E.g., truck or rail travel time savings, fuel consumption reductions
- **Localized, specific data preferred**
- **Standard per-mile values for light duty vehicles and commercial trucks provided in BCA Guidance**

Emissions Reduction Benefits

- **For infrastructure improvements, emission reductions will typically be a function of reduced fuel consumption**
- **Recommended year by year unit values for CO_2, SO_x, NO_x, and $PM_{2.5}$ found in BCA Guidance**
  - Be careful about the measurement units being applied
  - Check for $PM_{2.5}$ versus PM_{10}
- **Reductions in CO_2 emissions should be discounted at 3 percent, while all others should be discounted at 7 percent**

Amenity Benefits

- **Pedestrian, cycling, and transit facility/vehicle improvements can improve the quality or comfort of journeys**
- **Recommended values for different types of improvements found in BCA Guidance**
  - Pay attention to whether value is on a “per-trip” or “per-person-mile” basis
- **Carefully document baseline amenities, as well as specifically how the proposed project will add any amenity benefit categories being claimed**

Health Benefits

- Trips diverted to active transportation (walking and cycling) from other modes may yield health benefits to users
- Recommended monetization values, on a per trip basis, are found in DOT BCA Guidance
- Absent local data on existing mode share and estimated age profiles of users, applicants may apply national averages included in the BCA Guidance

Benefits to Existing and Additional Users

- **Primary benefits typically experienced directly by users**
- **Includes both "existing" users (under baseline) and "additional" users attracted as a result of the improvement**
  - Standard practice in BCA would value benefits to additional users less than those for existing users (see BCA Guidance)

Modal Diversion

- **Projected magnitude**
  - Should be based on careful analysis of local conditions and potential for shift from other modes that might be attributable to the project
- **Benefit estimates should not be based on comparing user costs of "old" and "new" mode**
  - Would be reflected in benefits to additional users
- **Reductions in external costs would be relevant**
  - E.g., emissions costs, congestion reduction, noise reduction
  - Values for congestion, noise and safety costs included in BCA Guidance

Other Benefits Topics

- **Agglomeration Economies**
- **Noise, Stormwater Runoff, and Wildlife Impact Reduction**
- **Emergency Response**
- **State of Good Repair**
- **Resilience**
  - Consider expected frequency of events and their consequences
- **Property Value Increases**
  - Is a measure rather than a benefit –avoid double-counting

Unquantified Benefits

- **Many potential benefits of RAISE projects may be difficult to quantify and monetize**
- **Any claimed unquantified benefits should be explained as well as possible**
  - Should clearly link specific project outcomes to any claimed unquantified benefits
  - Should quantify magnitudes/timing of the impacts wherever possible
  - Should only include impacts that would be counted as benefits, if quantified

Capital Costs

- **Include all costs of implementing the project**
  - E.g., design, ROW acquisition, construction
  - Regardless of funding source
  - Include previously incurred costs
- **Three forms of capital costs**
  - Nominal dollars (project budget)
  - Real dollars (base year)
  - Discounted Real dollars (use in BCA)

Maintenance Costs

- **Net maintenance costs may be positive or negative**
  - New facilities would incur ongoing maintenance costs over the life of the project
  - Rehabilitated/reconstructed facilities may result in net savings in maintenance costs between the build/no-build

Residual Value

- **For assets with remaining service life at the end of the analysis period, may calculate a "residual value" for the project**
  - Recall that service life does not necessarily match the physical life of the asset
- **Simply approach: assume linear depreciation**
- **Be sure to properly apply discounting**

Comparing Benefits to Costs

- **Net Present Value (Benefits – Costs)**
- **Benefit-Cost Ratio (Benefits / Costs)**
  - Denominator should only include capital costs (i.e., net maintenance costs and residual value should be in the numerator)
  - Dis-benefits should be subtracted from the numerator

Other Types of Economic Analysis

- **Examples**
  - Economic Impact Analysis (e.g., job creation)
  - Financial Impacts (e.g., revenue impacts)
  - Distributional Effects (e.g., equity)
- **Issues**
  - Use different approaches and answer different questions than does BCA
  - Do not represent additional benefits to include in BCA

Q&A

QUESTIONS?

Hypothetical BCA Example #1

Hypothetical BCA Example #1

Hypothetical BCA Example #1

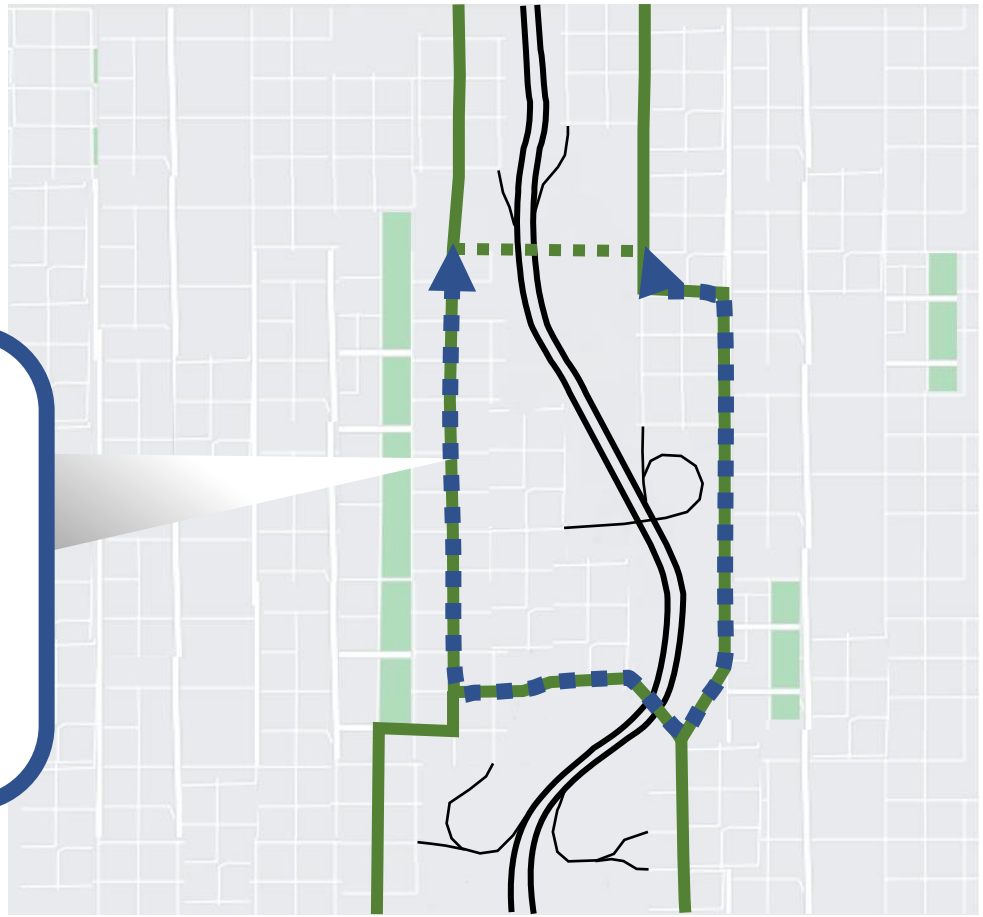
Proposed Project: Add new bike/pedestrian bridge over freeway to reconnect local neighborhoods.

Project Cost: $10.0 million

Hypothetical BCA Example #1

No-Build Scenario: Cyclists and pedestrians continue to use crossing to the south.
(2.6-mile route)

Daily users doing this route:
1,000 cyclists (Trail Counters)



Hypothetical BCA Example #1

No-Build Scenario: Cyclists and pedestrians continue to use crossing to the south.
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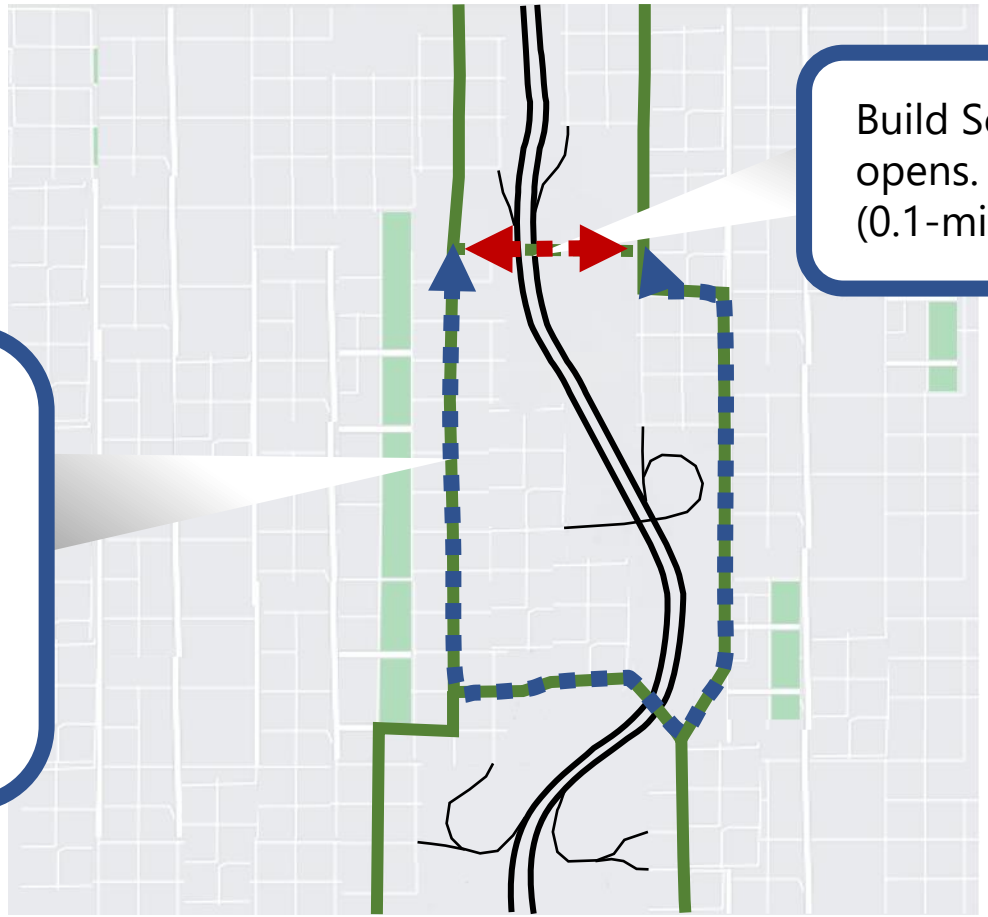
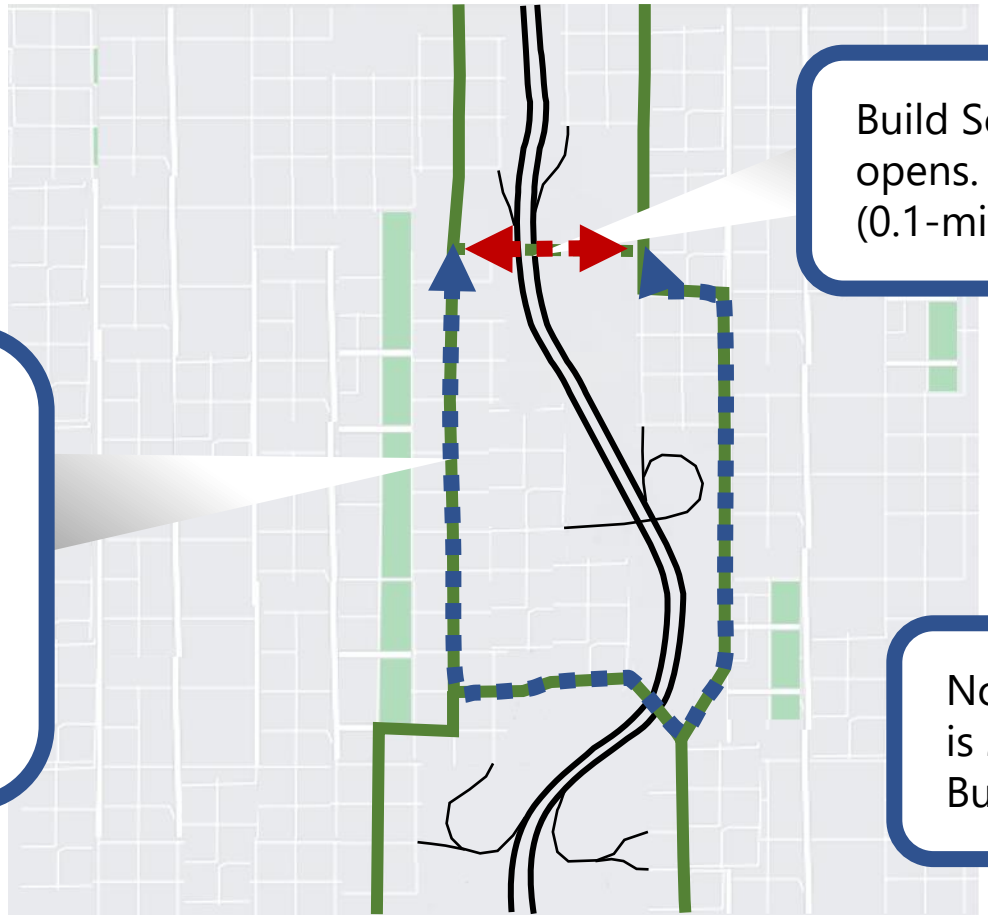


Build Scenario: Bridge opens.
(0.1-mile route)

Hypothetical BCA Example #1



Build Scenario: Bridge opens.
(0.1-mile route)

No-Build Scenario: Cyclists and pedestrians continue to use crossing to the south.
(2.6-mile route)

Daily users doing this route:
1,000 cyclists (Trail Counters)

No-Build Scenario route is 2.5 miles longer than Build Scenario route.

Approach

- **We want to compare the state of the world with and without the proposed project improvement**
  - No-Build Scenario: Cyclists use 2.6-mile route.
  - Build Scenario: Bridge opens, new route is 0.1 miles.
- **The expected major benefit category in this case would be the travel time savings for mitigating 2.5-miles of additional travel, starting when the project opens**

Travel Time Savings Example

- **For simplicity, let's assume no pedestrians, an average cycling speed of 9.8 mph, and no cycling growth over time**

Annual Travel Time Savings*	=	Marginal Detour Time	x	Daily Users	x	Hourly Value of Time	x	Annualization Factor

*Undiscounted.

Travel Time Savings Example

- **For simplicity, let's assume no pedestrians, an average cycling speed of 9.8 mph, and no cycling growth over time**

Annual Travel Time Savings* = Marginal Detour Time x Daily Users x Hourly Value of Time x Annualization Factor

Annual Travel Time Savings* = $\frac{\text{2.5 Miles}}{\text{9.8 mph}}$ x

No-Build Scenario route: 2.6 miles
Build Scenario route: 0.1 miles

Speed: Observed average speed on both routes

*Undiscounted.

Travel Time Savings Example

- **For simplicity, let's assume no pedestrians, an average cycling speed of 9.8 mph, and no cycling growth over time**

Annual Travel Time Savings* = Marginal Detour Time x Daily Users x Hourly Value of Time x Annualization Factor

Annual Travel Time Savings* = $\frac{2.5 \text{ Miles}}{9.8 \text{ mph}}$ x 1,000 x

Recent trail count

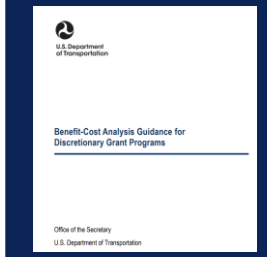
*Undiscounted.

Travel Time Savings Example

- **For simplicity, let's assume no pedestrians, an average cycling speed of 9.8 mph, and no cycling growth over time**

Annual Travel Time Savings*	=	Marginal Detour Time	x	Daily Users	x	Hourly Value of Time	x	Annualization Factor
Annual Travel Time Savings*	=	$\frac{2.5 \text{ Miles}}{9.8 \text{ mph}}$	x	1,000	x	$34.00	x	

USDOT BCA Guidance



(Appendix A)

*Undiscounted.

Travel Time Savings Example

- **For simplicity, let's assume no pedestrians, an average cycling speed of 9.8 mph, and no cycling growth over time**

Annual Travel Time Savings*	=	Marginal Detour Time	x	Daily Users	x	Hourly Value of Time	x	Annualization Factor
Annual Travel Time Savings*	=	$\frac{2.5 \text{ Miles}}{9.8 \text{ mph}}$	x	1,000	x	$34.00	x	365

We expect this project to have an impact each day (not just weekdays, for example).

*Undiscounted.

Travel Time Savings Example

- **For simplicity, let's assume no pedestrians, an average cycling speed of 9.8 mph, and no cycling growth over time**

Annual Travel Time Savings*	=	Marginal Detour Time	x	Daily Users	x	Hourly Value of Time	x	Annualization Factor
Annual Travel Time Savings*	=	$\frac{2.5 \text{ Miles}}{9.8 \text{ mph}}$	x	1,000	x	$34.00	x	365
	=	$3,165,816 Per Year						

*Undiscounted.

Hypothetical BCA Example #1

- **Assume construction in 2024, ten years of project operations, and $10,000 in annual maintenance costs for the project**

Year	Capital Cost	Discounted Costs	Travel Time Savings	O&M Costs	Discounted Benefits
2024	$10,000,000		$0	$0	
2025	$0		$3,165,816	$10,000	
2026	$0		$3,165,816	$10,000	
2027	$0		$3,165,816	$10,000	
2028	$0		$3,165,816	$10,000	
2029	$0		$3,165,816	$10,000	
2030	$0		$3,165,816	$10,000	
2031	$0		$3,165,816	$10,000	
2032	$0		$3,165,816	$10,000	
2033	$0		$3,165,816	$10,000	
2034	$0		$3,165,816	$10,000	

Hypothetical BCA Example #1

- **Next, we discount costs and benefits using a 7% discount rate**

Discounted Value = Future Year Value / (1+Discount Rate)^(Future Year - Base Discounting Year)

Year	Capital Cost	Discounted Costs	Travel Time Savings	O&M Costs	Discounted Benefits
2024	$10,000,000	**$8,162,979**	$0	$0	$0
2025	$0	$0	$3,165,816	$10,000	**$2,407,557**
2026	$0	$0	$3,165,816	$10,000	$2,200,053
2027	$0	$0	$3,165,816	$10,000	$2,002,854
2028	$0	$0	$3,165,816	$10,000	$1,965,284
2029	$0	$0	$3,165,816	$10,000	$1,836,714
2030	$0	$0	$3,165,816	$10,000	$1,716,555
2031	$0	$0	$3,165,816	$10,000	$1,604,257
2032	$0	$0	$3,165,816	$10,000	$1,499,306
2033	$0	$0	$3,165,816	$10,000	$1,401,220
2034	$0	$0	$3,165,816	$10,000	**$1,309,552**

$10,000,000 / (1+0.07)^(2024-2021)

($3,165,816-$10,000) / (1+0.07)^(2025-2021)

($3,165,816-$10,000) / (1+0.07)^(2034-2021)

Note: Totals may differ slightly due to rounding

Hypothetical BCA Example #1

- **Next, we sum the discounted benefits and costs to get total discounted benefits and total discounted costs**

Year	Capital Cost	Discounted Costs	Travel Time Savings	O&M Costs	Discounted Benefits
2024	$10,000,000	$8,162,979	$0	$0	$0
2025	$0	$0	$3,165,816	$10,000	$2,407,557
2026	$0	$0	$3,165,816	$10,000	$2,250,053
2027	$0	$0	$3,165,816	$10,000	$2,102,854
2028	$0	$0	$3,165,816	$10,000	$1,965,284
2029	$0	$0	$3,165,816	$10,000	$1,836,714
2030	$0	$0	$3,165,816	$10,000	$1,716,555
2031	$0	$0	$3,165,816	$10,000	$1,604,257
2032	$0	$0	$3,165,816	$10,000	$1,499,306
2033	$0	$0	$3,165,816	$10,000	$1,401,220
2034	$0	$0	$3,165,816	$10,000	$1,309,552
TOTAL		**$8,162,979**			**$18,093,351**

Note: Totals may differ slightly due to rounding

Results – The NPV and BCR

- **Lastly, we calculate the project's net present value (NPV) and benefit-cost ratio (BCR)**

$$\text{Net Present Value (NPV)} = \text{Total Discounted Benefits} - \text{Total Discounted Costs}$$

$$= \$18{,}093{,}351 - \$8{,}162{,}979$$

$$= \mathbf{\$9{,}930{,}372}$$

$$\text{Benefit-Cost Ratio (BCR)} = \frac{\text{Total Discounted Benefits}}{\text{Total Discounted Costs}}$$

$$= \frac{\$18{,}093{,}351}{\$8{,}162{,}979}$$

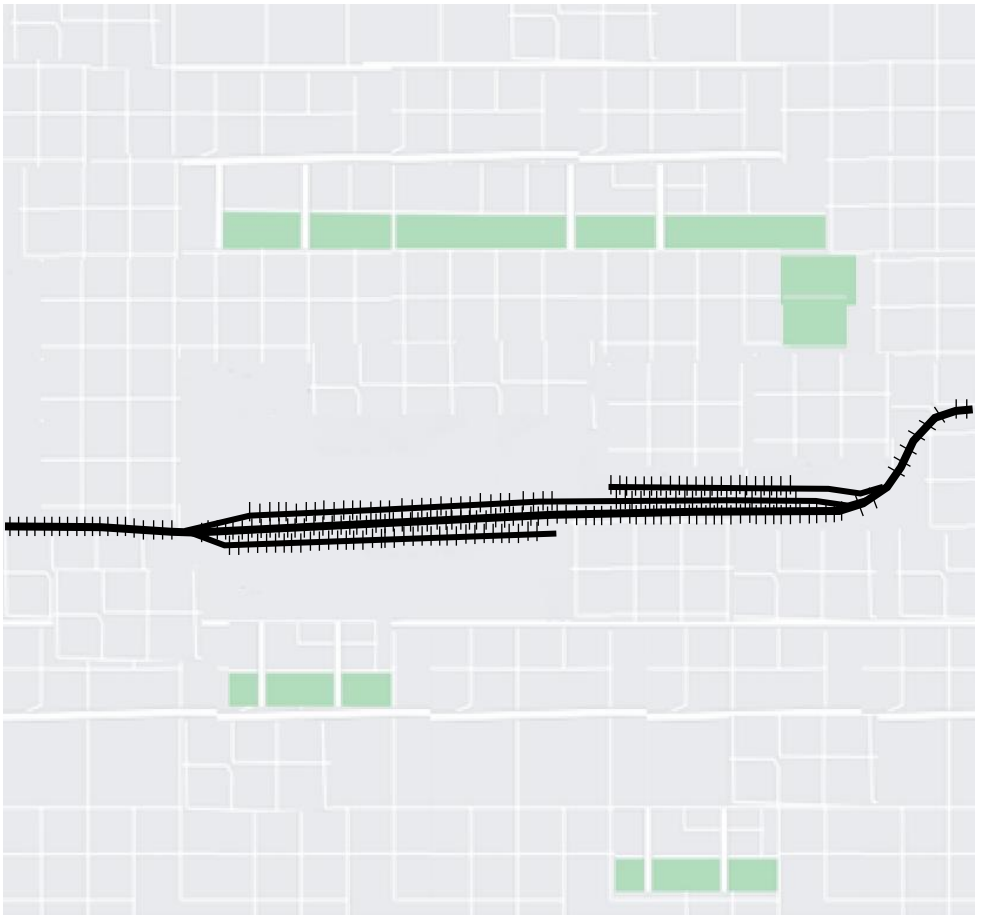
$$= \mathbf{2.2}$$

Note: Totals may differ slightly due to rounding

Hypothetical BCA Example #1

- **Other potential benefits such a project might have:**
  - Travel time savings for pedestrians
    - Different speed assumptions and number of users as the example just given, but otherwise the method would be the same
  - Mortality reduction from induced walking and cycling trips
  - Reduced emissions from modal shift to active transportation
  - Amenity benefits
    - If the no-build route did not already have a dedicated cycling or pedestrian facility
  - Safety benefits
    - Shorter walking and cycling distances for existing users
  - Residual value
- **This is not meant to be an exhaustive list**

Hypothetical Example #2



Hypothetical Example #2

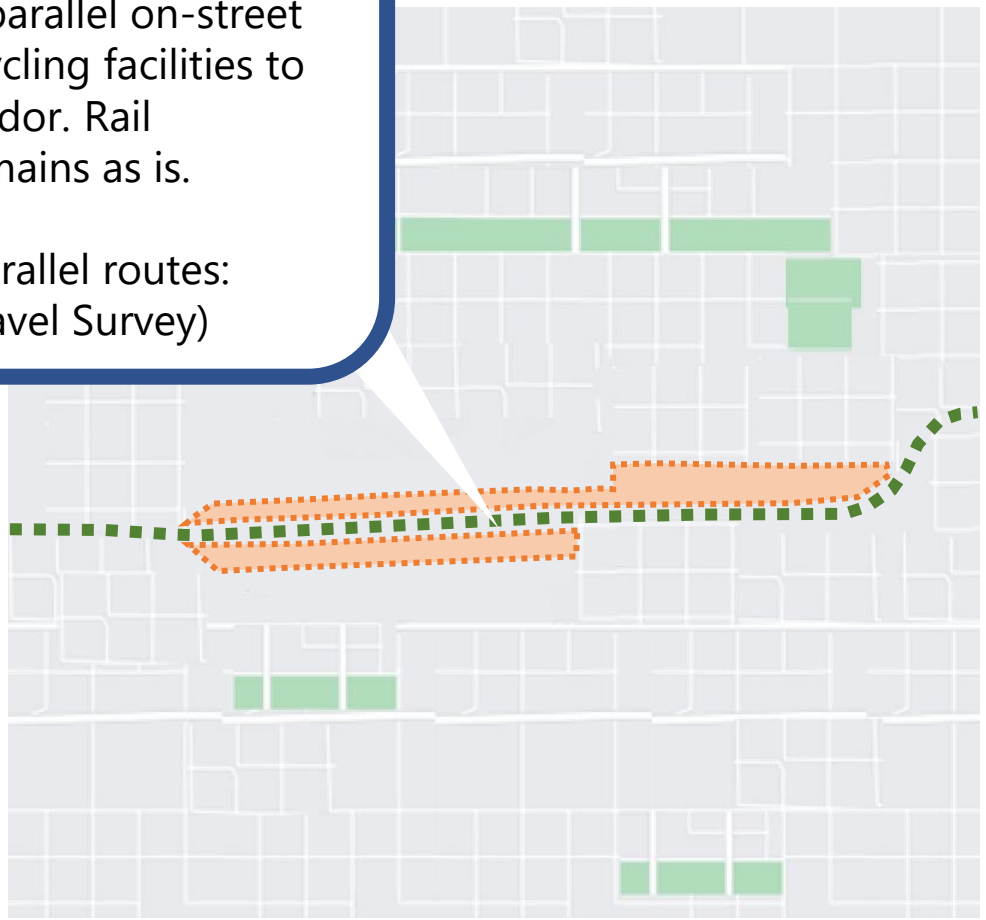
Proposed Project: Convert 2.0 miles of an abandoned rail line to a cycling path and sell 40 acres of excess right-of-way for future mixed-use development.

Project Cost: $20.0 million

Hypothetical Example #2

No-Build Scenario: Cyclists continue to use parallel on-street routes with no cycling facilities to traverse the corridor. Rail infrastructure remains as is.

Daily users on parallel routes: 3,000 cyclists (Travel Survey)



Hypothetical Example #2

No-Build Scenario: Cyclists continue to use parallel on-street routes with no cycling facilities to traverse the corridor. Rail infrastructure remains as is.

Daily users on parallel routes: 3,000 cyclists (Travel Survey)

Build Scenario: The rail infrastructure is removed and the new cycling path is completed. Cyclists on parallel routes shift to new facility. Excess right-of-way of 40 acres is sold.

Land price per acre: $90,000 (Local Sale Comps)

Approach

- **We want to compare the state of the world with and without the proposed project improvement**
  - No-Build Scenario: Abandoned rail infrastructure remains as is and cyclists use on-street parallel routes
  - Build Scenario: 2.0 miles of the abandoned rail line are converted to a cycling path for use by 3,000 daily cyclists and 40 acres of excess right-of-way are sold for future mixed-use development
- **The expected major benefit categories in this case would be:**
  - Amenity benefits to users given the addition of 2.0-miles of off-street cycling path, starting when the project opens
  - The sale of unused right-of-way for other purposes

Amenity Benefits Example

- **For simplicity, let's assume that all cyclists use the entire length of the facility, and no cycling growth over time**

Annual Amenity Benefits*	=	Improved Facility Length	x	Daily Users	x	Amenity Value Per Mile Cycled	x	Annualization Factor

*Undiscounted.

Amenity Benefits Example

- **For simplicity, let's assume that all cyclists use the entire length of the facility, and no cycling growth over time**

Annual Amenity Benefits*	=	Improved Facility Length	x	Daily Users	x	Amenity Value Per Mile Cycled	x	Annualization Factor
Annual Amenity Benefits*	=	2.0 Miles	x					

Distance traveled over new cycling path per user

*Undiscounted.

Amenity Benefits Example

- **For simplicity, let's assume that all cyclists use the entire length of the facility, and no cycling growth over time**

Annual Amenity Benefits*	=	Improved Facility Length	x	Daily Users	x	Amenity Value Per Mile Cycled	x	Annualization Factor
Annual Amenity Benefits*	=	2.0 Miles	x	3,000	x			

Estimate based on travel survey

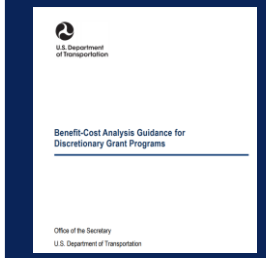
*Undiscounted.

Amenity Benefits Example

- **For simplicity, let's assume that all cyclists use the entire length of the facility, and no cycling growth over time**

Annual Amenity Benefits*	=	Improved Facility Length	x	Daily Users	x	Amenity Value Per Mile Cycled	x	Annualization Factor
Annual Amenity Benefits*	=	2.0 Miles	x	3,000	x	$1.49	x	

USDOT BCA Guidance



(Appendix A)

*Undiscounted.

Amenity Benefits Example

- **For simplicity, let's assume that all cyclists use the entire length of the facility, and no cycling growth over time**

Annual Amenity Benefits*	=	Improved Facility Length	x	Daily Users	x	Amenity Value Per Mile Cycled	x	Annualization Factor
Annual Amenity Benefits*	=	2.0 Miles	x	3,000	x	$1.49	x	365

We expect this project to have an impact each day (not just weekdays, for example).

*Undiscounted.

Amenity Benefits Example

- **For simplicity, let's assume that all cyclists use the entire length of the facility, and no cycling growth over time**

Annual Amenity Benefits*	=	Improved Facility Length	x	Daily Users	x	Amenity Value Per Mile Cycled	x	Annualization Factor
Annual Amenity Benefits*	=	2.0 Miles	x	3,000	x	$1.49	x	365
	=	$3,263,100 Per Year						

*Undiscounted.

Excess Right-of-Way Sale Example

- **For simplicity, let's assume all excess land is sold at a single price per acre after project completion**

Excess ROW Benefits*	=	Amount of Land Made Available for Sale	x	Land Price

*Undiscounted.

Excess Right-of-Way Sale Example

- **For simplicity, let's assume all excess land is sold at a single price per acre after project completion**

Excess ROW Benefits*	=	Amount of Land Made Available for Sale	x	Land Price
Excess ROW Benefits*	=	40 Acres	x	

Excess right-of-way remaining after project

*Undiscounted.

Excess Right-of-Way Sale Example

- **For simplicity, let's assume all excess land is sold at a single price per acre after project completion**

Excess ROW Benefits*	=	Amount of Land Made Available for Sale	x	Land Price
Excess ROW Benefits*	=	40 Acres	x	$90,000 per Acre

Based on recent land sale comps in the area

*Undiscounted.

Excess Right-of-Way Sale Example

- **For simplicity, let's assume all excess land is sold at a single price per acre after project completion**

Excess ROW Benefits*	=	Amount of Land Made Available for Sale	x	Land Price
Excess ROW Benefits*	=	40 Acres	x	$90,000 per Acre
	=	$3,600,000 after Project Completion		

*Undiscounted.

Hypothetical BCA Example #2

- **Assume construction in 2024, ten years of project operations, and no change in maintenance costs**

Year	Capital Cost	Discounted Costs	Amenity Benefits	Excess Land Sale	Discounted Benefits
2024	$20,000,000		$0	$0	
2025	$0		$3,263,100	$3,600,000	
2026	$0		$3,263,100	$0	
2027	$0		$3,263,100	$0	
2028	$0		$3,263,100	$0	
2029	$0		$3,263,100	$0	
2030	$0		$3,263,100	$0	
2031	$0		$3,263,100	$0	
2032	$0		$3,263,100	$0	
2033	$0		$3,263,100	$0	
2034	$0		$3,263,100	$0	

Hypothetical BCA Example #2

- **Next, we discount costs and benefits using a 7% discount rate**

Discounted Value = Future Year Value / (1+Discount Rate)^(Future Year - Base Discounting Year)

Year	Capital Cost	Discounted Costs	Amenity Benefits	Excess Land Sale	Discounted Benefits
2024	$20,000,000	**$16,325,958**	$0	$0	$0
2025	$0	$0	$3,263,100	$3,600,000	**$5,235,826**
2026	$0	$0	$3,263,100	$0	$3,6,545
2027	$0	$0	$3,263,100	$0	$2,174,341
2028	$0	$0	$3,263,100	$0	$2,032,095
2029	$0	$0	$3,263,100	$0	$1,899,154
2030	$0	$0	$3,263,100	$0	$1,774,910
2031	$0	$0	$3,263,100	$0	$1,658,795
2032	$0	$0	$3,263,100	$0	$1,550,275
2033	$0	$0	$3,263,100	$0	$1,448,855
2034	$0	$0	$3,263,100	$0	**$1,354,070**

$20,000,000 / (1+0.07)^(2024-2021)

($3,263,100+$3,600,000) / (1+0.07)^(2025-2021)

$3,263,100 / (1+0.07)^(2034-2021)

Note: Totals may differ slightly due to rounding

Hypothetical BCA Example #2

- **Next, we sum the discounted benefits and costs to get total discounted benefits and total discounted costs**

Year	Capital Cost	Discounted Costs	Amenity Benefits	Excess Land Sale	Discounted Benefits
2024	$20,000,000	$16,325,958	$0	$0	$0
2025	$0	$0	$3,263,100	$3,600,000	$5,235,826
2026	$0	$0	$3,263,100	$0	$2,326,545
2027	$0	$0	$3,263,100	$0	$2,174,341
2028	$0	$0	$3,263,100	$0	$2,032,095
2029	$0	$0	$3,263,100	$0	$1,899,154
2030	$0	$0	$3,263,100	$0	$1,774,910
2031	$0	$0	$3,263,100	$0	$1,658,795
2032	$0	$0	$3,263,100	$0	$1,550,275
2033	$0	$0	$3,263,100	$0	$1,448,855
2034	$0	$0	$3,263,100	$0	$1,354,070
TOTAL		**$16,325,958**			**$21,454,867**

Note: Totals may differ slightly due to rounding

Results – The NPV and BCR

- **Lastly, we calculate the project's net present value (NPV) and benefit-cost ratio (BCR)**

$$\text{Net Present Value (NPV)} = \text{Total Discounted Benefits} - \text{Total Discounted Costs}$$

$$= \$21{,}454{,}867 - \$16{,}325{,}958$$

$$= \mathbf{\$5{,}128{,}910}$$

$$\text{Benefit-Cost Ratio (BCR)} = \frac{\text{Total Discounted Benefits}}{\text{Total Discounted Costs}}$$

$$= \frac{\$21{,}454{,}867}{\$16{,}325{,}958}$$

$$= \mathbf{1.3}$$

Note: Totals may differ slightly due to rounding

Hypothetical BCA Example #2

- **Other potential benefits such a project might have:**
  - Travel time savings for cyclists and pedestrians
    - If the new cycling path provides new shorter-distance connections
  - Mortality reduction from induced walking and cycling trips
  - Reduced emissions from modal shift to active transportation
  - Benefits to any induced cyclists
    - Remember to apply the "rule of half," see Appendix B of BCA Guidance
- **This is not meant to be an exhaustive list**

Remember Key Resources

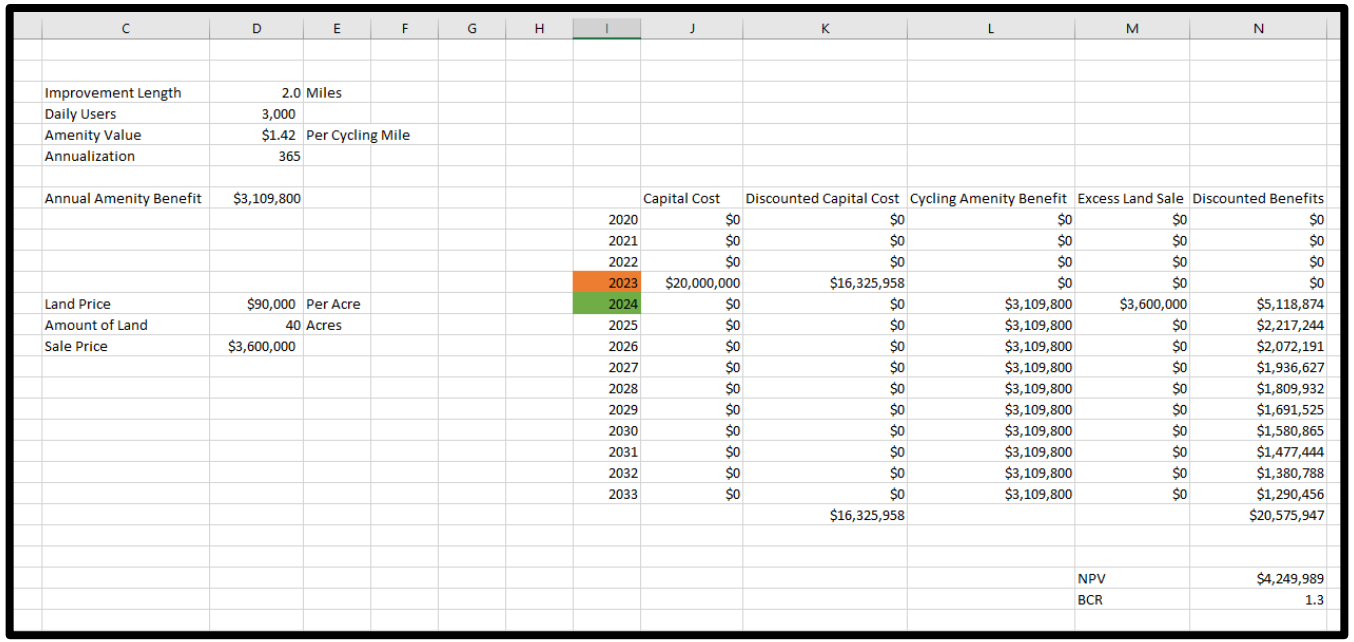
- **The BCA Guidance**
  - https://www.transportation.gov/mission/office-secretary/office-policy/transportation-policy/benefit-cost-analysis-guidance
  - The main body of the Guidance discusses methodology
  - Appendix A has many useful input values
  - Appendix B shows sample calculations
- **BCA webinars for previous USDOT discretionary grant programs**
  - https://railroads.dot.gov/rail-network-development/training-guidance/webinars-0
  - https://www.transportation.gov/office-policy/rural/routes-webinar-bca
  - https://www.transportation.gov/grants/reconnecting-communities/reconnecting-communities-additional-guidance
  - Note that parameter values updated each year
- **Project engineering and planning documents**

Remember Key Resources

- **Local traffic counts and travel survey data**
- **U.S. Census Bureau**
- **Project partners (higher levels of government, MPOs, universities, etc.)**
- **Many BCAs submitted for other programs are publicly available via web search**
- **FRA's Crossing Inventory and Accident Reports**
  - https://safetydata.fra.dot.gov/OfficeofSafety/PublicSite/Crossing/Crossing.aspx
- **NHTSA's Fatality Analysis Reporting System**
  - https://www.nhtsa.gov/research-data/fatality-analysis-reporting-system-fars
- **The Crash Modification Factors Clearinghouse**
  - https://www.cmfclearinghouse.org/
- **Technical questions can be submitted to RAISEgrants@dot.gov**

Avoiding Common Mistakes

- **Make sure inputs and assumptions in the BCA are sourced and documented**
- **Make sure the submitted BCA and claimed benefits match the project being proposed for grant funding**
- **Show individual utility of different separable project components**
- **Provide an unlocked BCA spreadsheet (rather than a PDF of a spreadsheet)**



	Improvement Length	2.0	Miles								
	Daily Users	3,000									
	Amenity Value	$1.42	Per Cycling Mile								
	Annualization	365									
	Annual Amenity Benefit	$3,109,800					Capital Cost	Discounted Capital Cost	Cycling Amenity Benefit	Excess Land Sale	Discounted Benefits
						2020	$0	$0	$0	$0	$0
						2021	$0	$0	$0	$0	$0
						2022	$0	$0	$0	$0	$0
						2023	$20,000,000	$16,325,958	$0	$0	$0
	Land Price	$90,000	Per Acre			2024	$0	$0	$3,109,800	$3,600,000	$5,118,874
	Amount of Land	40	Acres			2025	$0	$0	$3,109,800	$0	$2,217,244
	Sale Price	$3,600,000				2026	$0	$0	$3,109,800	$0	$2,072,191
						2027	$0	$0	$3,109,800	$0	$1,936,627
						2028	$0	$0	$3,109,800	$0	$1,809,932
						2029	$0	$0	$3,109,800	$0	$1,691,525
						2030	$0	$0	$3,109,800	$0	$1,580,865
						2031	$0	$0	$3,109,800	$0	$1,477,444
						2032	$0	$0	$3,109,800	$0	$1,380,788
						2033	$0	$0	$3,109,800	$0	$1,290,456
								$16,325,958			$20,575,947
										NPV	$4,249,989
										BCR	1.3

QUESTIONS?