US Department of Transportation

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

December 17, 2024

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

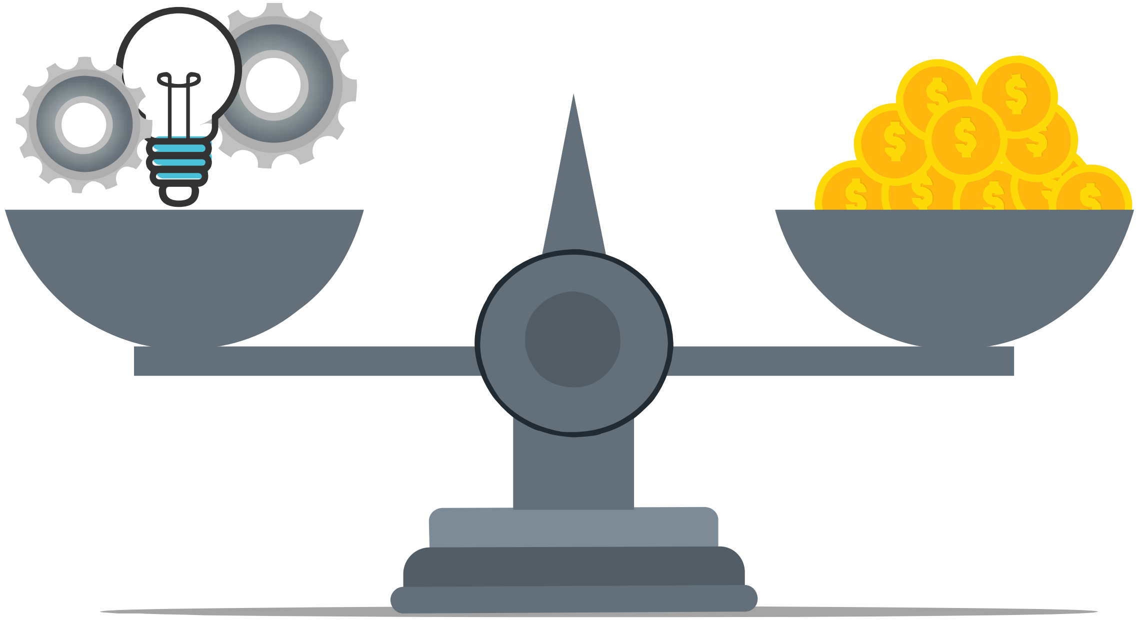
- This webinar is being recorded and will be posted on the RAISE Grants website at https://www.transportation.gov/RAISEgrants/outreach

Today's Presenters

- **Darren Timothy, Chief Economist, USDOT**
- **Ryan Endorf, Economist, USDOT**

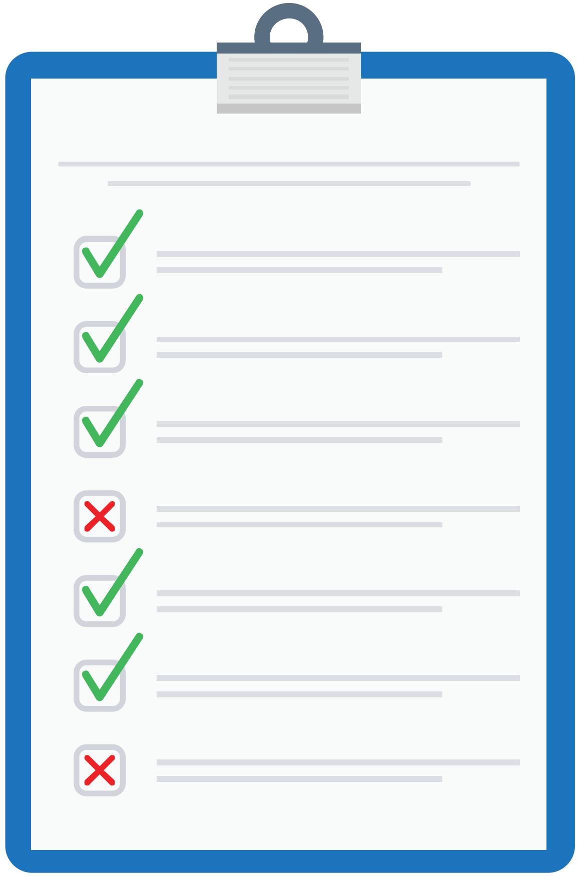
What is BCA?

- 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
- Required by executive orders, OMB guidance, and by statute for certain programs and Department activities.



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
  - Required to consider the extent to which the project is cost effective
- Planning grant applications **do not need** to include a benefit-cost analysis

Use of the BCA in RAISE 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 receives a "Highly Recommended" rating and demonstrates exceptional benefits for underserved or disadvantaged 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)
  - How the project addresses the problem (measures of effectiveness)
- **Well-defined project scope and cost estimate**
- **Monetization factors for key project benefits**

Developing a BCA

1. Identification and analysis of the problem to be solved (baseline conditions)

2. Estimation of the costs of the proposed investment

3. Projection of the expected impacts of the investment (e.g., measures of effectiveness)

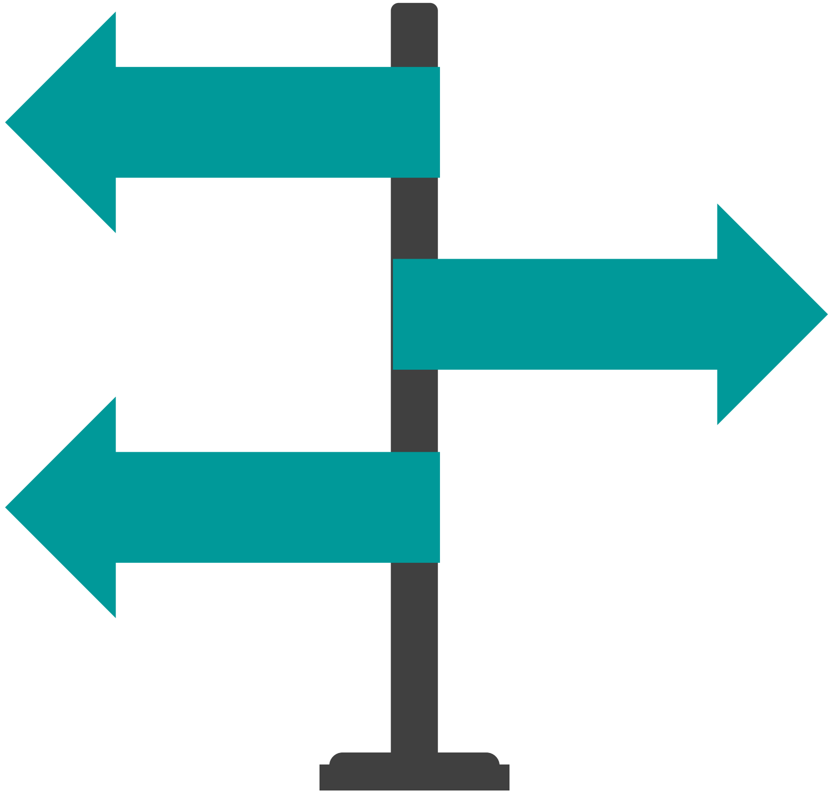
4. Monetization of expected impacts into estimated benefits

5. Conversion of benefit and cost streams into their present value (discounting) and calculation of the benefit-cost ratio (BCR)

6. Consideration of any unquantified benefits

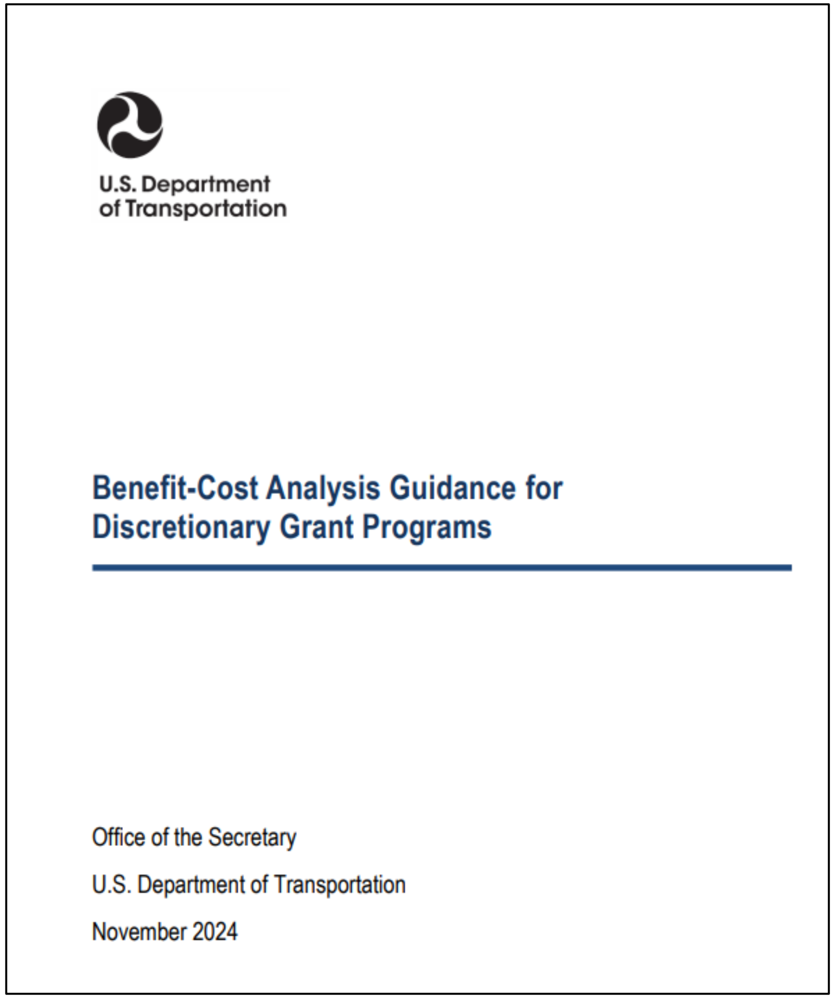
What do I need to do BCA?

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



USDOT BCA Guidance

- Covers all USDOT discretionary grant programs
- Structure of the Guidance
  - Overview of BCA ("how to get started")
  - BCA methodologies
  - Recommended input values
  - Sample calculations
- 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

November 2024

What’s new for 2025?

- **The 2025 update to the BCA Guidance (released November 2024) includes:**
  - Updated parameter and monetization values

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

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 2023 base year for all cost and benefit data
  - Index values for the GDP Deflator included in the BCA guidance
- **Discounting**
  - Use a 3.1% discount rate for all benefits and costs (except CO_2, which should be discounted at 2.0%).
  - Recommend using a 2023 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 or other, lesser 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**
- **Avoid double-counting benefits**
- **Negative outcomes should be counted as “disbenefits”**
- **Any estimated benefits should be clearly tied to the project scope and expected outcomes**
- **Some common benefit categories estimated in BCAs for transportation projects are presented in the following slides**
  - Applicants may also include other benefit categories or approaches in their BCAs

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 the 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, reduced fuel consumption
- **Localized, specific data preferred**
- **Standard per-mile values for light duty vehicles and commercial trucks**
  - Should not be converted to per-hour values
- **Values for hourly operating costs for commuter, intercity, and freight rail 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}
- **Values for reduced CO_2 emissions should be discounted at 2.0 percent, while all others should be discounted at 3.1 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

Work Zone Impacts

- **Transportation infrastructure improvements often involve work zones that can have a negative impact on travelers during the construction period**
  - Ex: travel times, safety
- **Applicants should account for any work zone impacts in their analysis**
  - If expected to be minimal, the analysis should describe characteristics of the project or delivery method that would mitigate such impacts

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 values 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
- **Total capital costs for the project should be clearly presented in three forms**
  - 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
- **Simple 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

- BCA considers the **increased economic efficiency** resulting from a project, and assesses the net change to overall societal welfare
- This is distinct from other types of economic analysis, such as
  - Economic Impact Analysis (e.g., job creation)
  - Financial Analysis (e.g., revenue impacts)
  - Distributional Analysis (e.g., equity impacts)
- These other types of analysis can be used to answer important questions and aid in decision-making; however, they use different approaches and answer fundamentally different questions than does BCA
- Importantly, these analyses do not provide estimates of additive benefits to be considered in BCA

QUESTIONS?

Hypothetical BCA Example #1

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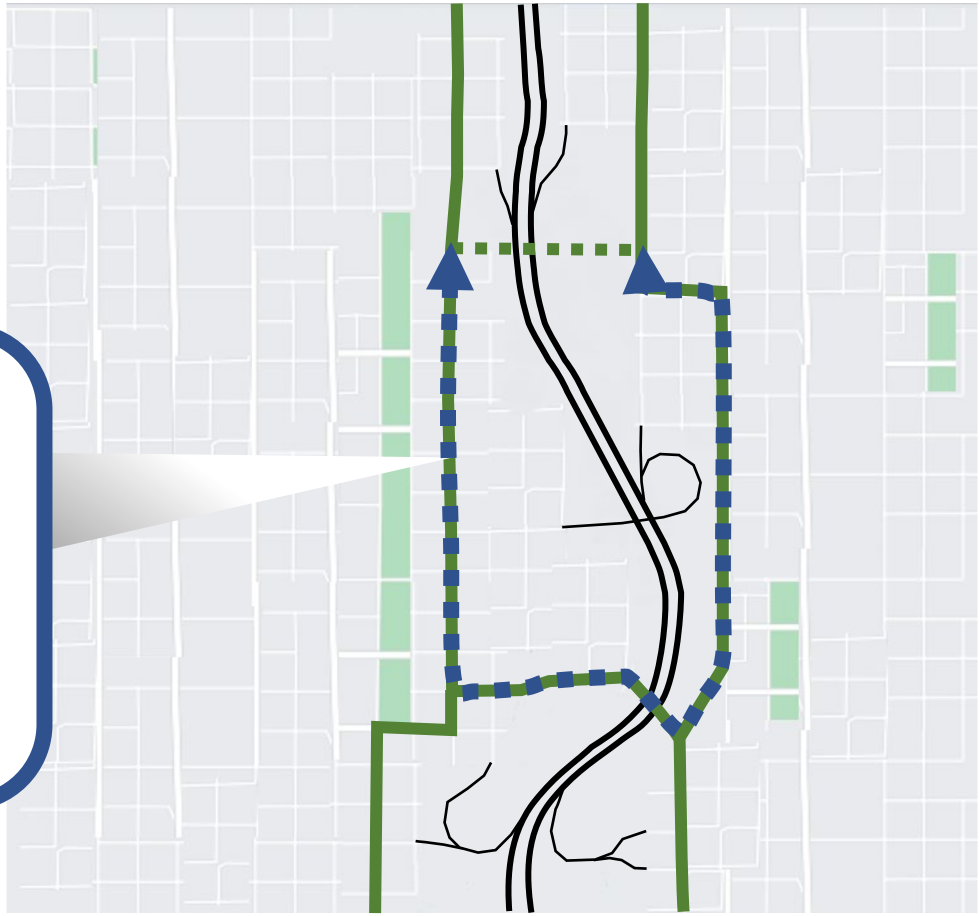
Proposed Project: Add new bike/pedestrian bridge over freeway to reconnect local neighborhoods.

Project Cost: $10.0 million

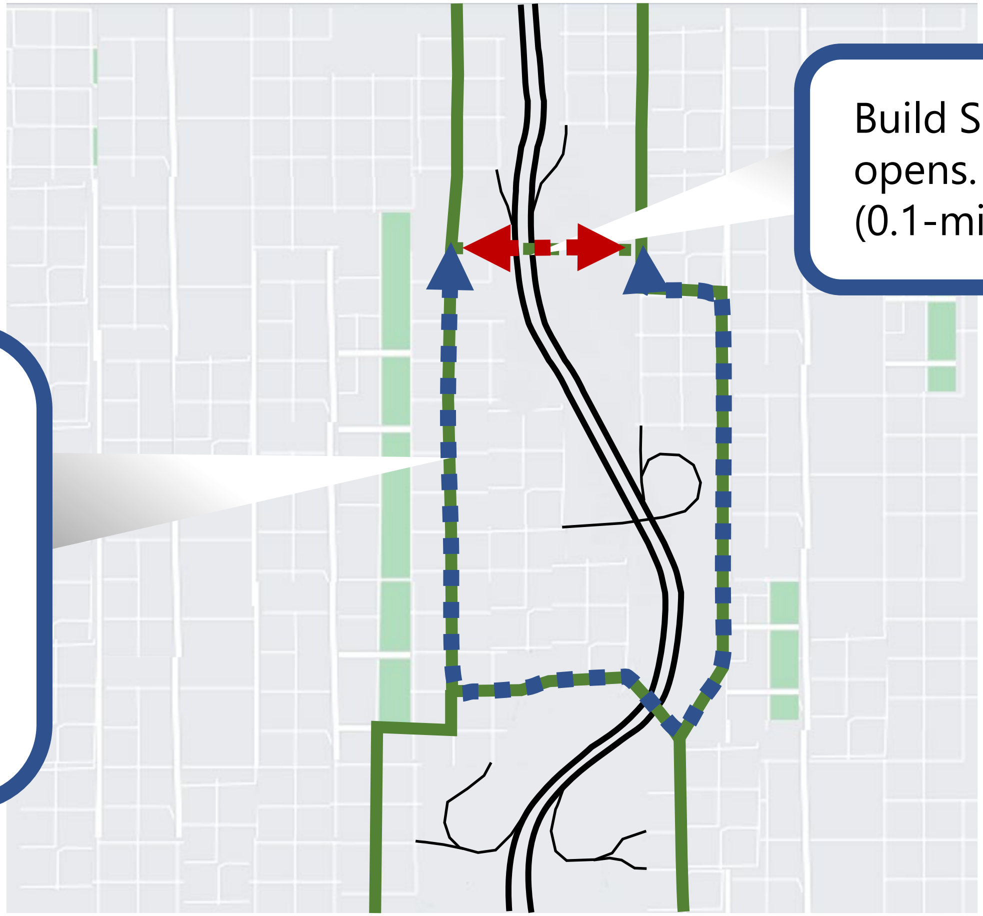
Hypothetical BCA Example #1



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

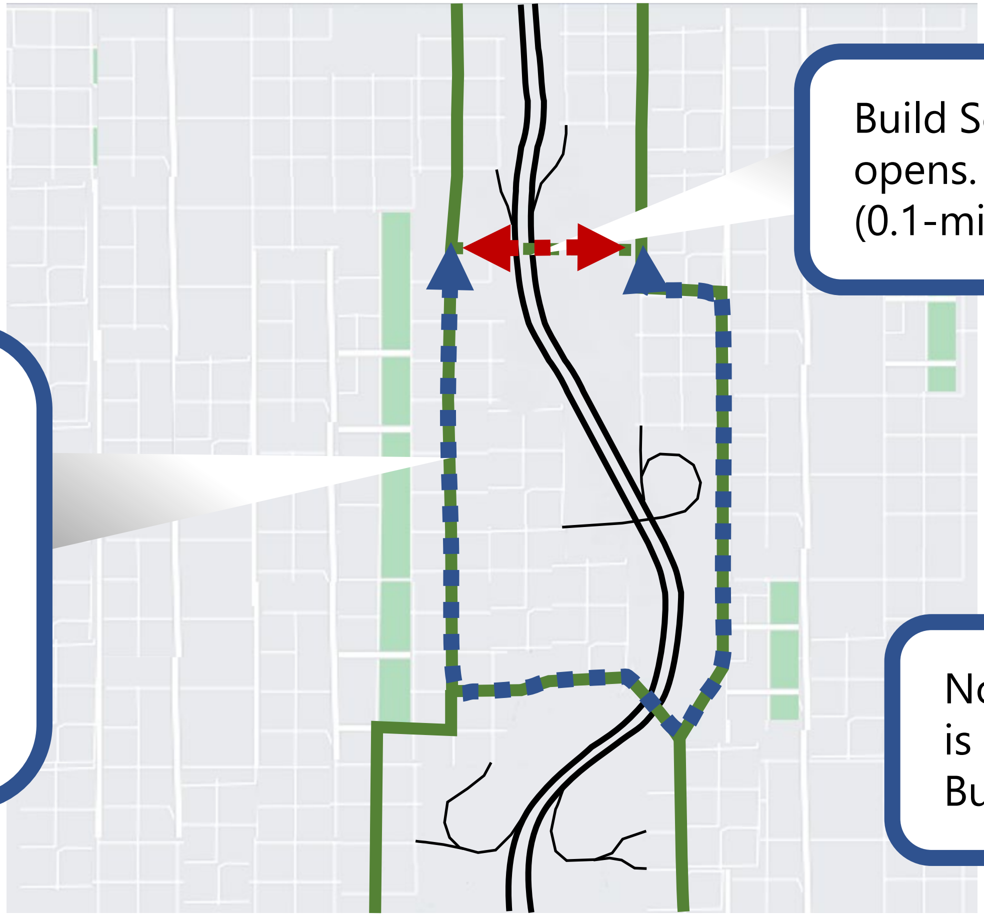


No-Build Scenario: Cyclists and pedestrians continue to use crossing to the south.
(2.6-mile route)

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

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

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

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

Recent trail count

*Undiscounted.

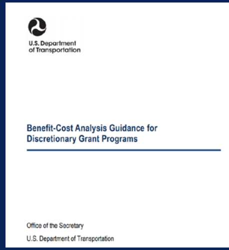
Travel Time Savings Example

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

$$\text{Annual Travel Time Savings*} = \text{Marginal Detour Time} \times \text{Daily Users} \times \text{Hourly Value of Time} \times \text{Annualization Factor}$$

$$\text{Annual Travel Time Savings*} = \frac{\text{2.5 Miles}}{\text{9.8 mph}} \times 1{,}000 \times \$38.80 \times$$

USDOT BCA Guidance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(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**

$$\text{Annual Travel Time Savings*} = \text{Marginal Detour Time} \times \text{Daily Users} \times \text{Hourly Value of Time} \times \text{Annualization Factor}$$

$$\text{Annual Travel Time Savings*} = \frac{\text{2.5 Miles}}{\text{9.8 mph}} \times 1{,}000 \times \$38.80 \times 365$$

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**

$$\text{Annual Travel Time Savings*} = \text{Marginal Detour Time} \times \text{Daily Users} \times \text{Hourly Value of Time} \times \text{Annualization Factor}$$

$$\text{Annual Travel Time Savings*} = \frac{2.5 \text{ Miles}}{9.8 \text{ mph}} \times 1{,}000 \times \$38.80 \times 365$$

$$= \$3{,}612{,}755 \text{ Per Year}$$

*Undiscounted.

Hypothetical BCA Example #1

- **Assume construction in 2026, 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
2026	$10,000,000		$0	$0	
2027	$0		$3,612,755	$10,000	
2028	$0		$3,612,755	$10,000	
2029	$0		$3,612,755	$10,000	
2030	$0		$3,612,755	$10,000	
2031	$0		$3,612,755	$10,000	
2032	$0		$3,612,755	$10,000	
2033	$0		$3,612,755	$10,000	
2034	$0		$3,612,755	$10,000	
2035	$0		$3,612,755	$10,000	
2036	$0		$3,612,755	$10,000	

Hypothetical BCA Example #1

- **Next, we discount costs and benefits using a 3.1% 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
2026	$10,000,000	**$9,124,814**	$0	$0	$0
2027	$0	$0	$3,612,755	$10,000	**$3,188,600**
[illegible]	$0	$0	$3,612,755	$10,000	[illegible]
2029	$0	$0	$3,612,755	$10,000	$2,999,734
2030	$0	$0	$3,612,755	$10,000	$2,909,538
2031	$0	$0	$3,612,755	$10,000	$2,822,055
2032	$0	$0	$3,612,755	$10,000	$2,737,201
2033	$0	$0	$3,612,755	$10,000	$2,654,900
2034	$0	$0	$3,612,755	$10,000	$2,575,072
2035	$0	$0	$3,612,755	$10,000	$2,497,645
2036	$0	$0	$3,612,755	$10,000	**$2,422,546**

$10,000,000 / (1+0.031)^(2026-2023)

($3,612,755-$10,000) / (1+0.031)^(2027-2023)

($3,612,755-$10,000) / (1+0.031)^(2036-2023)

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
2026	$10,000,000	$9,124,814	$0	$0	$0
2027	$0	$0	$3,612,755	$10,000	$3,188,600
2028	$0	$0	$3,612,755	$10,000	$3,092,726
2029	$0	$0	$3,612,755	$10,000	$2,999,734
2030	$0	$0	$3,612,755	$10,000	$2,909,538
2031	$0	$0	$3,612,755	$10,000	$2,822,055
2032	$0	$0	$3,612,755	$10,000	$2,737,201
2033	$0	$0	$3,612,755	$10,000	$2,654,900
2034	$0	$0	$3,612,755	$10,000	$2,575,072
2035	$0	$0	$3,612,755	$10,000	$2,497,645
2036	$0	$0	$3,612,755	$10,000	$2,422,546
TOTAL		**$9,124,814**			**$27,900,018**

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)**

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

$$= \$27{,}900{,}018 - \$9{,}124{,}814$$

$$= \mathbf{\$18{,}775{,}204}$$

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

$$= \frac{\$27{,}900{,}018}{\$9{,}124{,}814}$$

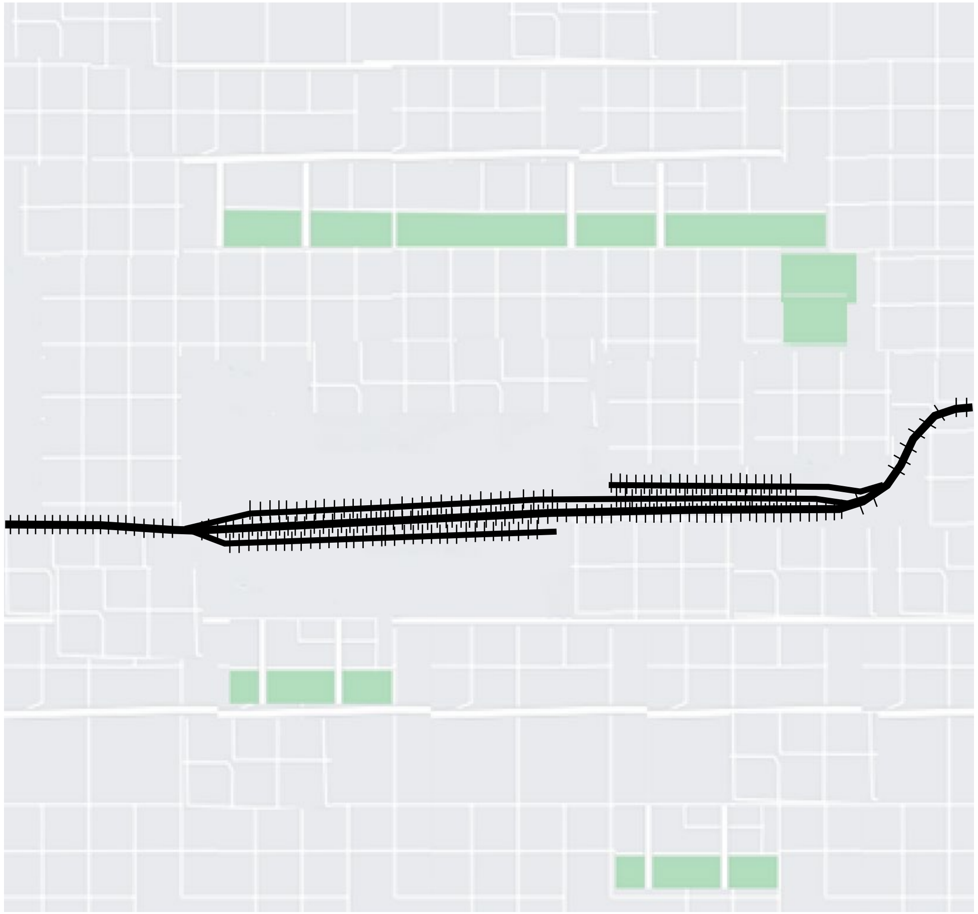
$$= \mathbf{3.1}$$

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**

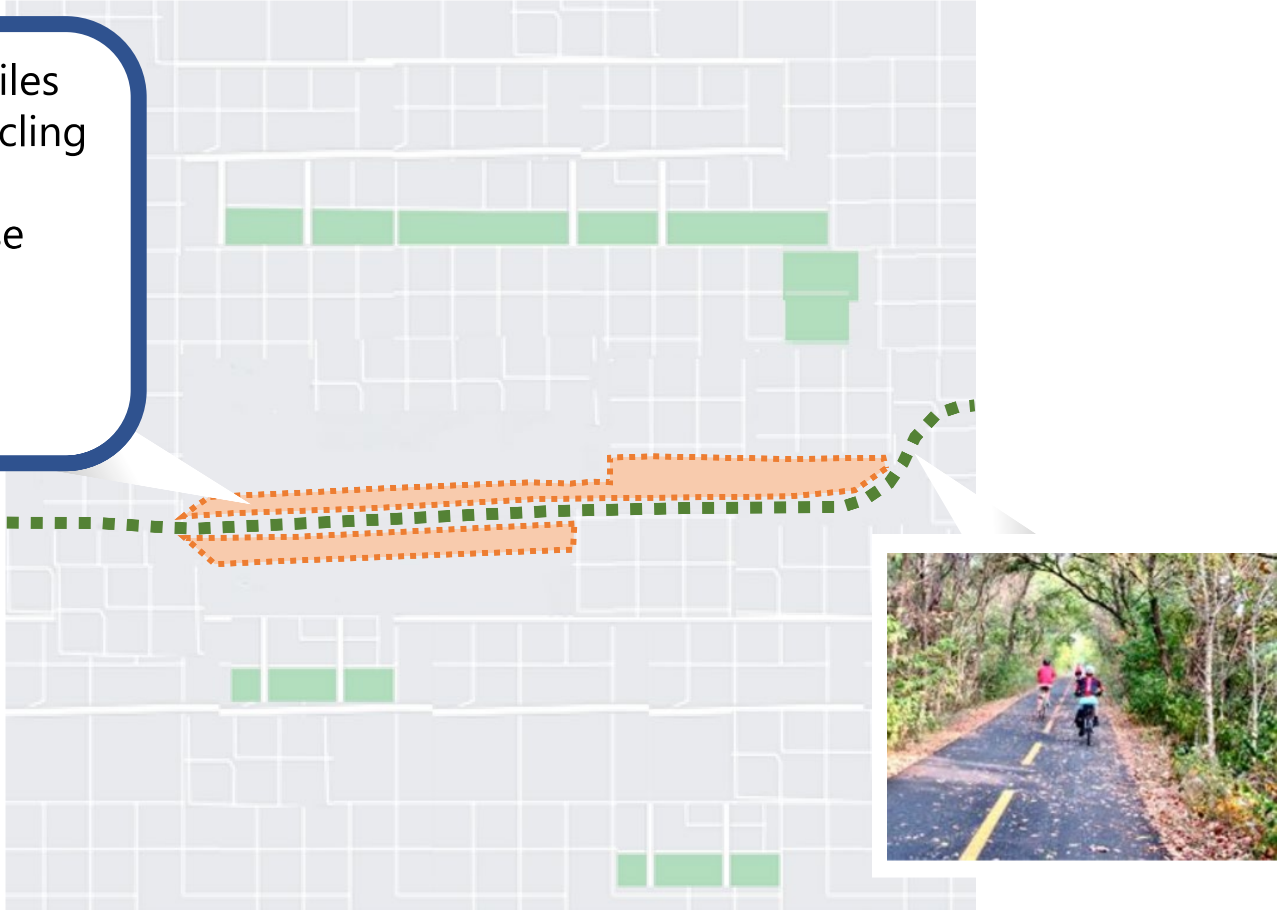
Hypothetical Example #2



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)

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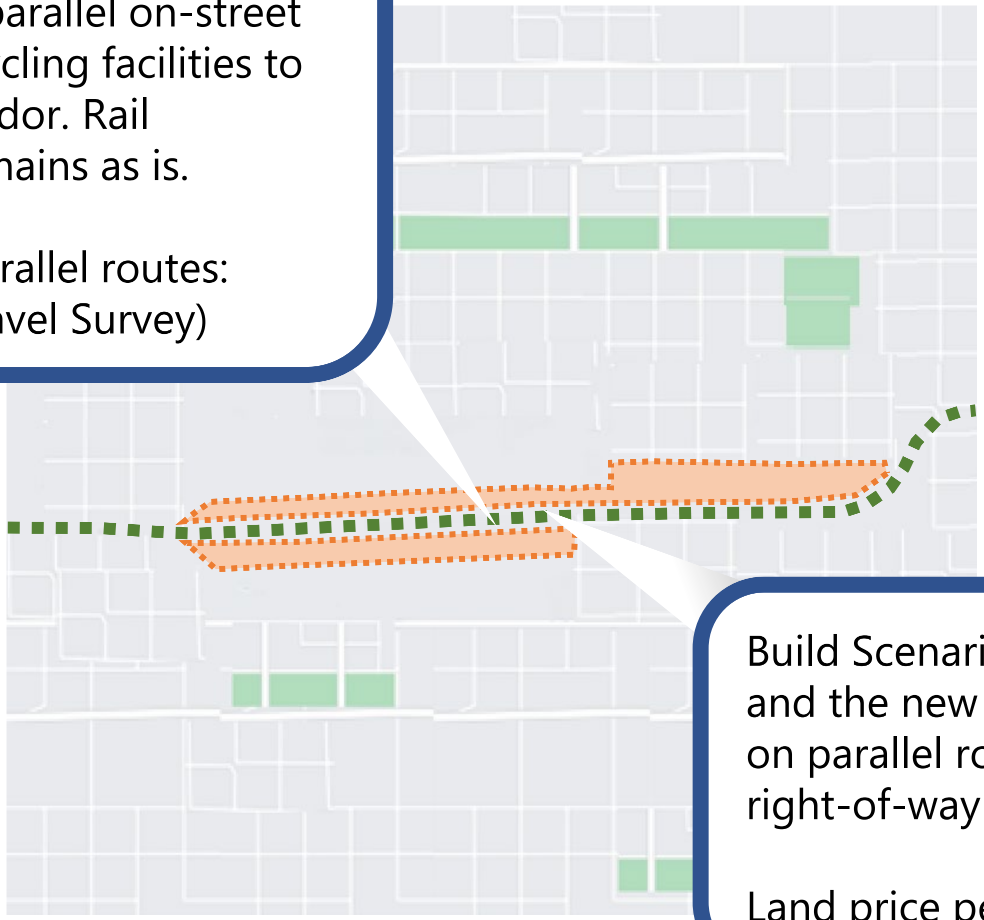


Build Scenario: The rail infrastructure is removed and the new cycling path is completed. Cyclists on parallel routes shift to new facility. Excess right-of-way of 40 acres is sold.

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**

$$\text{Annual Amenity Benefits*} = \text{Improved Facility Length} \times \text{Daily Users} \times \text{Amenity Value Per Mile Cycled} \times \text{Annualization Factor}$$

*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

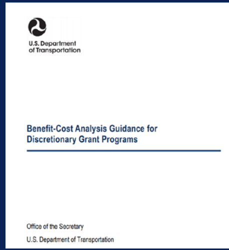
*Undiscounted.

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	$1.70	x	

USDOT BCA Guidance


U.S. Department of Transportation

Benefit-Cost Analysis Guidance for Discretionary Grant Programs

Office of the Secretary
U.S. Department of Transportation

(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	$1.70	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	$1.70	x	365
	=	$3,723,000 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 2026, ten years of project operations, and no change in maintenance costs**

Year	Capital Cost	Discounted Costs	Amenity Benefits	Excess Land Sale	Discounted Benefits
2026	$20,000,000		$0	$0	
2027	$0		$3,723,000	$3,600,000	
2028	$0		$3,723,000	$0	
2029	$0		$3,723,000	$0	
2030	$0		$3,723,000	$0	
2031	$0		$3,723,000	$0	
2032	$0		$3,723,000	$0	
2033	$0		$3,723,000	$0	
2034	$0		$3,723,000	$0	
2035	$0		$3,723,000	$0	
2036	$0		$3,723,000	$0	

Hypothetical BCA Example #2

- **Next, we discount costs and benefits using a 3.1% 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
2026	$20,000,000	**$18,249,627**	$0	$0	$0
2027	$0	$0	$3,723,000	$3,600,000	**$6,481,184**
[illegible]	$0	$0	[illegible]	[illegible]	[illegible]
2029	$0	$0	$3,723,000	$0	[illegible]
2030	$0	$0	$3,723,000	$0	$3,006,647
2031	$0	$0	$3,723,000	$0	$2,916,243
2032	$0	$0	$3,723,000	$0	$2,828,558
2033	$0	$0	$3,723,000	$0	$2,743,509
2034	$0	$0	$3,723,000	$0	$2,661,017
2035	$0	$0	$3,723,000	$0	$2,581,006
2036	$0	$0	$3,723,000	$0	**$2,503,401**

$20,000,000 / (1+0.031)^(2026-2023)

($3,723,000+$3,600,000) / (1+0.031)^(2027-2023)

$3,723,000 / (1+0.031)^(2036-2023)

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
2026	$20,000,000	$18,249,627	$0	$0	$0
2027	$0	$0	$3,723,000	$3,600,000	$6,481,184
2028	$0	$0	$3,723,000	$0	$3,195,948
2029	$0	$0	$3,723,000	$0	$3,099,853
2030	$0	$0	$3,723,000	$0	$3,006,647
2031	$0	$0	$3,723,000	$0	$2,916,243
2032	$0	$0	$3,723,000	$0	$2,828,558
2033	$0	$0	$3,723,000	$0	$2,743,509
2034	$0	$0	$3,723,000	$0	$2,661,017
2035	$0	$0	$3,723,000	$0	$2,581,006
2036	$0	$0	$3,723,000	$0	$2,503,401
TOTAL		**$18,249,627**			**$32,017,366**

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)**

Net Present Value (NPV) = Total Discounted Benefits - Total Discounted Costs

= $32,017,366 - $18,249,627

= **$13,767,738**

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

$$= \frac{\$32{,}017{,}366}{\$18{,}249{,}627}$$

= **1.8**

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**

Key Resources for BCA

- **DOT BCA Guidance**
  - https://www.transportation.gov/mission/office-secretary/office-policy/transportation-policy/benefit-cost-analysis-guidance
- **Additional project examples provided in 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/rcnprogram/rcn-webinars
  - Note that parameter values are 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**

Key Resources for BCA

- **DOT BCA Spreadsheet Template**
  - Developed by DOT as an optional template to aid applicants in structuring their BCA and performing certain calculations common to all analyses.
  - Designed as an open-ended template that can handle any project type
  - Available at: https://www.transportation.gov/mission/office-secretary/office-policy/transportation-policy/benefit-cost-analysis-spreadsheet-template
- **Bridge Investment Program BCA Tool**
  - Supports estimates of the benefits of bridge preservation or replacement investments using National Bridge Inventory data
  - Also provides a default methodology consistent with DOT BCA Guidance
  - Applicable to roadway bridge projects for any DOT program where BCA is required
  - Available at: https://www.fhwa.dot.gov/bridge/bip/bca/

RAISE Grants
Rebuilding American Infrastructure with Sustainability and Equity

QUESTIONS?