US Department of Transportation

Preparing a Benefit-Cost Analysis for the Port Infrastructure Development Program

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Today's Presenters

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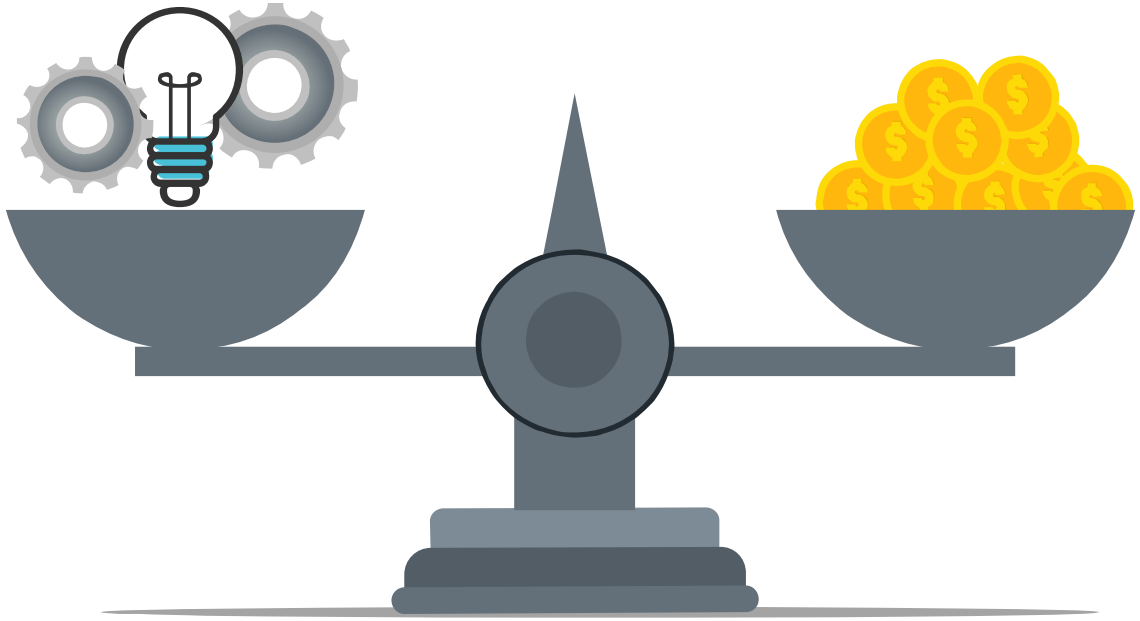
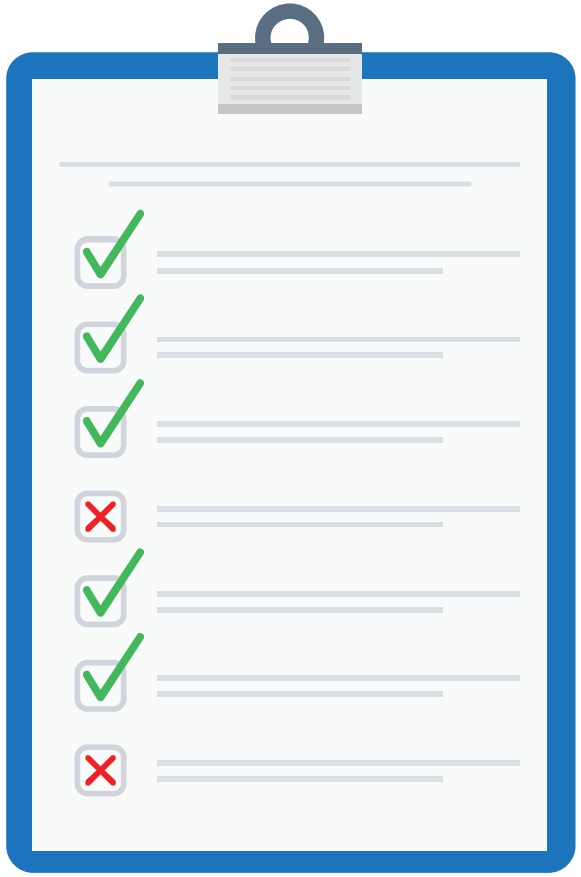
What is BCA?

- 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 PIDP

- Sponsors of most large projects (as defined in the NOFO) should submit a benefit-cost analysis (BCA) as part of their PIDP grant application
  - The BCA will be used in the assessment of project cost-effectiveness and the evaluation of the Economic Vitality merit criterion for those projects
  - Does not apply to small projects at small ports or large projects located in noncontiguous States or U.S. territories

Use of the BCA in PIDP Project Evaluation

- For large projects (other than projects located in noncontiguous States and territories), USDOT must determine that the project will be cost-effective in order for it to be selected under the PIDP
- Cost-effectiveness determinations based on the results of the BCA
  - Projects must be found to have estimated benefits that are likely to exceed costs in order to be deemed cost-effective
- For the Economic Vitality merit criterion, projects will be assigned one of five ratings
  - High (the project's benefits will exceed its costs, with a BCR of at least 2.0)
  - Medium-High (the project's benefits will exceed its costs)
  - Medium (the project's benefits are likely to exceed its costs)
  - Medium-Low (the project's costs are likely to exceed its benefits)
  - Low (the project's costs will exceed its benefits)

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?

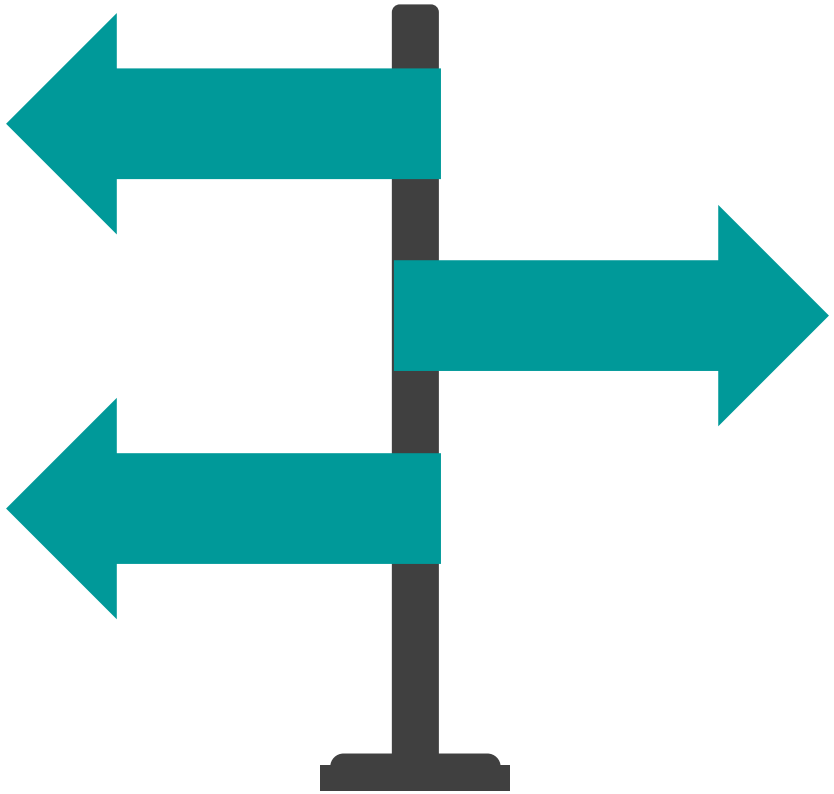
- **Clear understanding of:**
  - The problem the project is intended to solve (baseline conditions)
  - How the project addresses the problem (measures of effectiveness)
- **Well-defined project scope and cost estimate**
- **Monetization factors for key project benefits**

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

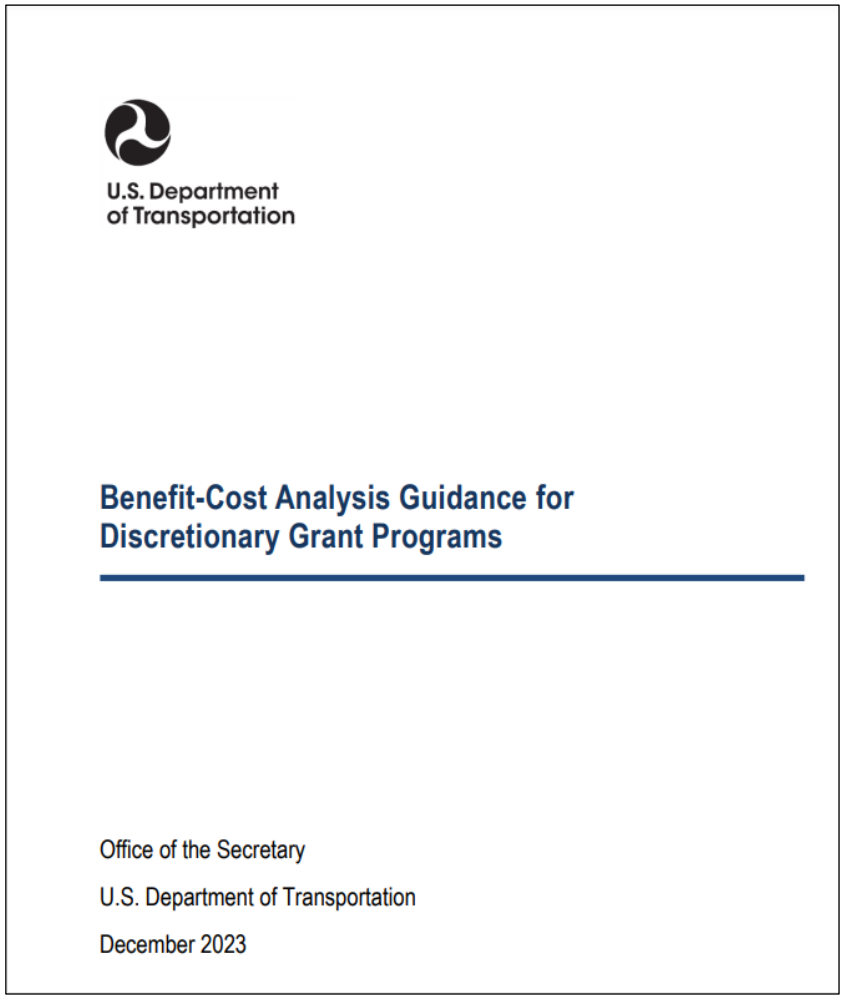
What do I need to do BCA?

- 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

December 2023

What's new for 2024?

- **The 2024 update to the BCA Guidance includes:**
  - Revised discount rates in accordance with updates to OMB Circular A-94
  - Revised values for the social cost of CO_2 emissions
  - Other new and updated monetization values
    - Includes commuter, intercity passenger, and freight rail per-hour operating and social costs
  - Simplified measure of emission costs per vehicle mile traveled
  - Links to two new documents to aid applicants in their BCA
    - FHWA Bridge Improvement Program BCA Tool
    - USDOT BCA Spreadsheet Template

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 usage estimates**
- **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 2022 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 2022 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 non-vehicle time, long-distance travel, business travel
- **Can be a function of both changes in travel speed and/or travel distance**
- **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 or facility operations during the construction period**
  - Ex: travel times, safety, operating costs
- **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
  - Don't apply urban values to rural truck travel

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 PIDP 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

Additional USDOT Resources for BCA

- **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

Key Resources for BCA

- **DOT BCA Guidance**
  - https://www.transportation.gov/mission/office-secretary/office-policy/transportation-policy/benefit-cost-analysis-guidance
- **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
  - Applicable to roadway bridge projects for any DOT program where BCA is required
  - Available at: https://www.fhwa.dot.gov/bridge/bip/bca/

Application Deadline and Contact Information

- **Applications must be submitted by 11:59 p.m. EDT on May 10, 2024**

- **Email any questions (including technical BCA questions) to PIDPGrants@dot.gov**

Q&A

QUESTIONS?