FY 2022 Port Infrastructure Development Program
Preparing a Benefit-Cost Analysis for a Large Project

April 7, 2022
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
What do I need to do a 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 a BCA?

**Sources of information may include:**

- Project planning and engineering documents
- Industry technical references and analytical tools
- DOT BCA Guidance
Applicants for large projects (as defined in the NOFO) should submit a benefit-cost analysis (BCA) as part of their PIDP grant application.

Use of the BCA in PIDP
- Assessment of project cost-effectiveness
- Evaluation of the Economic Vitality merit criterion
For large projects, USDOT must determine that the project will be cost effective in order for it to be selected under the PIDP

- For amounts made available under the FY22 Consolidated Appropriations Act, this requirement does not apply to projects located in noncontiguous states and territories

Cost-effectiveness determinations based on results of the BCA

- Projects must be found to have estimated benefits that are reasonably likely to exceed costs in order to be considered cost effective
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
USDOT considers the relative magnitude of estimated project benefits and costs

Assign projects to one of four benefit-cost ratio ranges

- $BCR > 3.0$
- $BCR 1.5 - 3.0$
- $BCR 1.0 - 1.5$
- $BCR < 1.0$

Also assign a confidence rating to the assessment (high, medium, low)
- Covers all USDOT discretionary grant programs
- Updated March 2022
- Available at https://www.transportation.gov/office-policy/transportation-policy/benefit-cost-analysis-guidance-discretionary-grant-programs-0
What’s New?

- New and updated monetization values
- Additional guidance and new examples on:
  - Valuing pedestrian, cycling, and transit infrastructure improvements
  - Valuing the benefits of improved health from active transportation and reduced crowding on transit
- Additional guidance on benefits from reduction in stormwater runoff and wildlife impacts
BCAs should provide enough information for a reviewer to follow the logic and reproduce the results

- Spreadsheet or database files showing the calculations
- Technical memos describing the analysis and documenting sources of information used (assumptions and inputs)
- Present annual benefit & cost streams by type (not just summary output)
Should measure costs and benefits of a proposed project against a baseline alternative ("base" or "no build")

**“Do’s”**
- Factor in any projected changes (e.g., increased traffic or cargo volumes) that would occur even in the absence of the requested project
- Factor in ongoing routine maintenance
- Consider full long-term impacts of no build (e.g. facility closure)
- 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 or freight flows
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 facility
Should cover both initial development and 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 projects 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 assets
**Inflation Adjustments**

- Recommend using a 2020 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 2020 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
- **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**
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 (and document any CMF 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
- **Recommended values found in BCA Guidance**
  - See footnotes for discussion of non-vehicle time, long-distance travel, business travel

- **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
Avoid double counting operating savings and other impacts
  - E.g., truck 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
For infrastructure improvements, emissions reductions will typically be a function of reduced fuel consumption.

Recommended unit values for CO$_2$, SO$_2$, NOx, and PM$_{2.5}$ found in BCA guidance:
- Be careful about the measurement units being applied.

Reductions in CO$_2$ emissions should be discounted at 3 percent, while all others should be discounted at 7 percent.
• 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 category being claimed
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 BCA Guidance.

Absent local data on existing mode share and estimates age profiles of users, applicants may apply national averages included in the BCA Guidance.
Primary benefits typically experienced directly by users of the improved facility

Includes both “existing” users (under baseline) and “additional” users attracted to the facility 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)
- **Projected magnitude**
  - Should be based on careful analysis of the market and potential for diversion from other modes that might be attributable to the project

- **Benefits 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, pavement damage
  - Values for noise and congestion costs included in Guidance
  - Don’t apply urban values to rural truck travel
  - Should net out highway user fees paid by trucks from marginal pavement damage costs
Other Benefits

- 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
Should quantify magnitudes/timing of the impacts wherever possible

Should clearly link specific project outcomes to any claimed unquantified benefits
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)
- 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
For assets with remaining service life at the end of the analysis period, may calculate a “residual value” for the project

- Recall 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)
Other Types of Economic Analysis

- **Examples**
  - Economic Impact Analysis
  - Financial Impacts
  - Distributional Effects

- **Issues**
  - Use different approaches and answer different questions than does BCA
  - Do not represent additional benefits to include in BCA
Applications must be submitted by 11:59 p.m. E.D.T. on May 16th, 2022.

Email any questions to PIDPGrants@dot.gov
Questions?