FEMA Benefit-Cost Analysis Overview

Specifics on BRIC Program

Shane Parson with AECOM

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Welcome and Introductions

- MEMA
- AECOM
- Communities

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Agenda

1. Benefit-Cost Analysis (BCA) Overview
2. Approaches: Pre-calculated vs. Project-Specific from BCA Software
3. Components: Costs, Benefits, Economic Calculations
4. Type of Benefits
5. Hazard Types
6. BCA Software Overview
7. BCA Info in FEMA GO
8. Tricks and Tips
9. Questions

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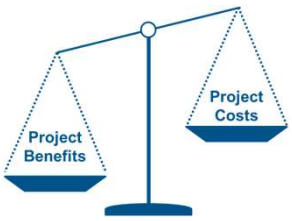
Benefit Cost Analysis (BCA) Overview

Benefit-Cost Analysis (BCA) is the process of quantifying the advantages (benefits) of an action and comparing it to its drawbacks (costs).



If an action's benefits are greater than its costs, then it is considered **cost-effective.**

Once we add up the benefits for an action, we divide that value by the costs, which gives us the **Benefit-Cost Ratio (BCR)**. If the BCR is greater than or equal to **1.0**, then the action is cost-effective.

$$\frac{\text{Benefits}}{\text{Costs}} = \text{BCR}$$

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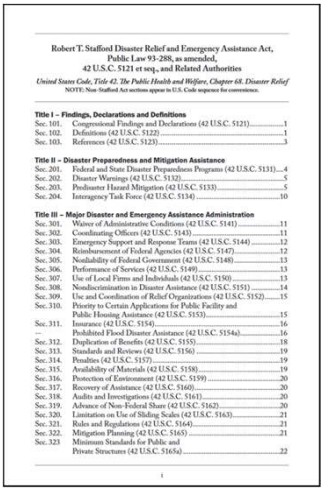
Benefit Cost Analysis (BCA) Overview

Why do a BCA? It's the Law!

The Stafford Act (including the Disaster Recovery Reform Act (DRRA) Section 1234, which amends Section 203 of the Stafford Act for BRIC) says:

Projects must be cost-effective (BCR = 1.0 or greater)

In BRIC, only needed for Mitigation Projects



Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law 93-288, as amended, 42 U.S.C. 5121 et seq., and Related Authorities

United States Code, Title 42. The Public Health and Welfare, Chapter 68. Disaster Relief

NOTE: Non-Stafford Act sections appear in U.S. Code sequence for convenience.

Title I – Findings, Declarations and Definitions

Sec. 101. Congressional Findings and Declarations (42 U.S.C. 5121)....1
Sec. 102. Definitions (42 U.S.C. 5122)....1
Sec. 103. References (42 U.S.C. 5123)....3

Title II – Disaster Preparedness and Mitigation Assistance

Sec. 201. Federal and State Disaster Preparedness Programs (42 U.S.C. 5131)....4
Sec. 202. Disaster Warnings (42 U.S.C. 5132)....5
Sec. 203. Predisaster Hazard Mitigation (42 U.S.C. 5133)....5
Sec. 204. Interagency Task Force (42 U.S.C. 5134)....10

Title III – Major Disaster and Emergency Assistance Administration

Sec. 301. Waiver of Administrative Conditions (42 U.S.C. 5141)....11
Sec. 302. Coordinating Officers (42 U.S.C. 5143)....11
Sec. 303. Emergency Support and Response Teams (42 U.S.C. 5144)....12
Sec. 304. Reimbursement of Federal Agencies (42 U.S.C. 5147)....12
Sec. 305. Nonliability of Federal Government (42 U.S.C. 5148)....13
Sec. 306. Performance of Services (42 U.S.C. 5149)....13
Sec. 307. Use of Local Firms and Individuals (42 U.S.C. 5150)....13
Sec. 308. Nondiscrimination in Disaster Assistance (42 U.S.C. 5151)....14
Sec. 309. Use and Coordination of Relief Organizations (42 U.S.C. 5152)....15
Sec. 310. Priority to Certain Applications for Public Facility and Public Housing Assistance (42 U.S.C. 5153)....15
Sec. 311. Insurance (42 U.S.C. 5154)....16
--- Prohibited Flood Disaster Assistance (42 U.S.C. 5154a)....16
Sec. 312. Duplication of Benefits (42 U.S.C. 5155)....18
Sec. 313. Standards and Reviews (42 U.S.C. 5156)....19
Sec. 314. Penalties (42 U.S.C. 5157)....19
Sec. 315. Availability of Materials (42 U.S.C. 5158)....19
Sec. 316. Protection of Environment (42 U.S.C. 5159)....20
Sec. 317. Recovery of Assistance (42 U.S.C. 5160)....20
Sec. 318. Audits and Investigations (42 U.S.C. 5161)....20
Sec. 319. Advance of Non-Federal Share (42 U.S.C. 5162)....20
Sec. 320. Limitation on Use of Sliding Scales (42 U.S.C. 5163)....21
Sec. 321. Rules and Regulations (42 U.S.C. 5164)....21
Sec. 322. Mitigation Planning (42 U.S.C. 5165)....21
Sec. 323 Minimum Standards for Public and Private Structures (42 U.S.C. 5165a)....22

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BCA Approaches

How to do a BCA? Typically project specific using the FEMA BCA software, but some can use pre-calculated BCA

- Acquisitions and Elevations in the Special Flood Hazard Area (SFHA)
- Residential Hurricane Wind Retrofits
- Non-Residential Hurricane Wind Retrofits
- Individual Tornado Safe Rooms
- Hazard Mitigation Grant Program Post Wildfire
- **Substantial Damage in SFHA (assumed BCR = 1.0)**

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Pre-Calculated BCA

Project Type	Maximum Project Cost	Notes
Acquisitions in SFHA	$276,000/property	Property must be in SFHA. See memo for details.
Elevations in SFHA	$175,000/property	Property must be in SFHA. See memo for details.
Residential hurricane wind retrofits (Portions of Wicomico and Worcester Counties)	Ranges from $13,153-$52,018/property	Only certain states and counties eligible. Maximum cost depends on type of work being performed; see Job Aid for details.
Non-residential hurricane wind retrofits	10% of Building Replacement Value (BRV)	See memo for details.
Residential tornado safe rooms (no values for Maryland)	Ranges from $3,936-$20,067/property	Maximum cost depends on state; see Job Aid for details.
Post-wildfire mitigation	$5,250/acre	See Policy Clarification for details.

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BCA Components

- Cost
- Benefits
- Economic Calculations
  - Discount rate
  - Project Useful Life (PUL)
  - Project Design/Recurrence interval (RI) associated with project effectiveness

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BCA Costs (not always same as project cost)

Costs of a mitigation project include:

- Construction/acquisition costs
- Any other project-related costs such as title searches, permits, etc.
- **Maintenance costs**
- Any in-kind contributions or match from the recipient or subrecipient

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Benefits

Benefits are any future costs or losses that can be avoided by completing a mitigation project.

Benefits = Losses Before Mitigation – Losses After Mitigation

Most projects are not 100% effective to avoid all hazard losses, so Losses After Mitigation usually not $0.

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BCA Economic Calculations

- Costs given as net present value (lump sum)
- Benefits derived as difference in annual losses before and after mitigation
- BCR needs to compare benefits and cost by same basis
- How do we convert annual benefits into net present value?
- Economic Calculations (similar to house mortgage and car payments)
- Need to know rate and years (number of payments)

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Discount Rate

The rate at which benefits decline in value each year is the **discount rate**.

Federally-funded mitigation projects must use a discount rate of **7%**, which is set by the U.S. Office of Management and Budget (OMB).

This is NOT the inflation rate (prices going up, typically).

Time value of money: If we could achieve a rate of return on our money equal to the discount rate, then $1,000 today would be worth $1,070 a year from now.

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Project Useful Life (PUL)

Project Useful Life (PUL) is the estimated amount of time (in years) that the mitigation action will be effective.

PUL is based on how long the mitigation measures will physically last, not the design of the measures.

Based on materials, wear down and maintenance of components, especially moving parts

Project Type	Useful Life	
	Standard Value	Acceptable Limits (documentation required)
Acquisition / Relocation		
Acquisition / Relocation	100	100
		Building Elevation
Residential Building	30	30-50
Non-Residential Building	25	25-50
Public Building	50	50-100
Historic Buildings	50	50-100
		Mitigation Reconstruction
Mitigation Reconstruction	50	50

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Project Effectiveness

Project Effectiveness is the concept of how the mitigation project is designed to eliminate or reduce hazard-specific damages to a certain threshold, represented by a recurrence interval (RI).

Example 1: A highway box culvert may be designed to eliminate damages up to flood flows from 25-yr RI (4%-annual-chance) event, but has a PUL of 50 years.

Example 2: A residential house elevation is designed to raise the first floor elevation to the 500-yr RI flood elevation, but only have a PUL of 30 years.

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BCA Benefit Types

- Physical Damages: Building and Contents, Infrastructure components
- Displacement Cost
- Loss of service/function
- Life Safety (avoided injuries or death)
- Emergency management
- Environmental/ecosystem benefits (no longer has BCR limits)
- Social benefits

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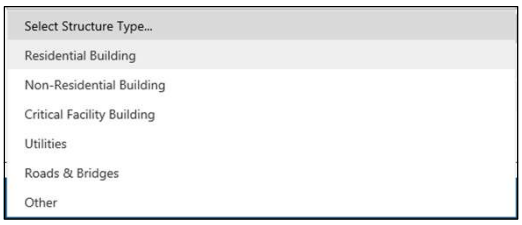
Modeling BCA: Structure and Hazard Types



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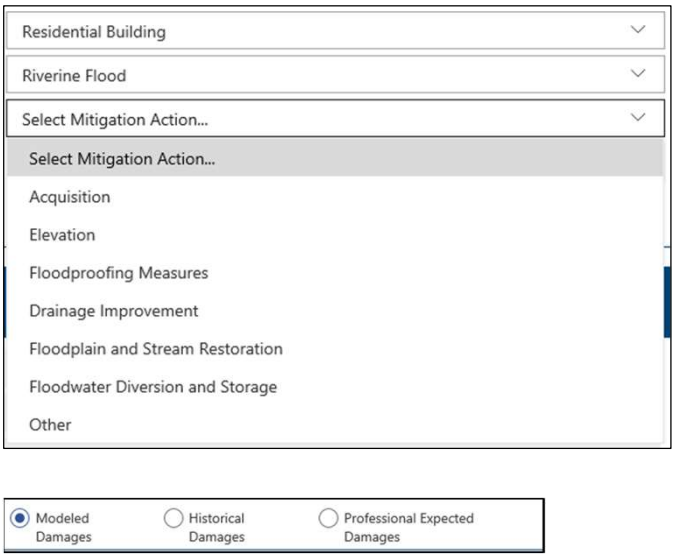
Flood BCA: Projects

- Acquisitions:
  Flood Modeled Damages
- Elevations:
  Flood Modeled Damages
- Flood Control:
  Flood Historical/
  Professional Expected
  Damages



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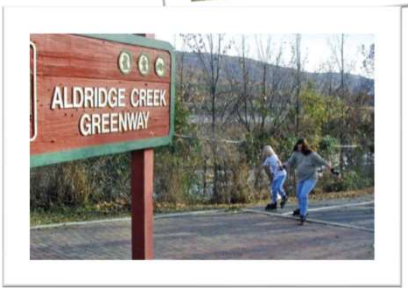
Acquisition Projects

- The purchase and demolition or relocation of a building. Future damage is eliminated because the project site is deed-restricted as open space.
- Many communities utilize the open space as wildlife habitat, active-use parks, or multi-use greenways.



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Lowest floor elevation (LFE)

- **What it is:**
  - The LFE is the elevation (in feet) of the lowest floor of the structure.

Input required ?	Potential sources	Recommended documentation with application
Yes	• Elevation certificate • LIDAR data • Signed, sealed, and dated structure elevation survey • Building permit	• Elevation certificate signed by a qualified professional • Signed, sealed, and dated structure elevation survey • Copy of building permit

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Elevation Projects

- Elevation projects raise the lowest floor elevation (LFE) of the structure above the Base Flood Elevation (BFE).
- The number of feet above the BFE the LFE is raised is known as freeboard.
- Freeboard requirements vary by jurisdiction.

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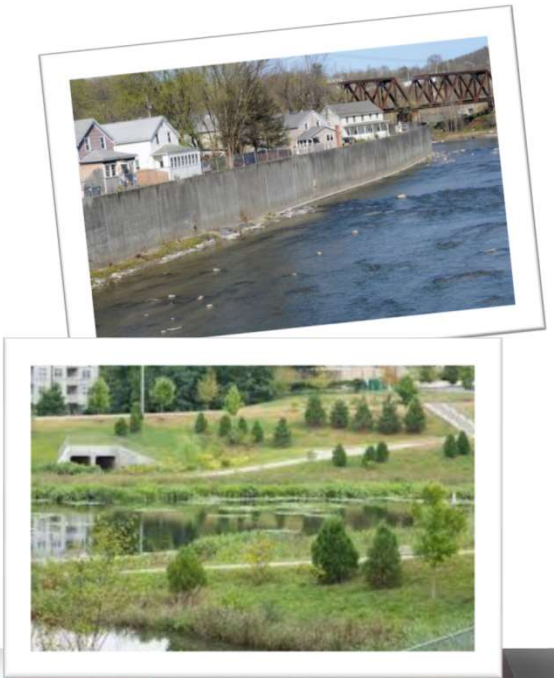
Number of feet the first floor is being raised

- **Why it's important:**
  - The number of feet the first floor is raised helps determine the expected damages after mitigation.

Input required ?	Potential sources	Recommended documentation with application
Yes	• Project scope of work (SOW) • Project engineer • Engineering designs	• None other than normally required project materials

Flood Control Projects

- The term "flood control" refers to systemic projects designed to reduce flood damage to a facility or area.
- For example:
  - Culverts
  - Floodplain & stream restoration
  - Drainage improvements
  - Floodwater diversion & storage
  - Floodwalls
  - Levees
  - Pumping stations



Damages before mitigation, historical

Input	Input required?	Potential sources
Damage Year	Yes*	• Property owner or facility operator • Insurance claims • FEMA Project Worksheets (PWs) • Newspaper articles from credible source
Recurrence Interval (years)	Yes**	• National Weather Service Precipitation Frequency Data Server • USGS stream gauge data • Qualified engineer or other professional
Damages ($) or Impact (Days)	Yes	• Property owner or facility operator • Insurance claims • FEMA Project Worksheets (PWs) • Estimates using flood depths and DDFs • Qualified engineer or other professional • Newspaper articles from credible source

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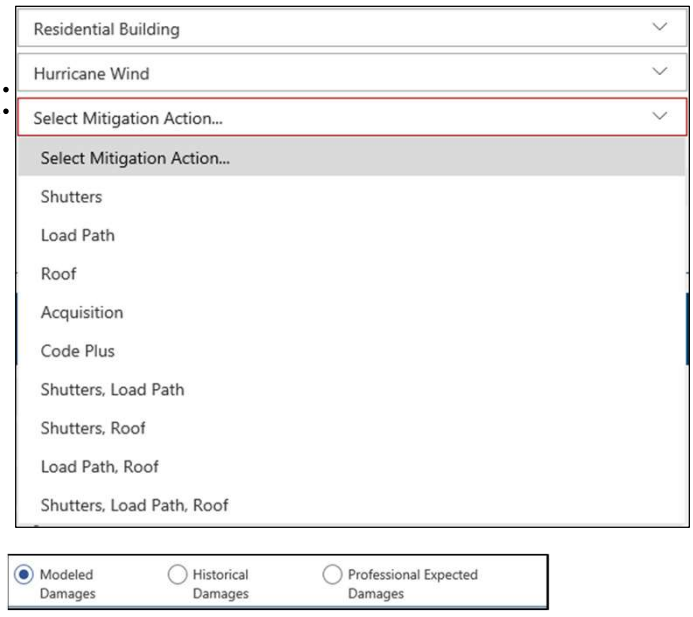
Hurricane Wind BCA: Projects

- Shutters
- Load Path
- Roof retrofit
- Code Plus



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Shutters

- Designed to protect all windows and doors
- Must meet the debris impact and wind pressure design requirements of the International Residential Code/ International Building Code
- Assumes all openings of a building will be protected

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Building properties before and after mitigation

- **What it is:**
  - Existence/type of roof, shutters, load path, etc. of the structure before and after the mitigation project.

Input required ?	Potential sources	Recommended documentation with application
Yes	• Property owner • Contractor • Building inspector • Project engineer	• Note from project engineer or BCA analyst • Photos

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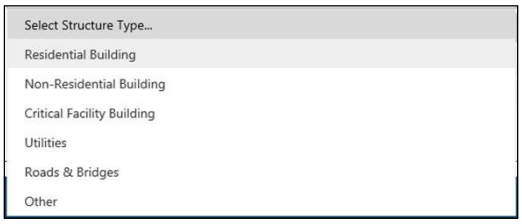
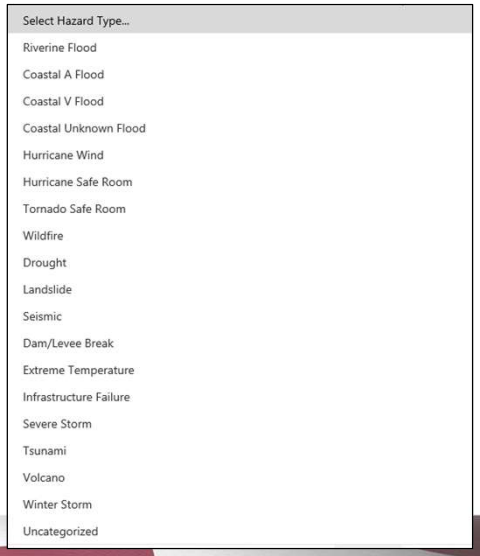
Other Hazard and Project Types





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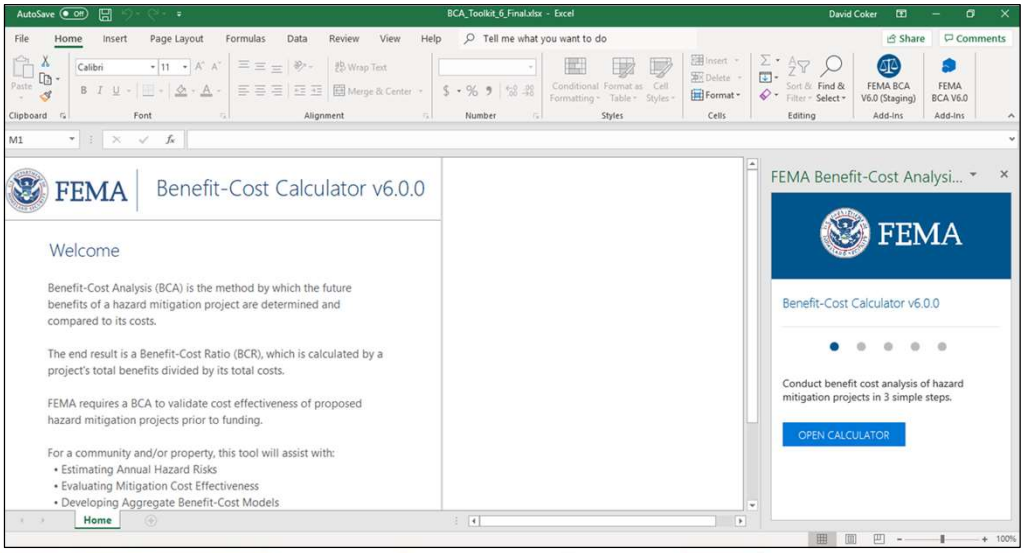
BCA Toolkit



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BCA Toolkit: Basic Inputs

- Project title
- Property location
- Property structure type
- Hazard type
- Mitigation action type
- Hazard data, damage history, or expected damages estimated by a qualified professional
- Project cost estimate
- Project useful life

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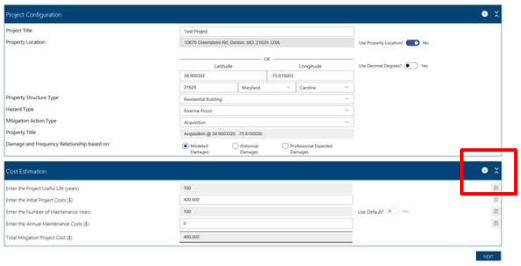
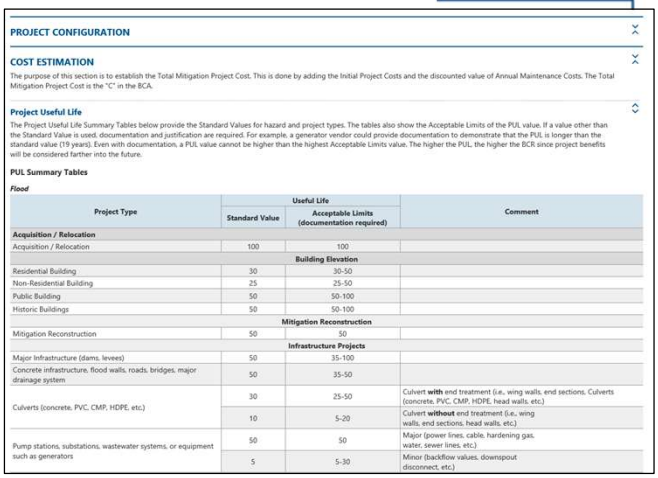
BCA Toolkit: Help (default values)





PROJECT CONFIGURATION

COST ESTIMATION

The purpose of this section is to establish the Total Mitigation Project Cost. This is done by adding the Initial Project Costs and the discounted value of Annual Maintenance Costs. The Total Mitigation Project Cost is the "C" in the BCA.

Project Useful Life

The Project Useful Life Summary Tables below provide the Standard Values for hazard and project types. The tables also show the Acceptable Limits of the PUL value. If a value other than the Standard Value is used, documentation and justification are required. For example, a generator vendor could provide documentation to demonstrate that the PUL is longer than the standard value (19 years). Even with documentation, a PUL value cannot be higher than the highest Acceptable Limits value. The higher the PUL, the higher the BCR since project benefits will be considered farther into the future.

PUL Summary Tables

Flood

Project Type	Useful Life: Standard Value	Useful Life: Acceptable Limits (documentation required)	Comment
Acquisition / Relocation			
Acquisition / Relocation	100	100	
Building Elevation			
Residential Building	30	30-50	
Non-Residential Building	25	25-50	
Public Building	50	50-100	
Historic Buildings	50	50-100	
Mitigation Reconstruction			
Mitigation Reconstruction	50	50	
Infrastructure Projects			
Major Infrastructure (dams, levees)	50	35-100	
Concrete infrastructure, flood walls, roads, bridges, major drainage system	50	35-50	
Culverts (concrete, PVC, CMP, HDPE, etc.)	30	25-50	Culvert **with** end treatment (i.e., wing walls, end sections. Culverts (concrete, PVC, CMP, HDPE, head walls, etc.)
	10	5-20	Culvert **without** end treatment (i.e., wing walls, end sections, head walls, etc.)
Pump stations, substations, wastewater systems, or equipment such as generators	50	50	Major (power lines, cable, hardening gas, water, sewer lines, etc.)
	5	5-30	Minor (backflow values, downspout disconnect, etc.)

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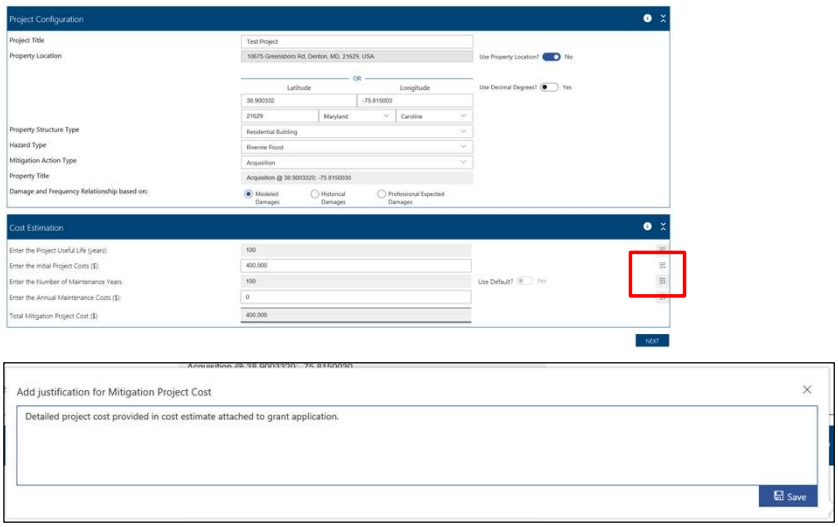
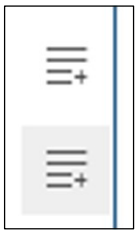
BCA Toolkit: Comments





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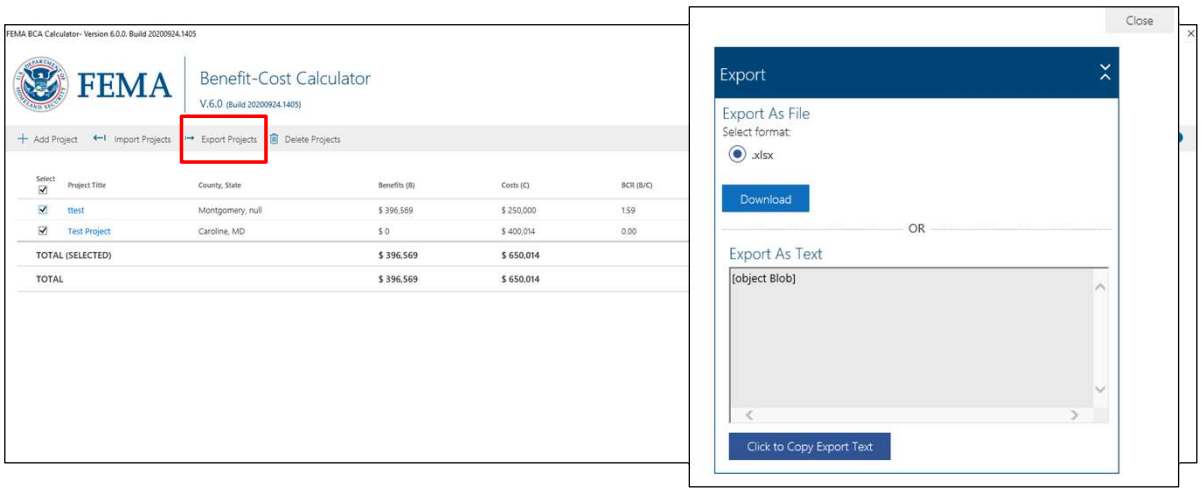
BCA Toolkit: Export Project



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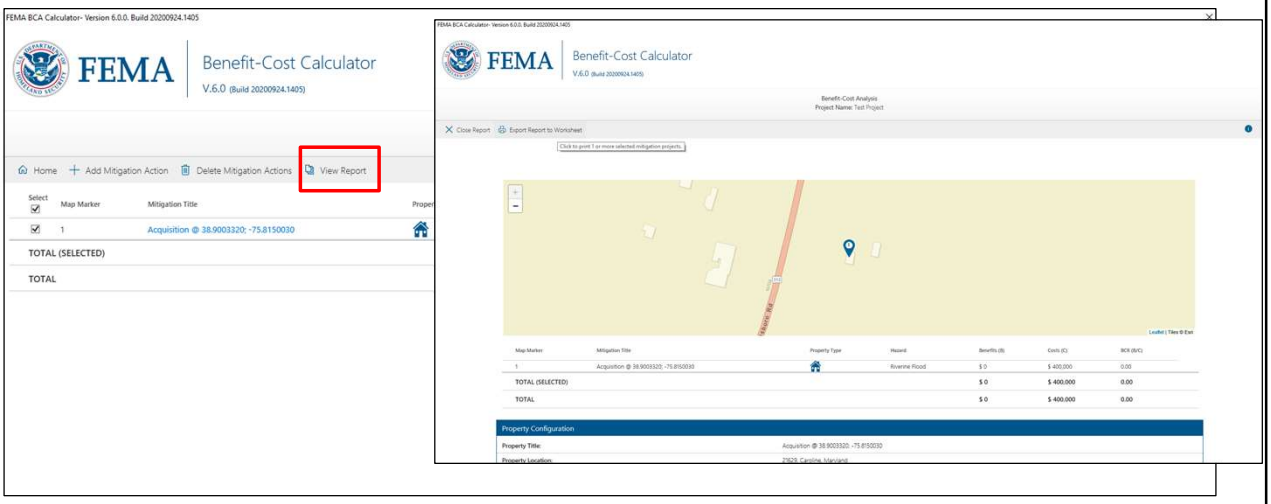
BCA Toolkit: Project Report



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BCA Toolkit: Data Documentation

- Subapplication needs to include checklist and detailed description of data sources of **every input value**
- Use FEMA defaults whenever possible, included in help info
- FEMA guidance lists trusted sources for each critical input
- Do this for every project, every structure

Project Type	Useful Life	
	Standard Value	Acceptable Limits (documentation required)
Acquisition / Relocation		
Acquisition / Relocation	100	100
		Building Elevation
Residential Building	30	30-50
Non-Residential Building	25	25-50
Public Building	50	50-100
Historic Buildings	50	50-100

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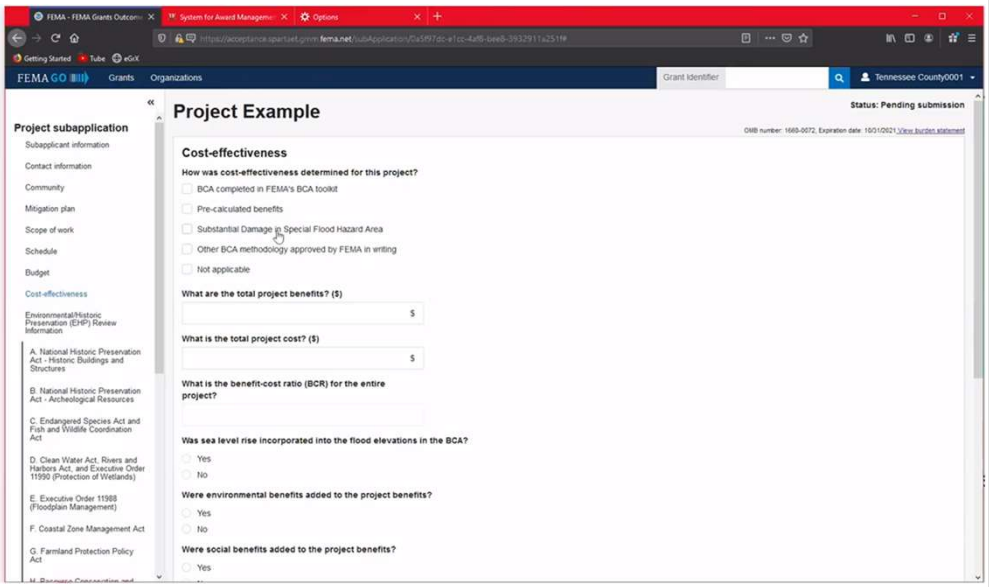
FEMA GO



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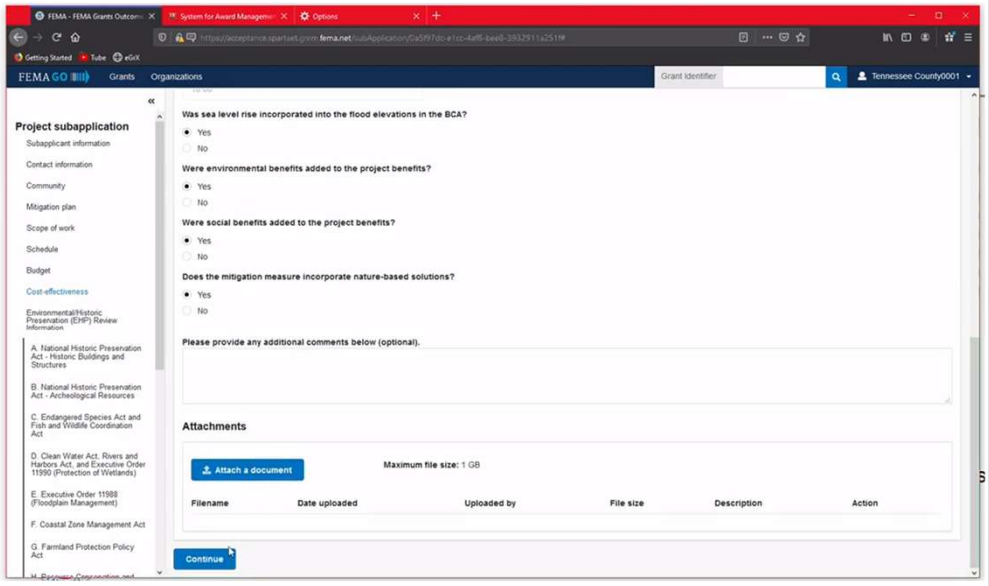
FEMA GO



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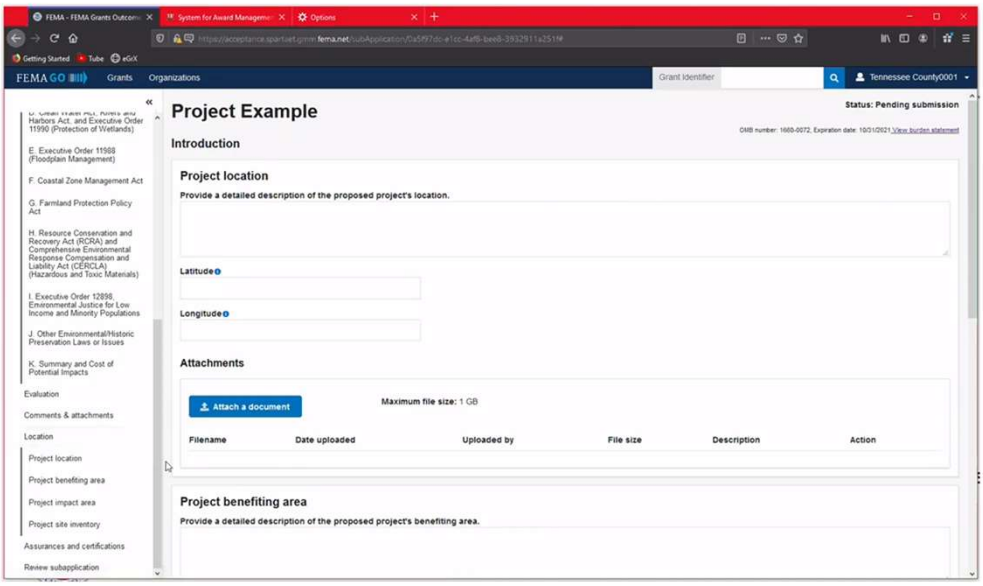

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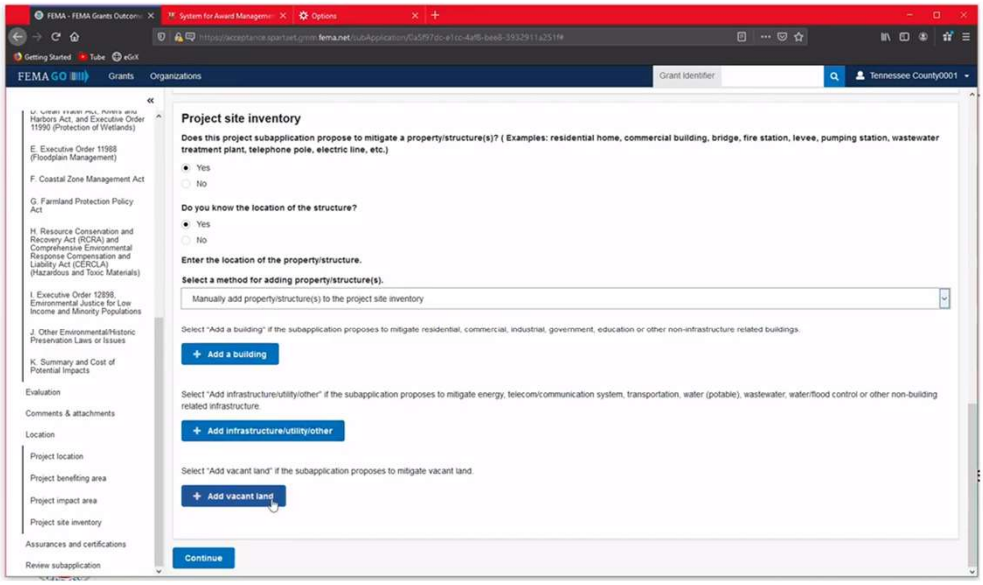
FEMA GO



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For More Information

- MEMA: https://mema.maryland.gov/community/Pages/grant-subapplicant-resources.aspx
- FEMA BCA: https://www.fema.gov/grants/guidance-tools/benefit-cost-analysis
- FEMA GO: https://www.fema.gov/grants/guidance-tools/fema-go

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The mission of the Maryland Emergency Management Agency is to proactively reduce disaster risks and reliably manage consequences through collaborative work with Maryland's communities and partners.

Mitigation.mema@Maryland.gov

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