Final

BCA Reference Guide

June 2009

FEMA

Federal Emergency Management Agency
Department of Homeland Security
500 C Street, SW
Washington, DC 20472

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Contract No. HSFEHQ-06-D-0162
Task Order HSFEHQ-07-J-0011
Task Order HSFEHQ-08-J-0052

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Appendices

Term	Definition
A Zone	The 100-year floodplains (except Zone V areas) shown on a community's FIRM. There are five types of Zone A areas: A: An approximate 100-year floodplain where no Base Flood Elevations (BFEs) or 100-year flood elevations are provided. A#: Numbered Zone A areas (e.g., A7 or A14), where the FIRM shows a Base Flood Elevation in relation to the NGVD. AE: 100-year floodplain where Base Flood Elevations are provided. Zone AE delineations are used on newer FIRMs instead of A# Zones. AO: 100-year floodplain with sheet flow, ponding, or shallow flooding. BFE depths (feet above grade) are provided on the FIRM.AH: 100-year floodplain with shallow flooding. Base Flood Elevations in relation to NGVD are provided on the FIRM. Same definition as **Zone A**.
Acquisition	A mitigation project where an asset, usually a building, is purchased by the Federal, State, or local government as a means to prevent future damages. Acquisition is often combined with demolition to eliminate future damages completely by removing the building from the flood hazard area.
Acre	Commonly used land area unit of measure (1 acre = 43,560 square feet, and 640 acres = 1 square mile).
Active Mitigation Measures	Require human intervention to operate properly and are usually less effective than passive mitigation measures.
AE Zone	100-year floodplain where Base Flood Elevations are provided. Zone AE delineations are used on newer FIRMs instead of A# Zones. Same definition as **Zone AE**.
After-mitigation	The conditions that exist after a mitigation measure is implemented and the impacts of the targeted natural hazard are reduced or eliminated.
Aggregation	The process of combining two or more buildings and functions in a single Benefit-Cost Analysis.
Approximate Studies	Floodplain mapping that contains the approximate delineation of the 100-year floodplain boundaries. There are no Base Flood Elevations and floodway delineations. There are no computer modules associated with an approximate study.
Architectural Elements	Exterior elements on a building or structure, including cornices, corbels, decorative features, and lighting. These and other architectural elements are common among historic, unreinforced masonry buildings. Such elements are generally constructed of stone or other heavy, brittle materials, and often fail during an earthquake due to poor anchoring or bracing.
Assets	Physical elements (i.e., buildings, infrastructure, or utilities) that have potential for damage from natural hazard events.

Term	Definition
Average Occupancy	Occupancy of a building or a room averaged over an entire year. The average occupancy of an office building will be higher over 1 year than the average occupancy of a public meeting room that is used only once per month.
B Zone	Area of moderate flood hazard usually depicted on FIRMs as floodplain areas between the limits of the 100- and 500-year floods. Zone B areas are also used to designate base floodplains with modest hazard, such as those with average depths of less than 1 foot, or with drainage areas of less than 1 square mile. Same definition as **Zone B.**
Barrier	A man-made structure between an asset and the flood source that blocks floodwaters from coming into contact with the asset. Examples include minor localized flood reduction projects and concrete or masonry floodwalls. Minor localized flood reduction projects or floodwalls may completely surround an asset or tie into high ground at each end.
Base Flood	A flood having a 1 percent (or 1 in 100) chance of occurring in any given year. It is also referred to as the 100-year flood and is the basis for the NFIP administered by FEMA.
Base Flood Elevation	The **Base** (100-year) **Flood Elevation** having a 1 percent chance of being exceeded in any given year. The Base Flood Elevation is determined by statistical analysis for each floodplain area and designated on FEMA FIRMs. Same definition as **BFE**.
BCA	**Benefit-Cost Analysis –** A method for determining the potential positive effects of a mitigation measure and comparing them to the cost of the measure. With the FEMA BCA modules, the positive effect is a reduction in future damages from natural hazards. This is the benefit of mitigation. The BCA can also be used to compare alternative projects to determine the best alternative from a fiscal standpoint.
BCA Module	The calculations, standard and default values, and methodologies that combine to determine the Benefit-Cost Ratio of a proposed mitigation project in accordance with FEMA Benefit-Cost Analysis requirements and guidelines. The modules are used to determine the required cost effectiveness of proposed mitigation projects across multiple FEMA Mitigation Grant Programs.
BCAR	**Benefit-Cost Analysis Re-engineering –** The re-engineering of the FEMA BCA software.
BCR	**Benefit-Cost Ratio –** This ratio is the present value of net project benefits divided by the project costs and is the result of a BCA. A ratio of 1.0 or greater indicates the project is cost effective; a ratio of less than 1.0 indicates the project is not cost effective.
Before-mitigation	The natural or current conditions existing prior to the implementation of a mitigation measure. Under this condition, the asset is unprotected from natural hazards.

Term	Definition
Benchmark	Date when a building code began to contain lateral force resisting requirements sufficient for a life safety performance level. Knowing the building type, date of construction, date of the building code used, and a history of seismic upgrades, a building owner can determine if their building is pre- or post-benchmark.
Benefits	Future losses prevented or reduced by a mitigation project. The benefits counted in a BCA are the present value (in dollars) of the sum of the expected annual avoided damages over the project useful life.
BFE	The **Base** (100-year) **Flood Elevation** having a 1 percent chance of being exceeded in any given year. The Base Flood Elevation is determined by statistical analysis for each floodplain area and designated on FEMA FIRMs.
Bounded Analyses	Methods for streamlined Benefit-Cost Analysis of hazard mitigation projects. See the Tutorial Section for more information.
Braced Frames	Braced building frames are generally constructed with steel diagonal braces that provide lateral load resistance, and are most commonly encountered in rigid steel frame buildings.
BRV	**Building Replacement Value** (i.e., the cost to replace the building with a functionally equivalent building of the same size, based on the current cost of labor and materials). The BRV is not the same as the current market value of the building.
Building	A structure that has walls and a roof and is occupied on a regular basis.
Building Area	The square footage of the enclosed building. This value includes heated and unheated areas, but excludes open porches, decks, and carports.
Building Envelope	Is the area that separates conditioned space from unconditioned space. The code is only concerned with the "building envelope."
C Zone	Area of minimal flood hazard usually depicted on FIRMs as areas above the 500-year flood level. Zones B and C may have flooding that does not meet the criteria to be mapped, and may include localized ponding or drainage problems. Same definition as **Zone C**.
Calibration Point	In a BCA, a data point that is known to be accurate, and upon which other elements of the analysis may be based.
Code of Federal Regulations	A Federal government coding system of Federal agency regulations published in the Federal Register. The Title 44 CFR includes all FEMA regulations.
Community	A city, village, town, township, borough, parish, county, or other legal governmental entity with the statutory authority to enact floodplain regulations and participate in the NFIP.
Construction Date	The year construction of the building started.

Term	Definition
Continuity Premium	A multiplier (or adjustment) that places a higher dollar value on critical services for Benefit-Cost Analysis. Non-essential services, such as a library, are valued at the daily cost of providing the services. However, services such as fire, police, and medical that are essential to the post-disaster response and recovery are worth more to the community in the immediate post-disaster period. Such services are valued more highly by adding a continuity premium or a multiplier on the normal daily cost of services.
Cost effective	In the context of Benefit-Cost Analysis, when the benefits of a hazard mitigation project exceed the project costs (i.e., BCR > 1.0).
Critical Services	Services that either directly affect life safety or services that, if lost, would have a large economic impact on a community.
Cross-section	Surveyed information that describes the geometry of the watercourse and the floodplain at a particular point along the watercourse.
Datum	A common vertical elevation reference point, usually in relation to sea level.
DDF	**Depth-Damage Function**, also known as a Depth-Damage Curve. A way of expressing expected flood damages for various types of buildings, their contents, or their functions at different water depths. For floods, this relationship is expressed as depth versus percentage damage to the element being considered.
Demolition	The destruction and removal of an acquired property as a means to eliminate future damages from natural hazards.
Demolition Threshold	The amount of damage, expressed as a percentage of the BRV, at which a building is considered a total loss and would not be repaired. In general, buildings that are old or in poor condition have lower demolition thresholds than new or high-quality buildings.
Depth	For *floods,* the depth of flooding (in feet) above the first floor elevation. For *earthquakes*, the distance, in miles below sea level, to the point of origin (hypocenter) of an earthquake. A default depth for shallow earthquakes is 20 miles below sea level.
Detailed Studies	Floodplain mapping that contains detailed delineation of the 100-year floodplain boundaries. The mapping includes Base Flood Elevation and floodway delineations, and is based on computer models and topographic (or elevation) data.
DFE	Design Flood Elevation.
Direct Benefits	The reduction or prevention of future losses to buildings, contents, or public facilities from natural hazards.
Discharge	Volume of water flow measured in cubic feet per second (cfs).

Term	Definition
Discount Rate	Used in FEMA Benefit-Cost Analysis to determine the "Net Present Value" of benefits. Discounting facilitates accurate comparisons of benefits that may occur in the future to the costs of a project that most often occur immediately or in the near term. For FEMA-funded projects, the rate is set by the Office of Management and Budget (OMB).
Displacement Costs	The costs when occupants (of residential, commercial, or public buildings) are displaced to temporary quarters while damage is repaired. These costs include rent and other monthly costs, such as furniture rental and utilities, and one-time costs, such as moving and utility hook-up fees.
Displacement Time	The time during which occupants are displaced to temporary quarters while damage is repaired.
DMA 2000	The Disaster Mitigation Act of 2000, passed in October 2001, focuses on taking action to reduce the impact of hazards before disasters occur. The objective of DMA 2000 is to help Federal and State reviewers evaluate mitigation plans from different jurisdictions in a fair and consistent manner, and to help States and local jurisdictions develop new mitigation plans or modify existing plans.
Dry Floodproofing	Any combination of mitigation measures added to or incorporated into an asset below the Base Flood Elevation to prevent flood damages. This approach completely seals the interior of a building by making the exterior walls substantially impermeable to the passage of floodwater. Although floodwater may touch or surround the asset, there are no damages and the interior remains dry. For existing assets, this is also known as retrofitting. Dry floodproofing is typically used in areas subject to short-duration, low-level flooding.
Ductility	The physical property of certain construction elements, such as wood or steel, to withstand large deformations without failing.
Duration	The length, in time, of an earthquake, flood, or other natural hazard. This can affect the severity of damages to buildings and infrastructure. In general, shorter durations result in less damage.
Elevation	The raising of a building to place the lowest floor at or above the designated Design Flood Elevation on an extended support building or fill.
EMA	**Emergency Management Agency.**
EOC	**Emergency Operations Center.**
Epicenter	The point on the earth's surface directly above the focus (or hypocenter) of an earthquake.
Exposure	The quantity, value, and vulnerability of the built environment (i.e., inventory of buildings and infrastructure) in a particular location subject to one or more hazards.
FBFM	**Flood Boundary and Floodway Map –** An official map of a community that contains the delineations of the regulatory floodway.

Term	Definition
FEMA BCA Program	The methodologies, modules (i.e., software), module standard and default values, guidance documents, user guides, analyst tools, and FEMA policy memorandum that provide specific requirements and guidance for preparing FEMA Benefit-Cost Analysis.
FEMA Mitigation Grant Programs	Grants provided to States and local governments to implement long-term hazard mitigation measures. The purpose of the programs is to reduce the loss of life and property due to natural disasters. These programs include Flood Mitigation Assistance (FMA), Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation (PDM), Repetitive Flood Claim (RFC), and Severe Repetitive Loss (SRL).
FFE	**First Floor Elevation** or Zero Flood Depth. This is the elevation of the top of the lowest finished floor in a building. The relationship between the First Flood Elevation and the Base Flood Elevation at a site determines the extent of flood risk. This elevation does not consider basements or crawl spaces.
FHBM	**Flood Hazard Boundary Map** – An official map of a community, on which FEMA has delineated the approximate boundary of the 100-year floodplain.
FIRM	**Flood Insurance Rate Map** – An official map of a community, on which FEMA has delineated the 100-year (1 percent annual chance) floodplain and insurance risk premium zones. Newer FIRMs include floodway boundaries.
FIS	**Flood Insurance Study** – Consists of three parts: FIRM, FBFM, and the FIS report. The FIS provides background on the study, estimated flood discharges (in cubic feet/second) for various frequencies (e.g., 10-year, 50-year, 100-year, 500-year), and the flood profiles for each of the flood frequencies.
Flash Flood	A flood in hilly areas that arrives at a location very quickly (minutes instead of hours) after a heavy rain. This can also occur in urban areas where pavement and drainage improvements speed rainfall runoff to a stream.
Flood	For NFIP purposes, a partial or complete inundation of normally dry land areas from: 1) overland flow of a lake, river, stream, creek, slough, or ditch; or 2) the unusual and rapid accumulation of rainfall runoff or snowmelt mudflows or the collapse of shoreline land.
Flood Fringe (or Floodway Fringe)	The portion of the floodplain located between the floodway and floodplain boundaries.
Flood of Record	The highest known recorded flood elevation for a location.
Flood Profile	A graph showing the plots of water surface elevations vs. stream distances for each flood frequency published in an FIS.
Floodplain	The area of water and land inundated during the highest point of the base, or 100-year, flood.

Term	Definition
Floodwall	A barrier constructed of flood-damage-resistant material, such as concrete or masonry block, designed to keep floodwaters away from a building.
Floodway	The stream channel and that portion of the adjacent floodplain that must remain open (i.e., free of development) to allow conveyance of the 100-year flood.
Floodway Data Table	The table in an FIS that provides detailed information for each mapped cross-section studied in detail.
FMA	**Flood Mitigation Assistance** – A mitigation grant program (FEMA) authorized by NFIRA and established in 1994. The purpose of FMA grants is to provide funding to help reduce or eliminate long-term risk of flood damage to buildings, manufactured homes, and other structures insured under NFIP. The intent is to reduce project costs to the NFIP, with the savings passed on to the home owner. Cost share requirements for an FMA grant state that up to a 75 percent Federal, and a minimum 25 percent non-Federal match is required. Allocation to eligible subapplicants is based on the number of NFIP insured properties and the number of repetitive loss properties.
FPE	**Flood Protection Elevation** – The elevation to which a building must be protected from flood damage through elevation or floodproofing. The FPE is usually the BFE plus 1 to 3 feet of freeboard.
Fragility Curves	Detailed seismic vulnerability analyses of buildings, non-structural components, or infrastructure. Fragility curves define the probabilities of damage for specified damage states at various levels of ground acceleration.
Freeboard	Additional height, above and beyond what is required by a building code or the NFIP, to account for flood heights above the Base Flood Elevation due to wave action or the limitations used in determining flood elevations.
Frequency	The interval at which a particular event occurs. For example, the frequency of a flood that has a 2 percent chance of occurring each year is 1 in 50 years (1.0 / 50 years = .02), or a 50-year event.
Fujita Scale	The Fujita Scale (F-scale) is an empirical scale that measures tornado intensity based on the estimated magnitude of damages caused by the tornado.
Full Data Module	The FEMA Full Data (or FD) Benefit-Cost Analysis module utilizes FIS data to establish risk while providing the most accurate Benefit-Cost Analysis results. The FD module (also referred to as the Engineering Method) is used primarily to conduct a best data analysis.
Functional Downtime	The time period during which services are lost.

Term	Definition
GIS	**Geographic Information System –** Electronic mapping based on latitude and longitude coordinates.
Hazard	In the context of Benefit-Cost Analysis, a naturally occurring phenomenon (flood, wind, earthquake, etc.) that poses a risk of asset damages, economic losses, or casualties. The impact (low vs. high) of a hazard is determined by its probability and severity.
Hazard Mitigation	Reduction of the risk of natural hazards through the implementation of projects or procedures that reduce or prevent future damages.
HAZMAT	Hazardous materials.
HAZUS	Hazards-United States. FEMA software for hazard analyses based on GIS mapping.
H&H	Hydrology (the study of rainfall runoff) and Hydraulics (the study of moving water and flood elevations).
High Water Mark	Peak elevation of a flood, as noted by water lines, mud lines, or debris lines on the outside (and in some cases, the inside) of buildings and structures, trees, bushes, lawns, floodwalls, culverts, or bridges.
HMGP	**Hazard Mitigation Grant Program –** FEMA program authorized by the Stafford Act and established in 1988. The purpose of this grant is to provide funding that is used to significantly reduce or eliminate future risk to lives and property from natural hazards. The HMGP funds projects in accordance with priorities outlined in State and location mitigation plans. Cost share requirements state that HMGP funds may be used to pay up to 75 percent of the eligible project costs. Administered through the State, available funds are based on a sliding scale of the total Federal assistance for a disaster.
HVAC	Heating, ventilation, and air-conditioning.
Hydraulics	The study of moving water and flood elevations. A hydraulic analysis within an FIS calculates how high and how fast a flood discharge flows.
Hydrology	The study of rainfall runoff, groundwater recharge, and snow melt, that determines the quantity of water in a watercourse.
Hypocenter	The point of origin of an earthquake (the location at which rupture begins).
Indirect Benefits	In the context of hazard mitigation, the reduction in damages from natural hazard events that are not directly caused by the event itself.
Inelastic Deformation	Deformation of a structural element where the element does not return to the original shape after the force is removed. This may be the result of large forces during and earthquake that are far in excess of normal structural loading conditions.

Term	Definition
Inflation	In the context of Benefit-Cost Analysis, the process of converting past damages to present-day values using a factor such as the Consumer Price Index. Usually used to compare past, present, and future values on a common basis.
Intensity	Intensity measures the strength of shaking produced by an earthquake at a given location. It varies depending on not only the magnitude of the earthquake, but on local soil conditions and the distance from the epicenter.
Inundation	Flooding due to the failure of minor localized flood reduction projects, water transmission lines, or large water tanks.
Level of Protection	The recurrence interval (such as a flood frequency risk) or physical extent to which a mitigation project offers protection.
Life Safety	Avoidance of potential casualties by mitigation that prohibits or reduces the potential for structural failure and falling building elements or contents.
Limited Data Module	The FEMA Limited Data (or LD) BCA module requires historical damage data for two or more events, and provides results that are less accurate than those of the Full Data (FD) module. The LD module (also referred to as the frequency damage approach) may be used to conduct bounded or best data analysis when FIS or other hazard frequency data are not available, and is applicable to most hazards (e.g., floods, landslides, ice storms, snow, etc.).
Liquefaction	Occurs when loose, wet, granular soil is shaken by an earthquake and becomes so unstable that the soil is transformed into a nearly fluid mass.
LOMC	A **Letter of Map Change** is an official document issued by FEMA in response to a request to revise or amend the effective FIRM or FHBM (and occasionally, the FIS report) to remove a property from the 100-year floodplain, or reflect changed flood conditions.
Loss of Function Damages	Costs and direct economic impacts that occur when physical damages are severe enough to interrupt the function of a building or other facility.
Loss of Public Services	The cost of providing services, plus a continuity premium, for services that are critical to immediate disaster response and recovery.
Lower Bound Analysis	A Benefit-Cost Analysis screening technique that counts only the most direct or clearly documented benefits. This includes the lowest reasonable estimate of benefits associated with a proposed mitigation measure, and is generally used to indicate that a mitigation measure is cost effective.
Magnitude	Measure of the strength or the amount of energy released at the source of an earthquake that can be expressed as a single number for each earthquake.
Maintenance Cost	The long-term costs of maintaining the effectiveness of a given mitigation measure. Maintenance costs are especially important in determining the true value of a non-structural earthquake mitigation project.

Term	Definition
Mitigation	Measures taken to reduce or eliminate the risk of damages, economic losses, or casualties.
MMI Scale	**Modified Mercalli Intensity Scale** – A qualitative, descriptive scale that measures earthquake intensity.
Monetize	To express in terms of money; usually done to compare actions or results of actions that are not comparable in other terms.
MSC	**FEMA Map Service Center** – Provides flood hazard mapping information to the public at: http://www.msc.fema.gov/
Net Benefits	The total benefits of a mitigation project minus the total project costs.
Net Present Value	The benefits of a mitigation measure that are counted into the future (for the duration of the project useful life) and then discounted using an OMB-established discount rate.
Net Social Benefits	A term used to describe the kind of benefits that may be counted legitimately in Benefit Cost Analysis for federally funded projects.
NFIP	**National Flood Insurance Program** – A voluntary program created by Congress in 1968 and administered by FEMA to reduce the loss of life, property damage, and rising disaster relief costs due to flooding.
NGVD 1929	**National Geodetic Vertical Datum of 1929** – A national elevation datum used by the NFIP.
NOAA SPC	**National Oceanic and Atmospheric Administration Storm Prediction Center** – Monitors and forecasts severe and non-severe thunderstorms, tornadoes, and other hazardous weather phenomena across the contiguous United States.
Non-Recurring Event	A one-time hazard with no calculable recurrence interval.
Non-Structural Building Elements	Building or structure elements that will not cause the building or structure to collapse if the elements fail. These include exterior or interior elements, such as electrical, mechanical, plumbing systems, decorative features, and contents.
Non-Structural Flood Protection Measures	Administrative means of controlling flood damages, such as applying development regulations, enforcing building codes, land planning, property acquisition, building relocation, and minor modifications to existing buildings.
Non-Structural Seismic Hazard Mitigation Projects	Projects that improve, strengthen, or brace non-structural elements of a building or a structure to reduce damages, losses, and casualties during an earthquake. This includes retrofitting, bracing, or reinforcing the non-structural elements of a building or structure.
OMB Circular No. A-94	The OMB guidance document for Federal agencies that addresses cost effectiveness and Benefit-Cost Analysis.

Term	Definition
Ordinary Services	Services or functions that could be interrupted without resulting in significant life safety or economic impacts on a community.
PA	**FEMA Public Assistance** – Provides a source of funds for States and local governments to implement hazard mitigation measures after a major disaster declaration. The use of these funds is limited to public facilities that have been damaged by the declared disaster event. The PA Program is authorized under Section 406 of the Stafford Act.
Parapets	The vertical extension of a wall above a roof. Brick or masonry parapets are typically mounted along the tops of unreinforced masonry buildings. Parapets can provide a firebreak between adjacent buildings and ornamentation. They are heavy, brittle, and typically collapse near the centers of long walls or at corners.
Passive Mitigation Measures	Mitigation measures that require no human intervention to be effective and are usually more effective than active mitigation measures.
P-Delta Effect	Excess building or structure horizontal displacement during an earthquake that can bring the building out of plumb and allow the force of gravity to deform the building or structure further. The P-Delta Effect tends to increase structural damage.
PDM	**Pre-Disaster Mitigation –** FEMA grant program authorized by the Stafford Act and established in 1988. The purpose of this grant is to provide funding to help reduce the overall risk to the population and structures, while also reducing reliance on funding from actual disaster declarations. Cost share requirements are up to a 75-percent Federal, and a minimum 25-percent non-Federal match is required. Small, impoverished communities may be eligible for up to a 90-percent Federal cost share. PDM grants are awarded on a competitive basis nationwide.
PGA	**Peak Ground Acceleration** during an earthquake.
Ponding	Rainfall or snowmelt runoff that collects in natural ground depressions, creating a temporary pond.
Primary Effects	Ground motion due to seismic shaking and soil effects (settlement, displacement, or liquefaction).
Probability	The likelihood that an event will happen. In Benefit-Cost Analysis, probability is often expressed either as the annual percentage chance that an event will occur, or as the number of years required to "accumulate" a 100-percent chance of occurring.
Project Cost	The total cost of a mitigation project, including an applicant's share. These costs include such items as land or right-of-way acquisitions, construction and materials, design, testing, permits, project management, and equipment. In most Benefit-Cost Analysis, all future benefits are counted, so all project costs should be counted as well.

Term	Definition
Project Useful Life	The estimated amount of time (in years) that the mitigation action will be effective.
Proximity	The distance from the epicenter of the earthquake and nearby earthquake faults to a specific location. In general, the closer the location is to the epicenter, the greater the damage.
PVC	**Present Value Coefficient** – This combines the effect of the discount rate and the useful lifetime of a mitigation project to determine the net present value of benefits.
QWTP Model	**Quasi-Willingness to Pay Model** – The primary economic model used in determining the value of lost public function in Benefit-Cost Analysis. The model is based on the idea that the value of public functions can be approximated by what a community pays for the services.
Reconstruction	The construction of a new building on an old foundation or the slab of a building that was moved to a new location, destroyed, damaged, or demolished on its original site.
Recurrence Interval	The average or mean time in years between the expected occurrence of an event of specified intensity. See also return period.
Regulatory Floodway	The stream channel and that portion of the adjacent floodplain that must remain open (i.e., free of development) to allow conveyance of the 100-year flood. This is the same definition as **Floodway**.
Rehabilitation	An improvement to an existing building that does not affect the external dimensions.
Relevant Occupancy	The average occupancy of a potential fall area within a building during an earthquake. (This is not peak occupancy or the occupancy of the entire building.)
Relocation	A mitigation measure designed to physically move a building to a new location outside of an identified floodplain.
Relocation Costs	The costs incurred for moving to temporary quarters while the mitigation project is being implemented or constructed.
REO	**FEMA Regional Environmental Officer.**
Replacement Value	The cost to build or repair a building of a given size, type, and amenity, including both materials and labor. Several standard sources provide this information various handbooks, local building officials, among others.
Residual Risk	The expected future damages that remain after a mitigation project is in place. Some kinds of mitigation projects, such as elevation or floodproofing, do not eliminate all flood damages.
Retrofitting	Rehabilitation or reconstruction of an existing building to provide damage protection from natural hazards such as floods or earthquakes.

Term	Definition
Return Period	The average or mean time in years between the expected occurrences of an event of specified intensity. The mean recurrence interval.
RFC	**Repetitive Flood Claims** – A FEMA mitigation grant program authorized by the Flood Insurance Reform Act of 2004. The purpose of this grant program is to provide funding to help reduce flood damages to insured properties that have had one or more claims to the NFIP. FEMA may contribute up to 100 percent of the project cost for Applicants or subapplicants that cannot meet the FMA non-Federal share requirement. Up to $10 million is available annually for FEMA to assist communities nationwide.
Richter Scale	Charles Richter invented the original scale used to measure earthquake magnitude. The Richter Scale is a logarithmic scale, meaning that an increase of one unit of magnitude represents a 10-fold increase in wave amplitude on a seismogram, or approximately a 30-fold increase in the energy released from an earthquake.
Risk	The potential for damages, losses, and casualties arising from hazards. Risk results from the combination of hazard and exposure.
Riverine Flood	Flooding that occurs along a river, stream, or other non-coastal watercourses.
Secondary Effects	Additional (after primary) indirect earthquake effects that include landslides, tsunamis, fire, hazardous material incidents, and inundation.
Seismic Damage Functions	Defines the percentage of damage from an earthquake relative to the replacement value.
Seismic Hazard	The frequency and severity of damaging earthquakes.
Seismic Risk	The threat to the built environment, in the form of damage, economic losses, and casualties, caused by earthquakes.
Seismograph	Equipment used to measure the magnitude of an earthquake.
Severity	The relative strength of a negative event, such as a flood, hurricane, earthquake, or wildfire. There is nearly always a measure of severity associated with probability calculations.
SFHA	Special Flood Hazard Area. The base or 100-year floodplain shown on a FEMA FBFM, FHBM, or FIRM.
Shear Walls	Large structural walls that carry forces from floor and roof systems across the building and down to the foundation and the supporting soils. Shear walls are typically constructed of reinforced concrete, but may also be constructed of reinforced masonry or even wood framing. Braced frames consist of beams and columns with stiff diagonal braces that perform the same job as shear walls, but with less material.
Soft First Story	The lowest floor of a building containing large open spaces (for parking or interior storage) that are used to support one or more heavier upper floors.

Term	Definition
Soil Displacement	Lateral (horizontal) spreading of soil due to earthquake ground motion.
Soil Settlement	Vertical (downward) spreading of soil due to earthquake ground motion.
SPC	**National Oceanic and Atmospheric Administration Storm Prediction Center** – Monitors and forecasts severe and non-severe thunderstorms, tornadoes, and other hazardous weather phenomena across the contiguous United States. Same definition as NOAA SPC.
Spectral Acceleration	Earthquake-induced acceleration that, at specified frequencies or periods, accounts for energy dissipating (damping) characteristics of buildings.
SRL	**Severe Repetitive Loss** – A FEMA mitigation grant program authorized by the Flood Insurance Reform Act of 2004. The purpose of this grant program is to provide funding to help reduce or eliminate the long-term risk of flood damage to severe repetitive loss structures insured under the NFIP. Cost share requirements are up to a 75-percent Federal, and a minimum of 25-percent non-Federal match is required. A community with a strategy to reduce repetitive loss properties is eligible to receive an increased Federal cost share of up to 90 percent. Allocations are based on the number of SRL properties in each State or Territory. Ten percent is reserved for communities that receive little or no assistance under the allocation formula.
Stafford Act	This act established several of FEMA's programs, including the HMGP and PA Program. It also sets out requirements that projects funded with HMGP grants must be cost effective.
Storm Surge	An abnormal rise in sea level accompanying a hurricane or other intense storm, and whose height is the difference between the observed sea level and the level that would have occurred in the absence of the storm. Storm surge is usually estimated by subtracting the normal or astronomic high tide from the observed storm tide.
Storm Tide	The level of sea water resulting from the astronomic tide combined with the storm surge.
Structural Building Elements	Building or structure elements that act as a skeleton to support the rest of the building or structure. These include the foundation, load-bearing exterior and interior walls, beams, columns, floor systems, and roof systems. A failure of one or more structural elements may result in the collapse of the building or structure.
Structural Flood Control Measures	Projects that control floodwaters by construction of barriers (floodwalls or minor localized flood reduction projects), flood storage areas (minor localized flood reduction projects or detention and retention ponds), or channel improvements (widening, straightening, or stabilizing the banks).
Structural Seismic Hazard Mitigation Projects	Projects that improve, strengthen, or replace structural elements of a building or other structure to better resist earthquake forces. This includes retrofitting, bracing, or reinforcing the structural elements.

Term	Definition
Structure	A building with sides and a roof, but generally not occupied on a regular basis, with the exception of maintenance activities. An example is a stormwater pump house.
Substantial Damage	Damage, of any origin, sustained by a building that results in damage equal to 50 percent or more of the pre-damaged building value.
Substantial Improvements	Any improvement, new construction, rehabilitation, or addition that equals or exceeds 50 percent of the pre-improvement building value. This includes buildings that have been repaired after suffering substantial damage.
Tilt-Up Structure	A building or structure constructed with pre-cast concrete walls that are tilted up into place.
Unit Cost	Cost per unit of measurement, such as dollars per square foot.
Upper Bound Analysis	A Benefit-Cost Analysis screening technique that counts only the highest possible estimate of benefits associated with a proposed mitigation measure. This is generally used to indicate that a project is not cost effective.
V Zone	Flooding in coastal areas that are affected by wave heights greater than 3 feet. The 100-year floodplain subject to coastal high hazard flooding. This is mapped in the portion of a coastal floodplain subject to storm-driven velocity of 3 feet or more in height. There are three types of V Zones: V, V#, and VE, which correspond to the similar Zone A designations. Same definition as **Zone V**.
Value	The monetary worth of a physical element or a community function. This is one of the three components of risk.
VE Zone	**See Zone V.**
Vulnerability	The tendency of something to be damaged when it is affected by a natural hazard. This is one of the three components of risk.
Water Surface Elevation	The elevation, expressed in feet above sea level, of the surface of the water in flood events of various frequencies.
Wet Floodproofing	Modification of a building to allow short-duration, low-level floodwaters to enter the building in a way that minimizes damage to the building and its contents.
Wind-Damage Function (WDF)	The estimated building or contents damage, expressed as a percent of Building Replacement Value= or total contents value, for the range of storm classes from 0 to 5.
X Zone	Newer FIRMs contain shaded and unshaded Zone X floodplain areas. These designations replace the previous Zone B (shaded Zone X) and Zone C (unshaded Zone X). Same definition as **Zone X**.

Term	Definition
Zone A	The 100-year floodplains (except Zone V areas) shown on a community's FIRM. There are five types of Zone A areas: A: An approximate 100-year floodplain where no BFEs or 100-year flood elevations are provided. A#: Numbered Zone A areas (e.g., A7 or A14), where the FIRM shows a BFE in relation to the NGVD. AE: 100-year floodplain where BFEs are provided. Zone AE delineations are used on newer FIRMs instead of A# Zones. AO: 100-year floodplain with sheet flow, ponding, or shallow flooding. BFE depths (feet above grade) are provided on the FIRM.AH: 100-year floodplain with shallow flooding. BFEs in relation to NGVD are provided on the FIRM.
Zone A (Coastal)	Flooding in coastal areas that are affected by wave heights of 3 feet or less.
Zone B	Area of moderate flood hazard usually depicted on FIRMs as floodplain areas between the limits of the 100- and 500-year floods. Zone B areas are also used to designate base floodplains with modest hazard, such as those with average depths of less than 1 foot, or with drainage areas of less than 1 square mile.
Zone C	Area of minimal flood hazard usually depicted on FIRMs as areas above the 500-year flood level. Zones B and C may have flooding that does not meet the criteria to be mapped, and may include localized ponding or drainage problems.
Zone V	Flooding in coastal areas that are affected by wave heights greater than 3 feet. The 100-year floodplain subject to coastal high hazard flooding. This is mapped in the portion of a coastal floodplain subject to storm-driven velocity of 3 feet or more in height. There are three types of V Zones: V, V#, and VE, which correspond to the similar Zone A designations.
Zone X	Newer FIRMs contain shaded and unshaded Zone X floodplain areas. These designations replace the previous Zone B (shaded Zone X) and Zone C (unshaded Zone X).

SECTION ONE INTRODUCTION

1.1 PURPOSE

The Federal Emergency Management Agency (FEMA) Benefit-Cost Analysis (BCA) program, developed in the early 1990s, is used to determine the cost effectiveness of proposed mitigation projects for several FEMA mitigation grant programs. In 2008, FEMA collaborated with many Applicants and subapplicants on enhancements to update values in the software and to make it more efficient.

The purpose of the BCA Reference Guide is to provide BCA software users with an overview of the grant programs, application development, benefits and costs, and the location of BCA guidance documents and helpful information. This guide also outlines sources of additional information needed to use the software to obtain a Benefit-Cost Ratio (BCR) for a single project or multiple projects.

1.2 UNIFIED HAZARD MITIGATION ASSISTANCE

Hazard mitigation is any sustained action taken to reduce or eliminate long-term risk to people and property from natural hazards and their effects. This definition distinguishes actions that have a long-term impact from those that are more closely associated with immediate preparedness, response, and recovery activities. Hazard mitigation is the only phase of emergency management specifically dedicated to breaking the cycle of damage, reconstruction, and repeated damage. As such, States, Territories, Indian Tribal governments, and communities are encouraged to take advantage of the funding provided by Hazard Mitigation Assistance (HMA) programs in both the pre- and post-disaster periods.

The Department of Homeland Security (DHS) and FEMA HMA programs provide a critical opportunity to reduce the risk to individuals and property from natural hazards, while simultaneously reducing reliance on Federal disaster funds. HMA guidance provides continuity between five FEMA mitigation grant programs: the Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation (PDM), Flood Mitigation Assistance (FMA), Repetitive Flood Claims (RFC), and Severe Repetitive Loss (SRL) programs. Each HMA program was authorized by a separate legislative action, and as such, each program differs slightly in scope and intent, but all of them provide significant opportunities to reduce or eliminate potential losses to State, Tribal, and local assets.

HMGP may provide funds to States, Territories, Indian Tribal governments, local governments, and eligible private non-profits following a Presidential major disaster declaration. The PDM, FMA, RFC, and SRL programs may provide funds annually to States, Territories, Indian Tribal governments, and local governments. While the statutory origins of the programs differ, all share the common goal of reducing the risk of loss of life and property due to natural hazards.

Each of the grant programs unified under HMA is discussed in more detail below.

1.3 GRANT PROGRAMS SUMMARY

The **Hazard Mitigation Grant Program,** authorized by the Stafford Act, was established in 1988. The purpose of this grant program is to provide funding to significantly reduce or eliminate future risk to lives and property from natural hazards. A Presidential declaration of a major disaster triggers the availability of HMGP funds in every county within the affected State, instead of only those designated for Individual or Public Assistance. HMGP funds projects in accordance with priorities outlined in State and local mitigation plans. Cost share requirements state that HMGP funds may be used to pay up to 75 percent of the eligible project costs. Administered through the State, available funds are based on a sliding scale of the total Federal assistance for a disaster, excluding administrative costs:

- 15 percent for disasters up to $2 billion
- 10 percent for disasters from $2 billion to $10 billion
- 7.5 percent for disasters from $10 to $35.3 billion

The **Flood Mitigation Assistance Grant Program,** authorized by the National Flood Insurance Reform Act, was established in 1994. The purpose of this grant program is to provide funding to help reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insured under the National Flood Insurance Program (NFIP). The intent is to reduce project costs to the NFIP, with the savings passed on to the homeowner. Cost share requirements state that FMA funds may be used to pay up to 75 percent of the eligible project costs, with a minimum 25-percent, non-Federal match. Allocation to eligible subapplicants is based on the number of NFIP-insured properties and the number of repetitive-loss properties.

The **Pre-Disaster Mitigation Program** was created through the Disaster Mitigation Act of 2000 to provide mitigation funding not dependent on a disaster declaration. The genesis of PDM was an initiative of the Clinton administration called Project Impact: Building Disaster-Resistant Communities. Cost share requirements state that PDM funds may be used to pay up to 75 percent of the eligible project costs, with a minimum 25-percent, non-Federal match. Small, impoverished communities may be eligible for up to a 90-percent Federal cost share. PDM grants are awarded on a competitive nationwide basis.

The **Repetitive Flood Claims Program,** authorized by the Flood Insurance Reform Act of 2004, was established in 2006 with the purpose of providing funding to help reduce flood damages to insured properties that have had one or more claims to the NFIP. FEMA may contribute up to 100 percent of the project cost for Applicants or subapplicants that cannot meet the FMA non-Federal share requirement. Up to $10 million is available annually for FEMA to assist communities nationwide.

The **Severe Repetitive Loss Program,** authorized by Flood Insurance Reform Act of 2004, was established in 2008 with the purpose of provide funding to help reduce or eliminate the long-term risk of flood damage to severe repetitive loss structures insured under the NFIP. Cost share requirements state that SRL funds may be used to pay up to 75 percent of the eligible project costs, with a minimum 25-percent, non-Federal match. A community with a strategy to reduce repetitive loss properties is eligible to receive an increased Federal cost share of up to 90 percent. Allocations are based on the number of SRL properties in each State or Territory. Ten percent is reserved for communities that receive little or no assistance under the allocation formula.

For more information on FEMA's grants, visit www.fema.gov/government/grant/.

SECTION TWO GRANT APPLICATION DEVELOPMENT

Regardless of which grant program a subapplicant applies to, they must submit a complete grant application that reflects a project with a clear benefit. FEMA has developed procedures to assist Applicants and subapplicants applying for funding under FEMA's mitigation grant programs.

To be eligible to receive funding through FEMA's mitigation grant programs, the subapplicant must submit an application. The scope of work (SOW), work schedule or timeline, and budget for the project must be integrated. While each element is independent, they include many common data points. Both planning and project grant applications share the following four basic elements:

- Scope of Work
- Schedule
- Project Cost Estimate
- Cost Share Allocation

These application elements are required for all mitigation grant programs. However, in addition to the basic elements described above, the application/subapplication must also address:

- Decisionmaking Process
- Damage History
- Property Data
- Facility Data
- Engineering Feasibility
- Cost Effectiveness
- Environmental/Historic Preservation (EHP) Compliance

These elements are discussed in more detail on the following pages.

2.1 SCOPE OF WORK

The SOW is designed to answer the questions: who is applying for assistance, what is proposed, when will the project start and be completed, where will it take place, why is it important, and how will it be carried out? The SOW should provide specific details about the proposed project or plan, such as numbers of houses to be acquired, sizes and locations of components of drainage projects, and level of protection. It should be used as a framework for the development of the work schedule.

For planning projects, the planning process described in the SOW should stress the benefits of mitigation and mitigation planning to decisionmakers and citizens. Strategies for preparing the SOW include:

- Emphasize safety and economic benefit
- Include success stories
- Inform local officials that a plan is a requirement to get grant funding for projects

- Incorporate strategies to enlist support from Federal, State, Tribal, and local governments
- Identify steps to coordinate with other local planning initiatives

2.2 SCHEDULE

Every project needs a work schedule or timeline; and, this schedule or timeline must be included in a subapplicant's grant application. Without this information, the grant reviewers will not know how the subapplicant intends to delineate tasks on the project, which tasks rely on other tasks being completed, and whether all project elements are addressed. A schedule or timeline should:

- Divide the project into measureable tasks or milestones at 90-day intervals
- Include all task phases
- Provide a realistic timeline linked to the project activities outlined in the SOW and budget

Refer to specific program guidelines for details to finalize the work schedule or timeline. Remember, a task is measured by the duration—the time period between starting and ending—without specifying dates. Time periods may be days, weeks, months, or years. Keep in mind that the projected time needed to complete the project must not exceed the performance period, which begins when the grant is awarded.

The planning application work schedule or timeline should include time for:

- Solicitation of contractor bids
- Readiness or preparation activities to begin each task
- Review by the State/Tribal Emergency Management Agency and FEMA
- Plan adoption

2.3 PROJECT COST ESTIMATE

The project cost estimate or budget should outline the costs for the development of the overall plan or project, and should itemize specific costs by task. The cost estimate should include and clearly denote contractor and management costs. Keep in mind that the most expensive part of plan development is usually the risk assessment and hazard identification. Make sure that all costs are documented and that the cost estimate or budget meets the following criteria:

- Provides breakdowns of costs for the project (e.g., materials, labor, and fees corresponding to individual SOW activities)
- Identifies contractor costs
- Includes management costs
- Documents sources for estimated costs

A budget will also include:

- A detailed budget narrative

The budget **cannot** include:

- Hidden or contingency costs
- Post-implementation maintenance costs

- Lump sums
- Unreasonable costs or costs not necessary to accomplish the SOW

2.4 COST SHARE ALLOCATION

The mitigation grant programs can require a cost sharing element in which costs are divided between the Federal government and the Grantee. The standard maximum Federal share is 75 percent, while non-Federal shares must be at least 25 percent. Both cash and in-kind contributions can be considered for the non-Federal share. These non-Federal share contributions should be documented.

The documentation of cost share for the Application/subapplication should identify:

- Total project costs from the cost estimate
- Total Federal and non-Federal share amounts
- Sources, types, and values of the non-Federal share
- A letter from the jurisdiction committing to provide the local share

2.5 DECISIONMAKING PROCESS

An important portion of preparing an application is to justify the decisionmaking process that resulted in identification of the project proposed within the SOW. In other words, the SOW should help clarify the process for selecting the project. An outline of the decisionmaking process should include:

- A description of the process used to select this project as the best solution to the problem
- Alternatives that were considered
- References to relevant technical documentation

Each alternative for the project should be evaluated for:

- Eligibility
- Cost effectiveness
- EHP issues
- Engineering feasibility

2.6 DAMAGE HISTORY

An application must also contain information on the damage history at that project location. This information should clearly explain the purpose and need for the project. The damage history should include information such as:

- Damage figures and dates
- Details about the storm event

Sources of information for damage figures include:

- Insurance claims
- Map modernization data

- State Departments of Natural Resources
- State NFIP representatives
- U.S. Army Corps of Engineers (USACE)
- U.S. Geological Survey
- Water management agencies

2.7 PROPERTY DATA

A Property Site Inventory should be completed for each property included in the project. Record all relevant information that led the community to include each structure in the project, attaching at least three color photographs of the main structure from different angles. Collect specific data regarding the property and its damage history, including latitude and longitude for each structure, to assist FEMA with future tracking of mitigation projects.

Information to provide about the property to be mitigated by the project includes:

- Property owner
- Project location(s), including street names, block numbers, latitude and longitude
- Building/structure type, size, construction, and occupancy

Documentation of voluntary interest signed by each property owner must be submitted with the project subapplication. This documentation should be obtained as early in the project development process as is feasible. For acquisition/ relocation projects, participation by property owners is voluntary. The prospective participants must be informed in writing that participation in the program is voluntary, and that the subapplicant will not use its eminent domain authority to acquire their property for the project purposes should negotiations fail and the property owner choose not to participate.

Example Notices of Voluntary Interest are available at:

http://www.fema.gov/government/grant/resources/vol_notice1.shtm

http://www.fema.gov/government/grant/resources/vol_notice2.shtm

Additional information about the property, utilities, or systems should be collected, including:

- Replacement values
- Displacement costs
- Demolition threshold

And, for buildings that are used to provide public services:

- Loss of public services—the estimated dollar value per day for the loss of the public service
- Continuity premium—a multiplier on the ordinary value of services that applies to services critical to immediate disaster response and recovery

2.8 FACILITY DATA

When collecting information for a grant application, gather facility data to be used in the FEMA BCA Tool to determine the BCR. Important data that specifically applies to facilities includes:

- Customers served
- Facility or material type, such as size, length, location, and capacity
- Functional downtime estimates—the amount of time that the system is expected to be down, in days. If the service is not lost due to redundancy in the system, then there is no functional downtime.
- Loss-of-function impacts—economic impacts of loss of service are generally the largest category of benefits
- Loss of public services
- Physical damage estimate—the estimated average cost of damages based on historical data

This data will be used in the project's benefit-cost calculation. Other data needed for this calculation includes project useful life and project cost.

2.9 ENGINEERING FEASIBILITY

Engineering and design documentation support the project's feasibility review. Project type determines engineering data needs. All mitigation projects that involve construction require risk, project design, and past performance data.

Data required for the engineering review includes:

- Codes/regulations
- Engineering performance information
- Level of protection/impact
- Project-specific design
- Risk data

2.10 COST EFFECTIVENESS

BCA is the method by which the future benefits of a mitigation project are determined and compared to its cost. The end result is a BCR, which is derived from a project's total net benefits divided by its total project cost. The BCR is a numerical expression of the cost effectiveness of a project. A project is considered to be cost effective when the BCR is 1.0 or greater.

Although the preparation of a BCA is a technical process, FEMA has developed software, written materials, and training to simplify the effort. The FEMA BCA software provides a suite of tools to analyze each of the major natural hazards: earthquake, fire (wildland/urban interface fires), flood (riverine, Coastal A Zone, Coastal V Zone), hurricane wind, and tornado.

2.11 ENVIRONMENTAL/HISTORICAL PRESERVATION COMPLIANCE

The EHP review process for FEMA-funded projects and activities ensures that they are in compliance with Federal EHP laws and Executive Orders. It integrates EHP considerations into disaster planning, response, recovery, and mitigation. This process should be incorporated into all of FEMA's programs and activities, rather than treated as a separate process.

The unique nature of FEMA's activities in a disaster operation is based on the agency's responsibilities under Federal EHP laws. While many agencies have months or even years to plan federally funded activities, because of the nature and unpredictability of disasters, FEMA disaster assistance activities are often planned under extreme time constraints.

In coordination with other agencies, FEMA must act quickly after a disaster to identify and resolve EHP issues to facilitate the quick delivery of assistance to disaster victims and their communities.

Therefore, communities should start gathering their EHP documentation early in the project development process to ensure it is complete. Incomplete EHP documentation can result in a less competitive application, delay or denial of funding, or increased project costs.

For more information on EHP, visit http://www.fema.gov/plan/ehp/elearning/index.shtm.

SECTION THREE OVERVIEW OF BENEFITS AND COSTS

FEMA's BCA program is a key mechanism for evaluating certain hazard mitigation projects to determine eligibility and assist in Federal funding decisions. The FEMA BCA program is comprised of methodologies and software for a range of major natural hazards.

To be eligible for Federal funding assistance, a BCA should show that the project is cost effective and will reduce future damages and losses from natural disasters. Mitigation projects can include: construction projects, education programs, publications or videos, building code enhancements, and mitigation planning activities. A reduction in losses or prevention of future damages is the benefit of the project.

Cost, as it relates to mitigation, is the price to develop and maintain a mitigation project. The project cost estimate, as used in the FEMA mitigation grant guidance, includes all costs associated with the proposed mitigation project, and represents the best estimated costs for the activity. Estimates are required for the following cost item categories:

- Anticipated cash and in-kind Federal match
- Equipment
- Labor
- Materials
- Subcontract costs

Other costs are those that do not fall neatly into one of these categories, but must be delineated in the BCA if applicable to the project. The FEMA BCA tool utilizes a six-step cost-estimating methodology:

- Step 1: develop an estimate of pre-construction or non-construction costs
- Step 2: develop an estimate of construction costs
- Step 3: develop an estimate of ancillary costs
- Step 4: develop an estimate of annual maintenance costs
- Step 5: adjust the estimate to account for project timing and whether the data is current
- Step 6: review and confirm the cost estimate

FEMA has developed many tools and techniques to help subapplicants to use the FEMA BCA tool and to develop thorough grant applications.

3.1 BC HELPLINE

To assist users with the BCA program, FEMA has developed the BC Helpline. This resource, available on the Web or by a toll-free number, provides assistance to users of the program in developing complete and competitive project applications. Specifically, the Web site was created to:

- Answer questions about the re-engineering process
- Keep users informed about program updates and rollout schedules

- Provide resources for more information about BCA
- Receive feedback from existing users on enhanced features

The BC Helpline includes links to:

- BCA software and directions for download
- Frequently Asked Questions (FAQs)
- Resource Kit
- Training

The BC Helpline is available to anyone who requires technical assistance. Technical assistance for BCA questions can be obtained by contacting the FEMA BC Helpline toll-free at **866-222-3580,** via e-mail at **bchelpline@dhs.gov**, or through the Web site at: www.bchelpline.com. Responses to e-mail and phone calls are provided within 48 business hours. Questions about engineering feasibility or EHP can be e-mailed to the following Web-based Helplines:

- Engineering Feasibility Helpline: englhelpline@dhs.gov
- EHP Helpline: ehhelpline@dhs.gov

The BC Helpline cannot be used to perform BCAs, but the experts who answer calls or e-mails can respond to technical inquiries about the modules and the data requirements. The BC Helpline is intended to provide technical support for BCAs only; questions about FEMA and its policies should be directed to the appropriate FEMA Regional Office.

3.2 BCA SOFTWARE

BCA software is available to all grant Applicants for download via the BC Helpline and is available on a CD that can be requested through the Helpline.

3.2.1 System Requirements

To install the software, a user must have *full local administrative rights* to the computer on which the software will be installed, or have someone with adequate rights perform the installation. Minimum system requirements to run the BCA software include:

- 32-bit Processor [1-gigahertz (GHz) or faster processor recommended]
- Framework [NET ("dot NET") Framework 2.0]
- Operating System [Windows XP with Service Pack 2 or later]
- 512 megabytes (MB) of memory or more is recommended
- Approximately 600 MB of available hard-disk space for the recommended installation
- Super VGA (1,024x768) or higher-resolution video adapter and monitor
- Microsoft Internet Explorer 6.0 SP1 or later

- PDF reader such as Adobe Reader 7.0 or later
- An unzip utility

3.2.2 Downloading the Software

To download the BCA software, visit the BC Helpline, and then click the "Download Software" tab. A quick registration process is required before beginning the download process. If you have never downloaded the software version 4.0.0, click on the "installing for the first time" link. If you have downloaded this version before and want the latest software, download the "already successfully installed version 4.0.0" link. Make sure you have met all the system requirements and are logged on to the computer with full local administrator rights.

If you have trouble downloading the software, download the software troubleshooting guide (Trouble Shooting Guide) or visit the BC Helpline and select the "Software Troubleshooting Guide" link in the resources box to the right. This guide is updated to address frequent issues experienced by users.

3.2.3 Dynamic Help

FEMA wanted to ensure that you would be able to navigate the software and receive specific help when needed. Therefore, the software was created with dynamic help that allows you to select the help you need for that page and will display topics that are related to the page you are on in the software.

3.3 FREQUENTLY ASKED QUESTIONS

This section of the BC Helpline answers FAQs regarding the BCA software. It also explains changes to the software, as well as solutions to problems that are commonly experienced by users. The FAQ section can be accessed by clicking the tab labeled "FAQ" on the Helpline Web site.

3.4 RESOURCE KIT

FEMA provides several resources to enhance user understanding of BCA. These resources are available in the Resource Kit, which replaces the FEMA BCA Toolkit available with earlier versions of the software. The Resource Kit provides information on the BCA program and on the hazards addressed by FEMA grant programs. It can be accessed through the BC Helpline by selecting the "Resource Kit" tab.

3.4.1 Hazards

The following descriptions cover each hazard type and potential mitigation projects associated with each.

Damage Frequency Approach (DFA)

This module is applicable to any natural hazard as long as a relationship can be established between how often natural hazard events occur and how much damage and losses occur as a

result of the events. The advantage of the DFA module is its flexibility—it can be used for a wide range of hazards including flood, landslides, snow/ice storms, and earthquake mitigation for utility projects. The module requires historical damage data for two or more events and typically provides results that are less accurate than those from the Full Data BCA modules.

Earthquake

An earthquake is a sudden slipping or movement of a portion of the earth's crust, accompanied and followed by a series of vibrations. An earthquake's magnitude is measured by the amount of energy released. The Earthquake module is divided into two categories: structural and non-structural. Structural elements refer to the skeleton that supports the structure. Non-structural elements refer to everything else.

Possible projects include:

- Strengthening structural elements
  - Beams
  - Columns
- Installing tie-downs or reinforcement for non-structural elements
  - Awnings
  - Cantilevered roofs
  - Chimneys
  - Interior shelves
  - Parapet walls
  - Retrofit projects
  - Rooftop or other exterior water tanks or air-conditioning units

Flood

A flood is a partial or complete inundation of normally dry land areas from:

- Overland flow of a lake, river, stream, creek, slough, ditch, or the ocean
- The unusual and rapid accumulation of rainfall runoff or snowmelt
- Mudflows or the collapse of shoreline land

Floods are the most common and most costly of all natural disasters. In fact, most communities throughout the United States will experience some flooding. The Flood module utilizes Flood Insurance Study (FIS) data to establish risk, while providing the most accurate BCA results. This module takes into account probabilities of flooding; building type and associated damages; and the costs of contents, displacement, and loss of function.

Possible projects include:

- Acquisition/Demolition
- Acquisition/Relocation

- Elevation
- Mitigation reconstruction
- Dry floodproofing
- Minor localized flood reduction projects, including culverts, floodgates, minor floodwall systems, and stormwater management activities.

Hurricane

A hurricane is an intense tropical weather system of strong thunderstorms with a well-defined surface circulation and maximum sustained winds of 74 miles per hour or higher. Hurricanes are classified by their wind speeds into Categories 1 (being the weakest) through 5 (being the strongest).

The Hurricane Wind module takes into account probabilities of wind hazards; building type and associated damages; and the cost of contents, displacement, and loss of function.

Possible projects include:

- Acquisition (only in conjunction with another hazard)
- Installation of shutters/impact-resistant glazing
- Strengthening load path members and connections in the roof truss system and the building/foundation connection

Tornado

A tornado is a violent, rotating, funnel-shaped cloud that extends from a thunderstorm to the ground, with winds that can reach 300 miles per hour. A tornado is among the most destructive forces of nature. A tornado is classified by the Enhanced Fujita (EF) Scale, which not only correlates wind speeds with damage, but also takes into account the quality and type of structure that has been damaged to estimate wind speeds. The EF Scale is from EF0 (weakest) to EF5 (strongest).

The Tornado Safe Room module is used for projects providing safe room mitigation for high-wind events, and is used only to evaluate the life safety benefits of the mitigation project. Safe room projects are for tornadoes only.

Wildfire

The Wildland/Urban Interface (WUI) module takes into account LANDFIRE data, timber costs, fire suppression costs, and project effectiveness. WUI fires are essentially wildfires with additional fuel load from structures.

Possible projects include:

- Defensible Space Activities
  - Clearing out all combustibles
  - Minimizing the volume of vegetation
  - Replacing flammable vegetation with less-flammable species

- Hazardous Fuels Reduction Activities
  - Vegetation thinning or reduction of flammable vegetative materials for the protection of life and property
    - Slash removal
    - Vegetation clearing or thinning
    - Vegetation management
    - Vegetation removal
    - Vertical clearance of tree branches
- Ignition-Resistant Construction Activities
  - Involves the use of non-combustible materials and technologies on new and existing structures

FEMA will only consider a subapplication for an ignition-resistant construction project when the property owner has previously created defensible space and agreed to maintain the space, or the subapplication includes both the defensible space and ignition-resistant construction project as part of the same project subapplication.

3.4.2 Guidance Documents

Hazard-specific guidance documents are available through the BC Helpline in the Resource Kit. Other general guidance documents available through the BC Helpline include:

- Data Documentation Templates (DDTs) – Checklists tailored to the specific BCA modules that explain the required input values for the BCA modules, acceptable documentation, and potential credible sources. DDTs are provided in Appendix A.
- BCA Checklist – A list of the items needed before you sit down to enter information into the software, and the sources of this information. This checklist is provided in Appendix B.
- FEMA Standard Values – Pre-populated values used in the software once a particular field has been selected. A FEMA standard value is a suggested value that can be overridden if credible documentation is provided. FEMA standard values are located in Appendix C.
- Project Useful Life Table – A list of the standard useful life in years for different projects is provided in Appendix D.

Guidance documents for hazards include:

- Earthquake
  - Non-Structural Earthquake Mitigation Guidance Manual
- Flood
  - How to Read a Flood Insurance Rate Map (FIRM) tutorial
  - FIRMette Tutorial

  - FEMA Flood Insurance Study (FIS) Tutorial
  - Guidelines and Discount Rates for BCA (OMB Circular A-94) (PDF)
  - Guidelines and Discount Rates for BCA (OMB Circular A-94) (HTML)
- Wildfire
  - Wildland/Urban Interface Fire Guidance

3.4.3 Methodology Reports

FEMA's decision to re-engineer the existing BCA software was made to meet the technical needs of today's user and to address advances in hazard assessment methodology and FEMA policy. To accomplish these objectives, FEMA met with more than 300 users to gather data, feedback, and comments. This input has contributed to an integrated software package that provides present-day information and dynamic user guidance to a once complex process and has also resulted in a streamlined approach for meeting the FEMA cost-effectiveness requirements for hazard mitigation projects, including the ability to address multiple hazards in a single BCA module run. Based on the methodology for each hazard and the risk analysis process, the streamlined software will make it easier for users and evaluators to conduct and review BCAs and to address multiple hazards in a single BCA module run.

A methodology report is a mechanism used to capture user data, feedback, and comments and explains the reasoning and justifications for the calculations behind the BCA results. The methodology calculations vary for different hazards. These reports were provided to the FEMA Technical Advisory Group (TAG) to review and approve the recommended methodology for the re-engineering of the FEMA BCA Modules. The goals were to develop methodologies that are based on well-defined scientific and engineering principles, that accurately represent structural performances, and that simplify the analysis process for the average user. The intent of the BCA modules remains the same. The methodology report is part of a larger effort to re-engineer the FEMA BCA methods, modules, guidance, and training, in order to improve the BCA process.

Methodology reports were developed for the following modules, as well as for what was previously called the Limited Data module (now replaced by Damage Frequency Assessment), and are available on the BC Helpline site:

- Damage Frequency Assessment
- Earthquake
- Flood
- Hurricane Wind
- Tornado
- Wildfire

3.4.4 Policies

Additional guidance is available through hazard-specific FEMA polices. These policies can be found in the Resource Kit under the applicable hazard. Policy memos address a particular hazard and situation.

Flood Policies

- 2004 FEMA Policy – Guidance on the Eligibility of Generator Purchases under HMGP
- 2003 FEMA Policy – Pilot BCA Guidance for Repetitive Loss Properties
- 1997 FEMA Policy – 50/50 Cost Share for Planning
- 1996 FEMA Policy – Costs Included and Excluded from BCA
- 1996 FEMA Policy – Purchase of Structures in 100 EP
- 1996 FEMA Policy – 5% Initiative

Saferoom Policies

- FEMA 431: Tornado Protection – Selecting Refuge Areas in Buildings
- FEMA 361: Design and Construction Guidance for Community Shelters
- FEMA 320: Taking Shelter from the Storm
- 2009 FEMA Policy – Hazard Mitigation Assistance for Safe Rooms
- 1998 FEMA Policy – Use of HMGP in Tornado Safety

SECTION FOUR TRAINING SUPPORT

4.1 ONLINE TRAINING

FEMA provides many different sources of BCA training. BCA users are required to take the prerequisite training, "Introduction to the Benefit-Cost Analysis," on BCA prior to attending a classroom course either in the field or at the Emergency Management Institute (EMI). Advanced users are allowed to take the "Bridge Training" course to fulfill this requirement.

Both prerequisite courses can be found on the BC Helpline under the "Training" tab, or can be accessed directly through the links listed below.

The "Introduction to Benefit-Cost Analysis Training" course is for novice BCA users. This course can be accessed through this direct link: Introduction BCA Course.

The "Bridge Training" course is for experienced BCA users that conduct BCAs on a fairly regular basis or need a quick update on the changes to the Version 4.5 software. This course can be accessed through this direct link: Bridge Training Course.

A software demo is included in both courses. A hardcopy of this demo can be found in Appendix F of this document.

To access classes after _____, when they will be offered through EMI, go to the EMI homepage at http://training.fema.gov/. From that site, click on the Online Course Catalogue link and search for the desired course.

4.2 CLASSROOM TRAINING

To gain access to available classes, visit the BC Helpline, and select the "Training" tab. All available online training is listed on this site, as well as a schedule of available classes, their locations, the student manuals, and the BCA software.

Classroom trainings are generally 2 days, and are scheduled across the United States upon a request for training from the State/Region to FEMA. Individuals interested in training should contact the State Hazard Mitigation Office (SHMO) to find out about trainings within their State.

Student manuals are also available on the BC Helpline. To find the relevant BCA Training manual, select the "Training" tab, click on the appropriate student manual link to download.

Student Manuals are available for:

- BCA Course Introduction
- BCA Estimating Costs and Calculating Benefits
- BCA Tool Overview
- BCA Flood Hazard
- BCA Hurricane Wind Hazard
- BCA Earthquake Hazard
- BCA Tornado Hazard

- BCA Wildfire Hazard
- BCA Damage-Frequency Assessment Hazard
- Course Case Study, Exam, and Conclusion

4.3 SOFTWARE DEMONSTRATION

A video-based software demonstration is accessible through the BC Helpline, under the "Training" tab, and is offered in both the "Introduction to Benefit-Cost Analysis Training" and the "Bridge Training" courses. A slide version of the software demo can be found in Appendix F of this document.

APPENDIX A

Data Documentation Templates

Benefit-Cost Analysis (BCA) Data Documentation Template – Damage-Frequency Assessment

FEMA reviews Benefit-Cost Analyses (BCAs) for all proposed mitigation projects submitted under the FEMA grant programs to determine whether the information provided in the application is:

1. Credible and well-documented
2. Prepared in accordance with accepted FEMA BCA practices
3. Able to demonstrate that the project is cost-effective

The Damage Frequency Assessment can be used for any hazard for which frequency-damage relationships can be established from historical damage data and/or engineering judgment. The following template can be used to assist in the collection and entering of information to meet these requirements within the BCA Tool. One way to use this tool is to highlight or circle the source and use the last column to record the software input and justification for values that vary from the FEMA Standard Value (Default).

Obtained	Input	Documentation Summary	Potential Sources	Software Input/ Justification
☐	Name, address, county, and latitude/longitude for each project structure	Include contact information and whether building is historic.	Documents available from homeowner, local building inspector, local tax assessor's office, or title documents.	
☐	Project Information	Project Information includes: • Project Number • Analyst Name and Contact Information • Grant Program • Project Point of Contact (POC)	Information available from the project manager or POC.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/ Justification
☐	Scope of Work (SOW)	Should include: • Problem Description and Proposed Solution • Description of Existing Conditions • Work Schedule • Cost Estimate • Engineering schematics, detailed engineering drawings, or engineering designs • The proposed level of protection for the project (i.e., it will mitigate up to the 50-yr event)	The SOW is available from the project manager. The BCA Cost Estimation module will walk the user through costs that are valid for each project type.	
☐	Hazard Type	Refer to your project SOW to determine the hazard type. Choose from: Flood, Hurricane Wind, Earthquake, Tornado, Wildfire, or Other. Hazard type is found in the SOW.	The project manager or engineer can provide the SOW.	
☐	Mitigation Project Type and Description	Refer to your project SOW to determine the mitigation project type and to obtain the project description. Project types vary by hazard and can include: • **Flood**: Acquisition, Elevation, Relocation, Dry Flood Proofing, Drainage Improvement, Other Flood Proofing measures • **Hurricane Wind**: Acquisition, Shutters, Roof, Load Path • **Earthquake**: Strengthen Structure or Anchor/Brace Non-Structural • **Tornado**: New Safe Room or Retrofitting Existing Structure • **Wildfire**: Defensible Space Activities, Hazardous Fuels Reduction, Ignition Resistant Construction Activities, or Other	The project manager or engineer can provide the SOW. Engineering designs may provide this information.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/ Justification
☐	Cost Estimate	All anticipated project costs, including maintenance costs, should be detailed over the useful life of the project. Avoid the use of lump-sum costs. The Cost Estimate should include: • The estimate source and an itemized list of costs • The base year of all cost estimates and any changes to the anticipated construction date • Anticipated environmental resource remediation or historic property treatment measures • Other related construction/demolition/ relocation costs, such as survey permitting, site preparation, site maintenance, site assessment, legal costs and material disposal • Other acquisition costs, such as appraisals, legal recordation, displacement costs, and maintenance	Provide estimate from contractor or line-item cost estimate based on Standard Cost Estimating software or local similar historical costs in present day dollars. Source should be government representative or professional with relevant expertise.	
☐	Base Year of Costs	The year in which the mitigation project's cost was estimated. If cost estimates are several years old, the user can use the inflation calculator in the cost estimator to account for inflation in costs between the base year and the present. If cost figures are adjusted provide a description of methodology used in the justification tab of the cost estimator.	Information available from subapplicant. Analyst can escalate costs in the cost estimating portion of the BCA Tool.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/ Justification
☐	Project Useful Life (PUL)	The estimated amount of time (in years) that the mitigation action will be effective. The PUL is based on the type of mitigation.	Sources include the PUL table provided in the BCA Tool dynamic help; which provide the FEMA Standard Values. If the FEMA standard values are not used, additional documentation is required from the project manager, or the project engineer to justify the PUL.	
☐	Facility Type	Choose one or more facility types for loss of function: utilities, roads/bridges, non-residential buildings, or not applicable. Provide photocopies of tax records, hard copy or electronic photos, appraisals, or maps.	Data is available from assessor, owner, local tax appraiser or surveyor office, or title documents.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/ Justification
☐	Value of Services: Utilities	Enter the facility description, type of service, number of customers served and value per unit of service ($/person/day). Select electrical, water, wastewater, or other from the drop-down. If user chooses other, enter the description of the service. If a utility, enter the number of customers served by the utility. If other, enter the portion of the population that will be affected by the mitigation. Provide letters or technical studies from utilities that include engineering estimates or historic evidence of impact on service due to an event. FEMA Standard Values for Loss of Service for utilities: • Loss of electric power: $126/person/day • Loss of potable water: $88/person/day • Loss of wastewater: $41/person/day Any number outside of the FEMA Standard Values must be documented with a letter from the utility that would be affected.	Documentation is available from the agency providing the service. Local utility company data should indicate the number of affected customers. Determine the number of customer connections and then use census data to determine that average number of people at each location.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/ Justification
☐	Value of Services: Roads/Bridges	Enter the facility description, estimated number of one-way traffic trips per day, additional time per one-way trip due to the detour, number of additional miles, and the Federal mileage reimbursement rate for a private vehicle ($/mile). FEMA Standard Values for Loss of Service for roads: • Loss of road/bridge service: $38.15/vehicle/hour Mileage: Use current Federal Mileage Rate (http://www.gsa.gov/Portal/gsa/ep/contentView.do?contentId=17943&contentType=GSA_BASIC&queryYear=2008) Any number outside of the FEMA Standard Values must be documented with Department of Transportation (DOT) traffic studies or letter from utility or traffic departments. Maps indicating the location of road closure and the proposed detour route should be included.	This information is available from a professional engineer, planner, or county DOT manager with signature authority.	
☐	Non-Residential Buildings	Choose a facility type: fire station, hospital, police station, or other. For "other" buildings, enter the annual budget of public agencies, limited to the budget associated with building(s), and select the appropriate service name to provide the budget for that service.	Documentation is available from the agency providing the service or an agency's published annual report.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/ Justification
☐	Analysis Duration	Input the current analysis year and the year the utility, building, road, or bridge was built. This will provide a period of history for the historical losses. Provide documentation such as an appraisal or title. For structures less than 10 years old, input the minimum analysis duration of 10 years. For older structures for which flood damage/loss data or construction activities indicate a significant change in local flow conditions, the analysis can be assumed to begin on the date when the change first occurred. Therefore, the user would manually input the analysis duration in years. In this instance, required documentation includes a Flood Insurance Study or Hydrology and Hydraulics Study that accounts for the change in local flow conditions.	Documents available from homeowner, local building inspector, local tax assessor's office, or title documents. Documentation of changes in local flow conditions is available from a hydrologist or engineer.	
☐	Damages Before Mitigation	Enter the year of occurrence and number of days of a loss of function **before** the mitigation project is completed (i.e., a bridge was unusable for 5 days after a flood). If based on historical occurrence, provide written documentation from a credible source. If number of days of loss of function is derived or estimated, provide written explanation of the method used, including all assumptions. Click on the Icon to the left of "Damage Year" to see the field chooser. Update the fields to reflect information needed for documentation.	Documentation may be obtained from: • An official from a public utility, public works, or transportation department, technical report, or study. • The information may also be in mitigation project specifications or technical documents related to project development or in historical data from past events, i.e., insurance or repair records or photographs of damaged facilities, or FEMA Public Assistance documents for declared events	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/ Justification
		Enter the year of occurrence and a minimum of two hazard events of known frequency or three hazard damage events of unknown frequency that occur within the analysis period. The historical loss must have been a loss that the mitigation project would have mitigated. Columns can be added to reflect any damage category: avoided physical damages to structures and contents, infrastructure (bridges, roads, culverts, etc.), loss of function (displacement, loss of rental or business income), casualties, and avoided emergency management costs. Recommended documentation varies depending on how the data was obtained. Documentation should cite the date of the data, the source, and the author. Recommended documentation: • Frequencies or Reoccurrence Intervals (RIs) linked to documented Flood Insurance Study (FIS) data • U.S. Geological Survey (USGS) stream gauge data or National Oceanic and Atmospheric Administration (NOAA) tide gauge data • Insurance records (if used to assess how often events occurred) • Newspaper accounts citing credible sources, such as a public agency • Copies of engineering/technical expert reports • For peak ground acceleration and other	Historical occurrences can be documented by a letter from a local official, a copy of a newspaper account, or a copy of a technical study. Information may be obtained from: • National Weather Service; USGS; NOAA; or National Climactic Data Center • FEMA Project Worksheets/Damage Survey Reports • Insurance claims, BureauNet/Simple and Quick Assessment (SQA) Net information, damage repair records, or data from the State/local agency, local government Newspaper accounts citing credible sources (other than homeowner accounts)	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/ Justification
		seismic issues use the seismic module to determine the reoccurrence intervals and plug that number in to the chart. • Use Hurricane Wind module to determine Hurricane Wind reoccurrence intervals and plug that number in to the chart. Letter from subject matter expert who has independently calculated frequencies		
☐	Unknown Frequency Calculator	To use the unknown frequency calculator, provide documentation of: 1. A minimum of three hazard events that occur in different years where either: • Frequencies/RIs of all events are unknown, or • Frequencies/RIs of up to two events are known and have total inflated damage values that exceed the total inflated values of all the other unknown frequency/RI events. 2. Date of construction (needed for period of record).	Information may be obtained from: • National Weather Service, USGS, NOAA, or National Climactic Data Center • FEMA Project Worksheets/Damage Survey Reports • Insurance claims, BureauNet/SQA Net information, damage repair records, or data from the State/local agency, local government • Newspaper accounts citing credible sources (other than homeowner accounts)	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/ Justification
☐	After Mitigation: Loss of Function	Enter the calculated number of days of a loss of function **after** the mitigation project is completed (i.e., a bridge was unusable for 5 days after a flood). Except where a function (utility, road/bridge, and building) is completely eliminated, a post-project loss of function time should be entered in this part of the analysis. Documentation includes a letter from an official or a copy of a written technical study. If the number of days is derived or estimated provide a written explanation of the method used, including all assumptions.	Documentation may be obtained from: • An official from a public utility, public works, or transportation department • Technical report or study • Mitigation project specifications or technical documents related to project development.	
☐	Damages After Mitigation	Nearly all mitigation projects have some residual damages. Most projects will not completely eliminate damages after mitigation, but will reduce damages by a certain percentage or up to a certain design level event/RI (the level of protection).	This information is available in the SOW or from the project manager. Provide a written explanation of the method used, including all assumptions.	

Benefit-Cost Analysis (BCA) Data Documentation Template – Earthquake Structural

FEMA reviews Benefit-Cost Analyses (BCAs) for all proposed mitigation projects submitted under the FEMA grant programs to determine whether the information provided in the application is:

1. Credible and well-documented
2. Prepared in accordance with accepted FEMA BCA practices

3. Able to demonstrate that the project is cost-effective

The following template can be used to assist in the collection and entering of information to meet these requirements within the BCA Tool. One way to use this tool is to highlight or circle the source and use the last column to record the software input and justification for values that vary from the FEMA standard value (default).

Obtained	Input	Documentation Summary	Potential Sources	Software Input/ Justification
☐	Name, Address, County, and Latitude/Longitude for Each Project Structure	Include contact information and whether building is historic. Include latitude/longitude location for proper earthquake hazard data lookup.	Documents available from homeowner, local building inspector, local tax assessor's office, licensed surveyor, or title documents.	
☐	Project Information	Project Information includes: • Project Number • Analyst Name and Contact Information • Grant Program • Project Point of Contact (POC)	Information available from the project manager or POC.	
☐	Scope of Work (SOW)	Should include: • Problem Description and Proposed Solution • Description of Existing Condition • Work Schedule • Cost Estimate • Engineering schematics, detailed engineering drawings, or engineering designs	The SOW is available from the project manager. BCA Cost Estimation module will walk user through costs that are valid for each project type.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/ Justification
☐	Earthquake Mitigation Project Type	Refer to your project SOW to determine the type of mitigation project. Project types include structural retrofit of a building, anchor/brace non-structural elements of a building, or other.	The project manager or engineer can provide the SOW. Engineering designs can also be a source of this information.	
☐	Cost Estimate	All anticipated project costs should be detailed, including maintenance costs over the useful life of the project. Avoid the use of lump-sum costs. Cost estimate should include: • The source of the estimate and documentation supporting each source • The base year of all cost estimates and any deviations due to the anticipated date of construction • Anticipated environmental resource remediation or historic property treatment measures • Other related construction/demolition/relocation costs, such as survey permitting, site preparation, and material disposal • Other acquisition costs, such as appraisals, legal recordation, displacement costs for renters, and maintenance	Provide contractor or Standard Cost Estimating software estimates. Source should be government representative or professional with relevant expertise.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/ Justification
☐	Base Year of Costs	The year in which the mitigation project's cost was estimated. If cost estimates are several years old, they may need to be adjusted by the user to account for inflation in costs between the base year and the present. If cost figures are adjusted provide a description of methodology utilized.	Information available from subapplicant. Analyst can escalate costs in the cost estimating portion of the BCA Tool.	
☐	Project Useful Life (PUL)	The estimated amount of time (in years) that the mitigation action will be effective. The PUL is based on the type of mitigation.	Sources include the PUL table provided in the BCA Tool dynamic help, which provides the FEMA Standard Values. If the FEMA standard values are not used, additional documentation is required from the project manager or the project engineer to justify the PUL.	
☐	Facility Type	Choose one or more facility types for loss of service: fire station, hospital, police station, or other. Provide photocopies of tax records, hard copy or electronic photos, appraisals, or maps.	Data is available from assessor; owner; local tax, appraiser, or surveyor office; or title documents.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/ Justification
		Loss of Services facility types include: fire station, hospital, police station, and other. The fire station facility type includes fire fighting, search and rescue, public shelter, and Emergency Medical Services, if they are located in the same facility. The hospital facility type includes in-patient hospitals and emergency rooms. Other medical facilities, such as nursing homes, are included in the "other" facility type. Necessary documentation for Loss of Service Facility Type is determined by the Facility Type selected, however, it may include information to support the following data: • The number of people served by the facility • The type of area served by a fire station or a police station • The distance (in miles) between the facility type and alternate facility • The number of police officers working a particular facility • The number of police officers that would serve the area if a police station was shut down	Information regarding the number of people served by a facility (or by alternate hospitals) can be obtained from the municipality, facility operations managers, or documents such as annual reports. Information regarding the distance (in miles) between the facility and alternate facility can be obtained from facility operations managers or municipal officials. Local maps or GPS software can be used as documentation of the distance. Information regarding the number of police officers can be obtained from the municipality, facility operations managers, or documents such as annual reports. Information regarding the number of police officers that would serve the area if a police station were shut down can be obtained from municipal officials or facility operations managers who can provide the appropriate number on official letterhead. Many police stations have emergency plans that outline the number of critical staff needed to serve the area should a police station shut down.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/ Justification
☐	"Other" Facility Type: Service Name	A structure may provide multiple services. For example, a municipal building may house a government agency and a library. You may enter additional rows and select all that apply from the drop-down menu. Government – local, municipal, State, Federal, or Indian Tribal government agencies Library – Public information depository Education – Primary, secondary, college, university, or trade school, public or private Once the Service Type is selected, you must enter the annual operating budget of the agency providing the Service.	Information regarding the annual operating budget can be obtained from the agency providing the service or it can be obtained from an annual report. If an agency has multiple facilities, enter only the portion of the budget that pertains to the location of the proposed mitigation.	
☐	Soil Type	Select from drop-down menu of soil types. Selection ranges from soil type A to soil type F. Provide documentation such as soil type data from engineering design documents and engineering geology (geotechnical) reports.	Documentation is available from the project engineer or geotechnical engineers.	
☐	Ground Motion Values	Measures associated with the probability and severity of earthquakes at the site. FEMA ground motion values are based on the correct entry of the latitude/longitude location of the structure.	Hazard data is available from the U.S. Geological Survey (USGS).	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/ Justification
☐	Total Building Area	Expressed in square feet. This includes the total heated, enclosed area in the building. Used in conjunction with displacement costs.	Documents available from local tax office, appraiser's office, surveyor, or documents showing building footprint.	
☐	Building Replacement Value (BRV)	Enter total cost to build a comparable structure. Acceptable forms of documentation include a letter from a construction company, contracting firm, or local building inspector; photocopies of pages from standard cost reference manuals; or tax records.	Sources can include a local building inspector, construction company, architect, building engineer, or standard cost estimating software. If tax records are used, the source must be an assessor.	
☐	Number of Occupants	Average number of occupants on 24/7/365 basis. Can be based on employment or attendance records.	Documentation is available from the building owner or manager.	
☐	Building Use	Select the primary use of the building from the drop-down menu. Building use may be retail, bank, agricultural, parking, academia, residential dwelling, church, etc.	Information is available from owner, local building inspector, local tax assessor's office, or title documents.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/ Justification
☐	Percentage of BRV Allocated to Direct Physical Damage Categories	Percentage of BRV is listed by the three direct physical damage categories: • Structural Drift-Sensitive (STR) • Non-Structural Element Sensitive to Drift (NSD) • Non-Structural Elements Sensitive to Acceleration (NSA) No documentation is required if the FEMA standard value used. Values other than FEMA standard values must be documented and the basis of the estimate must be clear.	Sources can include consultation with a real estate appraiser, economist, local building inspector, contractor, builder or construction company, architect or building engineer, or planner.	
☐	Displacement Costs	Costs of occupants displaced to temporary quarters while damage is repaired. Includes rent and other monthly costs, such as furniture rental and utilities, and one-time costs, such as moving and utility hook-up fees. Possible documentation if the default value is overwritten includes: copies of advertisements for local rentals in the community, records of phone contacts with rental agencies, and receipts from similar rentals.	Sources include local community advertisements, rental agencies, and similar rental receipts. Extra commuting costs and day care may be estimated as long as the estimation methodology is explained.	
☐	Loss of Rent	Loss of rent is for rental properties ***only*** and does not include one-time costs.	Provide receipts for rent payments or owner's records as documentation.	
☐	Loss of Business Income	Enter lost business income for non-public service facilities.	Provide financial statements from business owner.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/ Justification
☐	Model Building Type and Number of Stories	Select building type from drop-down menu.	Building type and number of stories should be based on design drawings prepared by architect or building engineer. They should able be determined by a registered professional (civil or structural) engineer.	
☐	Design Level	Design levels are descriptors used in the Hazards U.S. Multi-Hazard (HAZUS-MH) risk assessment tool to classify the degree of seismic resistance of a structural system. Design levels include high code, moderate code, low code, or pre-code.	Design level should be based on building design information prepared by a registered professional (civil or structural) engineer. Additional guidance is available in the documentation for the HAZUS-MH risk assessment tool.	
☐	Capacity Parameters	Capacity parameters (i.e., design strength, elastic period, elastic damping, damage thresholds, etc.) are initially set based on the building type, number of stories, and the design level. Note: These initial capacity parameters will need to be modified based on the actual characteristics of the structure.	Capacity parameters, such as the design strength, elastic period, and elastic damping, should be modified based on the recommendation of a professional (civil or structural) engineer with seismic design experience.	

Benefit-Cost Analysis (BCA) Data Documentation Template – Earthquake Non-Structural

FEMA reviews Benefit-Cost Analyses (BCAs) for all proposed mitigation projects submitted under the FEMA grant programs to determine whether the information provided in the application is:

1. Credible and well-documented
2. Prepared in accordance with accepted FEMA BCA practices
3. Able to demonstrate that the project is cost-effective

The following template can be used to assist in the collection and entering of information to meet these requirements within the BCA Tool. One way to use this tool is to highlight or circle the source and use the last column to record the software input and justification for values that vary from the FEMA standard value (default).

Obtained	Input	Documentation Summary	Potential Sources	Software Input/ Justification
☐	Name, Address, County, and Latitude/Longitude for Each Project Structure	Include contact information and whether building is historic. Include latitude/longitude location for proper earthquake hazard data lookup.	Documents available from homeowner, local building inspector, local tax assessor's office, licensed surveyor, or title documents.	
☐	Project Information	Project Information includes: • Project Number • Analyst Name and Contact Information • Grant Program • Project Point of Contact (POC)	Information available from the project manager or POC.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/ Justification
☐	Scope of Work (SOW)	Should include: • Problem Description and Proposed Solution • Description of Existing Condition • Work Schedule • Cost Estimate • Engineering schematics, detailed engineering drawings, or engineering designs	The SOW is available from the project manager. BCA Cost Estimation module will walk user through costs that are valid for each project type.	
☐	Earthquake Mitigation Project Type	Refer to your project SOW to determine the type of mitigation project. Project types include structural retrofit of a building, anchor/brace non-structural elements of a building, or other.	The project manager or engineer can provide the SOW. Engineering designs can also be a source of this information.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/ Justification
☐	Cost Estimate	All anticipated project costs should be detailed, including maintenance costs over the useful life of the project. Avoid the use of lump-sum costs. Cost estimate should include: • The source of the estimate and documentation supporting each source • The base year of all cost estimates and any deviations due to the anticipated date of construction • Anticipated environmental resource remediation or historic property treatment measures • Other related construction/demolition/relocation costs, such as survey permitting, site preparation, and material disposal • Other acquisition costs, such as appraisals, legal recordation, displacement costs for renters, and maintenance	Provide contractor or Standard Cost Estimating software estimates. Source should be government representative or professional with relevant expertise.	
☐	Base Year of Costs	The year in which the mitigation project's cost was estimated. If cost estimates are several years old, they may need to be adjusted by the user to account for inflation in costs between the base year and the present. If cost figures are adjusted provide a description of methodology utilized.	Information available from subapplicant. Analyst can escalate costs in the cost estimating portion of the BCA Tool.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/ Justification
☐	Project Useful Life (PUL)	The estimated amount of time (in years) that the mitigation action will be effective. The PUL is based on the type of mitigation.	Sources include the PUL table provided in the BCA Tool dynamic help, which provides the FEMA Standard Values. If the FEMA standard values are not used, additional documentation is required from the project manager or the project engineer to justify the PUL.	
☐	Soil Type	Select from drop-down menu of soil types. Selection ranges from soil type A to soil type F. Provide documentation such as soil type data from engineering design documents and engineering geology (geotechnical) reports.	Documentation is available from the project engineer or geotechnical engineers.	
☐	Ground Motion Values	Measures associated with the probability and severity of earthquakes at the site. FEMA ground motion values are based on the correct entry of the latitude/longitude location of the structure.	Hazard data is available from the U.S. Geological Survey (USGS).	
☐	Non-Structural Element for Mitigation	Choose the non-structural element proposed for mitigation: ceilings (suspended or dropped), electrical cabinets, elevators, fire sprinklers, generators, generic contents and equipment, HVAC ductwork, HVAC fans on isolators, parapet walls and chimneys, and racks and shelves. If applicable, Indicate how the non-structural element is weighted, supported, or anchored before and after mitigation.	Documentation is available from a civil or structural engineer, local building inspector, contractor, builder or construction company, architect or building engineer, or planner.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/ Justification
☐	Damage State Information	Percent damage associated with a particular damage state (i.e., moderate and extensive) If FEMA default values are not used, provide detailed descriptions of how the value was determined.	Obtain damage state percentages differing from FEMA default values from credible sources such as civil or structural engineers and building officials familiar with damage to non-structural elements in earthquakes.	
☐	Additional Days of Functional Downtime	If FEMA default values are not used, provide detailed descriptions of the means by which the downtime value was assessed. The appropriate functional downtime for non-structural projects is only the additional functional downtime cause by failure of the non-structural items. In most cases, this downtime will be a small number because the non-structural items can be repaired or replaced while other repairs are being made.	Obtain functional downtime estimates differing from FEMA default values from credible sources such as civil or structural engineers and building officials familiar with loss of function of facilities caused by damage to non-structural elements in earthquakes.	
☐	Item Replacement Value	Replacement cost for non-structural items that is used to estimate physical damage. Expressed in terms of a unit price (i.e., $/foot, $/each) and the number of units (i.e., linear feet, area)	Documentation is available from a civil or structural engineer, local building officials, contractors, suppliers, architect or building engineer, or planner.	
☐	Fall Impact Area	Expressed in square feet. This is the area upon which a non-structural element may fall as a result of an earthquake. It is used in conjunction with the total building area and occupancy data to estimate casualties.	Documentation is available from a civil or structural engineer, local building inspector, contractor, builder or construction company, architect or building engineer, or planner.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/ Justification
☐	Total Building Area	Expressed in square feet. This includes the total heated, enclosed area in the building. Used in conjunction with occupancy data.	Documents available from local tax office, appraiser's office, surveyor, or documents showing building footprint.	
☐	Occupancy Data	The total building occupancy is the number of persons (residents, employees, and visitors) present in the building during the day, evening, and night for weekdays and weekends.	Documentation is available from the building owner or manager or can be based on employment or attendance records	
☐	Casualty Rates	Number of minor injuries, major injuries, and deaths per 1,000 occupants. If FEMA default values are not used, provide detailed descriptions of casualty rates and the means by which these values were derived.	Obtain casualty rates differing from FEMA default values from credible sources such as civil or structural engineers and building officials familiar with casualties resulting from damage to non-structural elements in earthquakes.	
☐	Secondary Damages Before and After Mitigation	Secondary damages are quantified damages that must be associated with a seismic intensity level Secondary damages may include additional damages resulting from non-structural element failure, such as fire damage and hazardous material spills.	Documentation must be from a credible source that considers the probability that secondary damage will occur as a result of a non-structural element failure. For example, a shelf supporting chemical containers may fall and cause a chemical spill. Another example is damage to an electrical cabinet that causes a fire. Sources may Include documented historic damage and engineering analyses.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/ Justification
☐	Facility Type – Loss of Services	Choose one or more facility types for loss of service: fire station, hospital, police station, or other. Provide photocopies of tax records, hard copy or electronic photos, appraisals, or maps. Loss of Services facility types include: fire station, hospital, police station, and other. The fire station facility type includes fire fighting, search and rescue, public shelter, and Emergency Medical Services, if they are located in the same facility. The hospital facility type includes in-patient hospitals and emergency rooms. Other medical facilities, such as nursing homes, are included in the "other" facility type. Necessary documentation for Loss of Service Facility Type is determined by the Facility Type selected, however, it may include information to support the following data: • The number of people served by the facility • The type of area served by a fire station or a police station • The distance (in miles) between the facility type and alternate facility • The number of police officers working a particular facility • The number of police officers that would serve the area if a police station was shut down	Data is available from assessor; owner; local tax, appraiser, or surveyor office; or title documents. Information regarding the number of people served by a facility (or by alternate hospitals) can be obtained from the municipality, facility operations managers, or documents such as annual reports. Information regarding the distance (in miles) between the facility and alternate facility can be obtained from facility operations managers or municipal officials. Local maps or GPS software can be used as documentation of the distance. Information regarding the number of police officers can be obtained from the municipality, facility operations managers, or documents such as annual reports. Information regarding the number of police officers that would serve the area if a police station were shut down can be obtained from municipal officials or facility operations managers who can provide the appropriate number on official letterhead. Many police stations have emergency plans that outline the number of critical staff needed to serve the area should a police station shut down.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/ Justification
☐	"Other" Facility Type: Service Name	A structure may provide multiple services. For example, a municipal building may house a government agency and a library. You may enter additional rows and select all that apply from the drop-down menu. Government – Local, municipal, State, Federal, or Indian Tribal government agencies Library – Public information depository Education – Primary, secondary, college, university, or trade school, public or private Once the Service Type is selected, you must enter the annual operating budget of the agency providing the Service.	Information regarding the annual operating budget can be obtained from the agency providing the service or it can be obtained from an annual report. If an agency has multiple facilities, enter only the portion of the budget that pertains to the location of the proposed mitigation.	

Benefit-Cost Analysis (BCA) Data Documentation Template – Flood

FEMA reviews Benefit-Cost Analyses (BCAs) for all proposed mitigation projects submitted under the FEMA grant programs to determine whether the information provided in the application is:

1. Credible and well-documented
2. Prepared in accordance with accepted FEMA BCA practices
3. Able to demonstrate that the project is cost-effective

The following template can be used to assist in the collection and entering of information to meet these requirements within the BCA Tool. One way to use this tool is to highlight or circle the source and use the last column to record the software input and justification for values that vary from the FEMA Standard Values.

Obtained	Input	Documentation Summary	Potential Sources	Software Input/Justification
☐	Name, address, county, and latitude/longitude for each project structure	Include contact information and whether building is historic.	Documents available from homeowner, local building inspector, local tax assessor's office, or title documents.	
☐	Project Information	Project Information includes: • Project Number • Analyst Name and Contact Information • Grant Program • Project Point of Contact (POC)	Information available from the project manager or POC.	
☐	Flood Mitigation Project Type	Refer to your project SOW to determine the type of mitigation project. Project types include acquisition, elevation, flood proofing/temporary flood barrier, drainage improvement, or other.	The project manager or engineer can provide the SOW. Engineering designs may also provide this information.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/Justification
☐	Scope of Work (SOW) (required) Upload the SOW to documents within the software.	Should include: • Problem Description and Proposed Solution • Description of Existing Conditions • Work Schedule • Cost Estimate • Engineering schematics, detailed engineering drawings, or engineering designs	The SOW is available from the project manager. The BCA Cost Estimation module will walk the user through costs that are valid for each project type.	
☐	Project Useful Life (PUL)	The estimated amount of time (in years) that the mitigation action will be effective. The PUL is based on the type of mitigation.	Sources include the PUL table provided in the dynamic help, the project manager, or the project engineer.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/Justification
☐	Cost Estimate	All anticipated project costs, including maintenance costs, should be detailed over the useful life of the project. Avoid the use of lump-sum costs. The Cost Estimate should include: • The source of the estimate and supporting documentation • The base year of all cost estimates and any deviations due to the anticipated date of construction • Anticipated environmental resource remediation or historic property treatment measures • Other related construction/demolition/relocation costs, such as survey permitting, site preparation, and material disposal • Other acquisition costs, such as appraisals, legal recordation, displacement costs for renters, or maintenance	Provide contractor or Standard Cost Estimating software estimates. Source should be government representative or professional with relevant expertise.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/Justification
☐	Flood Insurance Study (FIS) or Hydrology and Hydraulics (H&H) Study Data	Indicate the source of flooding as either riverine or coastal. The 10-, 50-, 100- and 500-year flood events must be input for each source of flooding. Specific locations for hazard-specific FIS data by flooding source: • Riverine: Summary of Discharge Table and Flood Profiles (Streambed Elevation is found in profile) • Coastal A or V: Summary of Stillwater Elevations Table, Transect Location Map, and Transect Data Tables Include a copy of FIS or H&H study marked up with project location, FIRM title block, and map scale in each project application.	FIS reports can be obtained from the FEMA Flood Map Service Center at http://store.msc.fema.gov. If the source of hazard information is not an FIS, include the agency name, report title, date, and name of the watercourse (from the report cover) OR engineer/ hydrologist name, registration number, date, and methodology used.	
☐	Special Flood Hazard Area (SFHA)	Show whether the project is located in the area that would be flooded by the "base flood" (1-percent-annual-chance or 100-year flood) and is at a high risk for flood damage. SFHAs are indicated in the grey areas on the Flood Insurance Rate Map (FIRM).	FIRMs can be obtained from the FEMA Flood Map Service Center at http://store.msc.fema.gov. Smaller versions of FIRMs, or FIRMettes, are also available at no extra cost.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/Justification
☐	FIS, FIRM, and H&H – Effective Dates, Panel, and Community ID Numbers	The FIS effective date is on the front of an FIS report. The FIRM effective date, panel, and Community ID numbers are in the FIRM title block in the lower right portion of a FIRM. If an H&H is used, enter the study title and the effective date.	See above entry.	
☐	Elevation of the top of the lowest floor Riverine or Coastal A: First Floor Elevation (FFE) Coastal V: Elevation of the lowest horizontal structural member	Depending on the source of flooding, the elevation of the top of the lowest finished floor in a building is described differently. However, the source of this information is the same: a FEMA Elevation Certificate signed by a licensed engineer or surveyor indicating the FFE or lowest horizontal structural member.	Obtain from licensed engineer or surveyor or municipal building department. Elevation certificate form is available at the FEMA Web site at http://www.fema.gov/pdf/nfip/elvcert.pdf.	
☐	Size of Building	The total enclosed square footage of the building. Acceptable forms of documentation include appraisals, tax records, survey, homeowner estimates, or measured drawings accompanied by photographs.	Data is available from assessor, owner, local tax office or appraiser's office, surveyor, or title documents with building footprint.	
☐	Building Replacement Value (BRV)	Enter cost per square foot to build a comparable structure. Acceptable forms of documentation include a letter from a construction company, contracting firm, or local building inspector; photocopies of pages from standard cost reference manuals; or tax records.	Sources can include a local building inspector, construction company, architect, building engineer, or standard cost estimating software. If tax records are used, the source must be an assessor.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/Justification
☐	Demolition Damage Threshold	The demolition damage threshold is the percentage of building damage at which demolition and replacement (rather than repair) would be the economically efficient choice. The FEMA Standard Value for the Demolition Damage Threshold is 50 percent. Documentation is required for value other than 50%.	Sources may include a local ordinance that documents a building is considered substantially damaged below the 50 percent threshold defined by the NFIP.	
☐	Residential Buildings Input Categories: • Building/foundation type • Number of stories • If there is a basement • Coastal V: with or without obstruction	Building and foundation types are a major determinant of anticipated damage from floods. Building types include one-story, two or more stories, split level, mobile home, or other buildings. Foundation types include slab, pier, or pile. Acceptable forms of documentation include photocopies of tax records, hard copy or electronic photos, appraisals, and letters from homeowners. In Coastal V areas you must determine whether the waves are with or without obstruction.	Information is available from the homeowner, local building inspector, local tax assessor's office, or title documents.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/Justification
☐	Non-Residential Buildings Input Categories: • Type of structure • Primary use of building	Determine whether the structure is engineered or pre-engineered. Building uses may be retail, hotel, fast food, non-fast food, hospital, medical office, protective services, correctional facility, recreation, religious facilities, schools, service station, office, convenience store, grocery store, apartment, industrial, or warehouse. If not using the default value for the primary use of building, documentation must be provided.	Information is available from owner, local building inspector, local tax assessor's office, or title documents.	
☐	Building Contents Value	**FEMA Standard Value (default):** • Residential Buildings: Varies between 50-100 percent depending on the Depth Damage Function • Non-Residential Buildings: Varies based on the primary use of the building Provide detailed descriptions of contents, their value, and the means by which the value was assessed for all non-residential buildings and if default value is not used for residential buildings.	Review insurance records, appraisals, purchase receipts, or estimates based on current market prices for similar contents. Contents do not include items that are permanent parts of the building, such as electrical and plumbing systems.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/Justification
☐	Displacement Costs	Costs of occupants displaced to temporary quarters while damage is repaired. Includes rent and other monthly costs, such as furniture rental and utilities, and one-time costs, such as moving and utility hook-up fees. **FEMA Standard Value for Residential (default):** $1.44 per square foot per month; one-time costs is $500. Possible documentation if the default value is overwritten includes: copies of advertisements for local rentals in the community, records of phone contacts with rental agencies, and receipts from similar rentals.	Local community advertisements, rental agencies, and similar rental receipts. Extra commuting costs and day care may be estimated as long as the estimation methodology is explained.	
☐	Loss of Rent	Loss of Rent is for rental properties ***only*** and does not include one-time costs.	Provide receipts for rent payments or owner's records as documentation.	
☐	Value of Contents of Crawlspace	Enter the value of contents stored between the ground and the underside of the lowest flood structural component. The value of contents of crawlspace only applies to structures with pier foundation types. An itemized list of contents in the crawlspace must be provided.	Data is available from owner.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/Justification
☐	Non-Residential: Loss of Service	Critical facility types include fire station, hospital, police station, and other. The fire station facility type includes fire fighting, search and rescue, public shelter, and Emergency Medical Services, if they are located in the same facility. The hospital facility type includes in-patient hospitals and emergency rooms. Other medical facilities, such as nursing homes, are included in the "other" facility type. Necessary documentation for Critical Facility Type is determined by the Facility Type selected, however it may include information to support the following data: • Number of people served by the critical facility • Type of area served by a fire or police station • Distance (in miles) between the critical facility and alternate facility • Number of police officers working a particular facility Number of police officers that would serve the area if a police station was shut down	Information regarding the number of people served by a critical facility (or by alternate hospitals) can be obtained from the municipality, facility operations managers, or documents such as annual reports. Information regarding the distance (in miles) between the critical facility and alternate facility can be obtained from facility operations managers or municipal officials. Local maps or GPS software can be used as documentation of the distance. The number of police officers can be obtained from the municipality, facility operations managers, or documents such as annual reports. Information regarding the number of police officers that would serve the area if a police station were shut down can be obtained from municipal officials or facility operations managers who can provide the appropriate number on official letterhead. Many police stations have emergency plans that outline the number of critical staff needed to serve the area should a police station shut down.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/Justification
☐	Non-Residential: Service Type Provided by Facility	A structure may provide multiple services. For example, a municipal building may house a government agency and a library. You may enter additional rows and select all that apply from the drop-down menu. • Government – local, municipal, State, Federal, or Indian Tribal government agencies • Library – Public information depository • Education – Primary, secondary, college, university, or trade school, public or private • Medical – Out-patient medical facility, rehabilitation center, or nursing home • EMS – Emergency Medical Service not co-located with a fire station or hospital • Shelter – Facility designed to provide safe, temporary housing during a hazard • EOC – Emergency Operations Center Once the Service Type is selected, you must enter the annual operating budget of the agency providing the Service	Information regarding the annual operating budget can be obtained from the agency providing the service or it can be obtained from an annual report. If an agency has multiple facilities, enter only the portion of the budget that pertains to the location of the proposed mitigation.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/Justification
☐	Building Depth-Damage Function (DDF)	**FEMA Standard Value (default):** Determined based on answers to the software questionnaire (foundation type, number of stories, basement, etc.). Users can choose between the default, a library of tables, or create a custom DDF table. If the default value is not used, provide complete documentation to support user-entered values.	Historical loss records or engineering judgment.	
☐	Other Damages/Losses Avoided	Can include damages/losses such as debris removal, emergency management costs, or disruption of life. Documentation must be provided for all elements.	Supply owners' bills, affidavits from emergency management, or other credible documentation.	

Benefit-Cost Analysis (BCA) Data Documentation Template – Hurricane Wind

FEMA reviews Benefit-Cost Analyses (BCAs) for all proposed mitigation projects submitted under the FEMA grant programs to determine whether the information provided in the application is:

1. Credible and well-documented
2. Prepared in accordance with accepted FEMA BCA practices
3. Able to demonstrate that the project is cost-effective

The following template can be used to assist in the collection and entering of information to meet these requirements within the BCA Tool. One way to use this tool is to highlight or circle the source and use the last column to record the software input and justification for values that vary from the FEMA Standard Value (Default).

Obtained	Input	Documentation Summary	Potential Sources	Software Input/Justification
☐	Name, address, county, and latitude/longitude for each project structure	Include contact information and whether building is historic. User MUST provide latitude/longitude	Documents available from homeowner, local building inspector, local tax assessor's office, or title documents.	
☐	Project Information	Project Information includes: • Project Number • Analyst Name and Contact Information • Grant Program • Project Point of Contact (POC)	Information available from the project manager or POC.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/Justification
☐	Scope of Work (SOW) (required)	Should include: • Problem Description and Proposed Solution • Description of Existing Conditions • Work Schedule • Cost Estimate • Engineering schematics, detailed engineering drawings, or engineering designs	The SOW is available from the project manager. The BCA Cost Estimation module will walk the user through costs that are valid for each project type.	
☐	Hurricane Wind Mitigation Project Type	Refer to your project SOW to determine the type of mitigation project. Project types include shutters, load path, roof, acquisition, code plus, or other.	The project manager or engineer can provide the SOW. Engineering designs may also provide this information.	
☐	Project Useful Life (PUL)	The estimated amount of time (in years) that the mitigation action will be effective. The PUL is based on the type of mitigation.	Sources include the PUL table provided in the BCA Tool dynamic help, the project manager, or the project engineer.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/Justification
☐	Cost Estimate	All anticipated project and maintenance costs should be detailed over the useful life of the project. Avoid the use of lump-sum costs. The Cost Estimate should include: • The source of the estimate and a copy of the documentation supporting each source • The base year of all cost estimates and any deviations due to the anticipated date of construction • Anticipated environmental resource remediation or historic property treatment measures • Other related construction/demolition/relocation costs, such as survey permitting, site preparation, and material disposal • Other acquisition costs, such as appraisals, legal recordation, displacement costs for renters, or maintenance	Provide contractor or Standard Cost Estimating software estimates. Source should be government representative or professional with relevant expertise.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/Justification
☐	Wind Gust/Wind Speed	The wind speed data is a default value based on either the zip code or latitude and longitude for the structure in the proposed project area. Default wind speed data in the software is provided in 3-second gusts for multiple return periods. If the standard default value is overridden, credible documentation, such as engineering studies or a justification and calculation on how the wind speeds were derived, is required.		
☐	Exposure	Exposure is the characteristics of the ground roughness and surface irregularities in the vicinity of a building. The categories are based on the natural topography, vegetation, and constructed facilities surrounding the project location.	Potential sources narrative, aerial, or map showing surrounding area.	
☐	Size of Building	The total enclosed square footage of the building. Acceptable forms of documentation include appraisals, tax records, survey, homeowner estimates, or measured drawings accompanied by photographs.	Data is available from assessor, owner, local tax office or appraiser's office, surveyor, or title documents with building footprint.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/Justification
☐	Building Replacement Value (BRV)	Enter cost per square foot to build a comparable structure. Acceptable forms of documentation include a letter from a construction company, contracting firm, or local building inspector; photocopies of pages from standard cost reference manuals; or tax records.	Sources can include a local building inspector, construction company, architect, building engineer, or standard cost estimating software. If tax records are used, the source must be an assessor.	
☐	Construction Type	The type of construction refers to the primary building material of the structure (wood, masonry, steel, etc.).	Refer to a structural engineer, contractor, or building inspector to determine the type of construction.	
☐	Building Type	The Building Type is one of the most critical data elements for determining an accurate Benefit-Cost Ratio (BCR). This should be based on design drawings prepared by architect or building engineer and determined by a building official, a registered professional engineer, or a licensed architect.	Building type should be based on design drawings prepared by architect or building engineer and determined by a building official, a registered professional engineer, or a licensed architect.	
☐	Loss of Rent	Loss of Rent is for rental properties ***only*** and does not include one-time costs.	Provide receipts for rent payments or owner's records as documentation.	
☐	Displacement Costs	Costs of occupants displaced to temporary quarters while damage is repaired. Includes rent and other monthly costs, such as furniture rental and utilities, and one-time costs, such as moving and utility hook-up fees.	Information sources include copies of ads for local rentals in the community, records of phone contacts with rental agencies, and receipts from similar rentals. Extra commuting costs and day care may be estimated as long as the estimation methodology is explained.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/Justification
☐	Contents Value	Provide detailed descriptions of contents, their value, and the means by which the value was assessed for all residential and non-residential buildings.	Review insurance records, appraisals, purchase receipts, or estimates based on current market prices for similar contents. Contents do not include items that are permanent parts of the building, such as electrical and plumbing systems.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/Justification
☐	Non-Residential: Loss of Service	Critical facility types include fire station, hospital, police station, and other. The fire station facility type includes fire fighting, search and rescue, public shelter, and Emergency Medical Services, if they are located in the same facility. The hospital facility type includes in-patient hospitals and emergency rooms. Other medical facilities, such as nursing homes, are included in the "other" facility type. Necessary documentation for Critical Facility Type is determined by the Facility Type selected, however it may include information to support the following data: • The number of people served by the critical facility • The type of area served by a fire station or a police station • The distance (in miles) between the critical facility and alternate facility • The number of police officers working a particular facility • The number of police officers that would serve the area if a police station was shut down	Information regarding the number of people served by a critical facility (or by alternate hospitals) can be obtained from the municipality, facility operations managers, or documents such as annual reports. Information regarding the distance (in miles) between the critical facility and alternate facility can be obtained from facility operations managers or municipal officials. Local maps or GPS software can be used as documentation of the distance. Information regarding the number of police officers can be obtained from the municipality, facility operations managers, or documents such as annual reports. Information regarding the number of police officers that would serve the area if a police station were shut down can be obtained from municipal officials or facility operations managers who can provide the appropriate number on official letterhead. Many police stations have emergency plans that outline the number of critical staff needed to serve the area should a police station shut down.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/Justification
☐	Non-Residential: Service Type Provided	A structure may provide multiple services. For example, a municipal building may house a government agency and a library. You may enter additional rows and select all that apply from the drop-down menu. Government – Local, municipal, State, Federal, or Indian Tribal government agencies Library – Public information depository Education – Primary, secondary, college, university, or trade school, public or private Medical – Out-patient medical facility, rehabilitation center, or nursing home EMS – Emergency Medical Service not co-located with a fire station or hospital Shelter – Facility designed to provide safe, temporary housing during a hazard event EOC – Emergency Operations Center Once the Service Type is selected, you must enter the annual operating budget of the agency providing the Service.	Information regarding the annual operating budget can be obtained from the agency providing the service or it can be obtained from an annual report. If an agency has multiple facilities, enter only the portion of the budget that pertains to the location of the proposed mitigation.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/Justification
☐	Other Damages/Losses Avoided	Can include damages/losses such as debris removal, emergency management costs, or disruption of life. Documentation must be provided for all elements.	Supply owners' bills, affidavits from emergency management, or other credible documentation.	

Benefit-Cost Analysis (BCA) Data Documentation Template - Tornado Safe Room

FEMA reviews Benefit-Cost Analyses (BCAs) for all proposed mitigation projects submitted under the FEMA grant programs to determine whether the information provided in the application is:

1. Credible and well-documented
2. Prepared in accordance with accepted FEMA BCA practices
3. Able to demonstrate that the project is cost-effective

The following template can be used to assist in the collection and entering of information to meet these requirements within the BCA Tool. One way to use this tool is to highlight or circle the source and use the last column to record the software input and justification for values that vary from the FEMA Standard or Default Value.

Obtained	Input	Documentation Summary	Potential Sources	Software Input/ Justification
☐	Name, address, county and latitude/longitude for safe room project	Include contact information and whether building is historic. The county is required for tornado probability lookup.	Documents from homeowner, local building inspector, local tax assessor's office, or title documents.	
☐	Scope of Work (SOW)	Should include: • Problem Description and Proposed Solution • Description of Existing Condition • Design Criteria • Work Schedule • Schematic design plans, detailed engineering drawings, or completed design plans	The SOW is available from the project manager. FEMA 361 Design and Construction Guidance for Community Safe Rooms and FEMA 320 Taking Shelter From the storm.	
☐	Safe Room Project Type	Refer to your SOW to determine the type of Safe Room project: • New or Retrofit • Stand-alone or Internal • Community or Residential	Information is available from the engineer, architect, or contractor responsible for Safe Room design.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/ Justification
☐	Project Useful Life (PUL)	The estimated amount of time (in years) that the mitigation action will be effective. The PUL is based on the type of mitigation.	Obtain from the PUL table provided in the BCA Tool dynamic help, project manager, or project engineer.	
☐	Cost Estimate	All anticipated project costs should be detailed, including maintenance costs over the PUL. Avoid the use of lump sum costs. Cost estimate should include: • The source of the estimate and documentation supporting each source • The base year of all cost estimates and any deviations due to the anticipated date of construction • Anticipated environmental resource remediation or historic property treatment measures • Other related construction/demolition/relocation costs, such as survey permitting, site preparation, and material disposal • Other acquisition costs, such as appraisals, legal recordation, displacement costs and maintenance	Provide design, contractor, or Standard Cost Estimating software estimates. Source should be government representative or professional with relevant expertise.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/ Justification
☐	Safe Room Maximum Occupancy	The maximum number of people that the Safe Room is designed to hold. According to FEMA 361, each community safe room should be sized to accommodate a minimum of one wheelchair space (10 sq. ft.) for every 200 occupants. Include a description of estimate method or reference for identifying the safe room population.	Obtain from the engineer, architect, or contractor responsible for Safe Room specifications. Occupancy data can also come from State or national sources, such as the US Census Bureau. Potential data sources provided in the BCA Tool dynamic help for maximum occupancy.	
☐	Gross area of the Safe Room	The gross area of the Safe Room is the total area from wall to wall for the portion of the building used as a Safe Room. For a stand-alone Safe Room, the gross area is the entire area of the building. For an internal Safe Room, the gross area should be based on the area of the building where structural elements are proposed to be upgraded to FEMA 361 and 320 guidelines. Provide appraisal, tax records, survey or homeowner estimates, or measured drawings accompanied by photographs to document. Include a description of estimate method or reference or provide copy of engineering or architectural specifications used.	Data is available from assessor, owner, local tax office or appraiser's office, surveyor, or title documents with building footprint, etc. Obtain from tax records, appraisals, or engineer. Obtain from the engineer, architect, or contractor responsible for Safe Room specifications.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/ Justification
☐	Usable area of the Safe Room	The usable area (in square feet) of the Safe Room must meet criteria for minimum square feet per person from FEMA 361 Table 3-1. Include a description of estimate method or reference used to determine Safe Room area. Provide copy of engineering or architectural drawings and show/locate safe room on plans.	Obtain from the engineer, architect, or contractor responsible for Safe Room specifications. Usable area dynamic help in the BCA Tool includes information on several ways to calculate the usable area based on a percentage of the gross area using default values from FEMA 361 and 320.	
☐	Safe Room Design Wind Speed	Find location on Wind Speed Design Map, FEMA 361, Chapter 3, Figure 3-1. Design must be effective for the risk associated with the location. Reference or provide copy of engineering or architectural specifications used. Identify debris resistant criteria.	FEMA 361: Wind Speed Design Map, Chapter 3, Figure 3-1. Map also provided in dynamic help in BCA Tool for Design Wind Speed.	
☐	Radius of the community that will use the Tornado Safe Room	Estimate a radius around the Safe Room location. A 0.5-mile radius or 5-minute walking distance is acceptable default value from FY2010 HMA Guidance. Provide a copy of a radius map using aerial photography showing the proposed Safe Room location and radius.	Use local map from census or municipality or GIS map.	

Obtained	Input	Documentation Summary	Potential Sources	Software Input/ Justification
☐	Structure types	Structure types occupants are currently using. A maximum of two structure types may be selected. Select the two most predominant structure types that the target population within the radius would reside in if they do not use Safe Room. Include on the radius map locations of structures. Include information about structure types from municipal data such as tax records or house counts.	Obtain from radius map showing structure detail or data from municipality, such as tax records, documenting structure types for radius area.	
☐	Occupancy	Estimate what percentage of the total population of the radius area would occupy each of the structure types during the day, evening, and night (when not in Safe Room). Using the radius map, count the number of each type of structure. Determine the total population within the designated radius. Divide the population into the two most predominant structure types (when not in Safe Room).	Obtain from current occupancy information from tax records, documentation from building managers, or census data.	
☐	Response rates	Responses to tornado warnings vary with the time of day. Default values for day, evening and night are given for the warning response percentages.	No documentation is required for the default values. Documentation from building managers or facilities operations managers needed for override. Must substantiate higher response by tornado alert monitoring, written plan, drills, trained staff, etc.	

Benefit-Cost Analysis (BCA) Data Documentation Template – Wildland/Urban Interface Fires

FEMA reviews Benefit-Cost Analyses (BCAs) for all proposed mitigation projects submitted under the FEMA grant programs to determine whether the information provided in the application is:

4. Credible and well-documented
5. Prepared in accordance with accepted FEMA BCA practices
6. Able to demonstrate that the project is cost-effective

The following template can be used to assist in the collection and entering of information to meet these requirements within the BCA Tool. One way to use this tool is to highlight or circle the source and use the last column to record the software input and justification for values that vary from the FEMA standard value (default).

Obtained	Input	Documentation Summary	Potential Sources	Software Input/ Justification
☐	Name, Address, County, and Latitude/Longitude for Each Project Structure	Include contact information and whether building is historic. Include latitude/longitude location for proper earthquake hazard data lookup.	Documents available from homeowner, local building inspector, local tax assessor's office, licensed surveyor, or title documents.	

☐	Project Information	Project Information includes: • Project Number • Analyst Name and Contact Information • Grant Program • Project Point of Contact (POC)	Information available from the project manager or POC.	
☐	Scope of Work (SOW)	Should include: • Problem Description and Proposed Solution • Description of Existing Conditions • Work Schedule • Cost Estimate • Engineering schematics, detailed engineering drawings, or engineering designs	The SOW is available from the project manager. The BCA Cost Estimation module will walk the user through costs that are valid for each project type.	
☐	Wildfire Mitigation Project Type	Refer to your project SOW to determine the type of mitigation project. Project types include defensible space activities, ignition-resistant construction activities, hazardous fuels reduction, or other*. *Note: Additional documentation is requested to justify the project.	The project manager or engineer can provide the SOW. Engineering designs may provide this information.	

☐	Mitigation Project Cost and Annual Maintenance Cost	All anticipated project costs, including maintenance costs, should be detailed over the useful life of the project. Avoid the use of lump-sum costs. The Cost Estimate should include: • The source of the estimate and a copy of the documentation supporting each source • The base year of all cost estimates and any deviations due to the anticipated date of construction • Anticipated environmental resource remediation or historic property treatment measures • Other fire-related construction/demolition/ relocation costs, such as survey permitting, site preparation, and material disposal The source and rationale for the mitigation and maintenance activity costs must be provided.	Provide estimate from contractor or line-item cost estimate based on Standard Cost Estimating software or local similar historical costs in present day dollars. Source should be government representative or professional with relevant expertise. For maintenance values, see the local, county, State, or Federal official specializing in vegetation removal, vegetation management, and/or ignition-resistance construction activity maintenance costs.	
☐	Project Useful Life (PUL)	The estimated amount of time (in years) that the mitigation action will be effective. The PUL is based on the type of mitigation.	Sources include the PUL table provided in the BCA Tool dynamic help; which provide the FEMA Standard Values. If the FEMA standard values are not used, additional documentation is required from the project manager, or the project engineer to justify the PUL.	
☐	Building Replacement Value (BRV)	Enter cost per square foot to build a comparable structure. (Note that the fair market value should not be used in place of a BRV). Acceptable forms of documentation include a letter from a construction company, contracting firm, or local building inspector; photocopies of pages from standard cost reference manuals; or tax records.	Sources can include a local building inspector, construction company, architect, building engineer, or standard cost estimating software. If tax records are used, the source must be an assessor and must include the conversion factor used to convert assessed value to replacement value.	

	Contents Value	**FEMA Standard Value (default):** • 50 percent of BRV If default value is not used, provide detailed descriptions of contents, their value, and the means by which the value was assessed for all non-residential and residential buildings.	Review insurance records, appraisals, purchase receipts, or estimates based on current market prices for similar contents. Contents do not include items that are permanent parts of the building, such as electrical and plumbing systems.	
☐	Infrastructure Costs	The value of infrastructure potentially damaged or destroyed by fire for which the mitigation project will provide protection.	Documents are available from the party responsible for maintenance or protection of the infrastructure in the area, most likely a local, county, or State agency, such as the highway department or the utility agency.	
☐	Timber Value	The estimated resale value of timber potentially destroyed by fire for which the mitigation project will provide protection.	Documentation (letter, email, etc.) should provide the rationale for the amount of timber at risk before mitigation. However, not all timber can be sold and the applicant needs to justify this as well. Documentation sources include the U.S. Department of Agriculture (USDA) Forest Service or other qualified company, a forester, or a qualified timber company representative.	
☐	Fire Suppression Costs	The estimated costs for responding to and fighting the fire. The costs should be limited to the area that the mitigation project would protect.	Documentation should justify the fire suppression costs before mitigation. Documentation sources include the local, county, State, or Federal fire-fighting agency that fights wildland fires. They may also include the USDA Forest Service or the property owner (must be supported with signed estimate).	

☐	Number of Residents	The estimated number of residents in the project area that would be affected by a fire.	Documentation should include a notation of the source and method applied to determine current population data for the community, county, or State within the proposed project area. Documentation sources include the community, county or State population official; current census data; an atlas; or other reference guides with population information.	
☐	Other Damages/Losses	Can include damages/losses such as debris removal, emergency management costs, or disruption of life that would be avoided by the mitigation project. Documentation must be provided for all elements.	Include owners' bills, affidavits from emergency management, or other credible documentation.	

APPENDIX B

BCA Information Checklist

BCA Information Checklist (Flood)		
Below is the information needed to get started with a Benefit-Cost Analysis		
Obtained	**Information Type**	**Potential Sources**
☐	First Floor Elevation (FFE)	FEMA elevation certificate; a signed, sealed, and dated structure elevation survey; a building permit; or other documentation where the FFE is certified by a State-licensed professional surveyor or State-registered professional engineer.
☐	Building Replacement (BRV)	Tax records or tax card, property appraisal from a building inspector or local contractor, or documented data from a national cost-estimating guide.
☐	Building Area (square footage)	Tax records or tax card, property survey, real estate listing, building permit, property appraisal, or other square footage data provided by the local jurisdiction.
☐	Flood Hazard Data (Flood Elevation and Discharge Data)	Copies of the relevant pages from the FEMA Flood Insurance Study (FIS) or a Hydrologic and Hydraulic (H&H) study for the flooding source, including the summary of discharges and flood profiles that reflect the flood data for the property locations.
☐	Building Contents Data	If the default is not used, a complete, itemized list of building contents with associated values, purchase receipts, appraisal of items, or copies of an itemized insurance policy that specifically cites the contents value.
☐	Displacement Costs	For displacement costs above the FEMA standard values of the displacement costs may include advertisements for rental properties in the community, advertisements for rental or storage spaces, contacts with rental agencies, or receipts from similar rentals.

BCA Information Checklist (Flood)		
Below is the information needed to get started with a Benefit-Cost Analysis		
Obtained	**Information Type**	**Potential Sources**
☐	Flood Frequency Data	If FIS or H&H not available or using the Damage Frequency Approach (DFA), use historical records of flood frequencies for past storm events with the date of the flood event; recorded flood depth; damage amounts (in dollars); stream gage data; rain gage data; newspaper clippings; or detailed engineering calculations prepared by a State-certified hydrologist or State-registered professional engineer. This information is often required for grant applications.
☐	Before Mitigation Damages Data	If FIS or H&H not available or using the Damage Frequency Approach (DFA), use insurance claims data, receipts for repair or replacement due to previous flood damages, newspaper clippings, or detailed damage estimates based on documented flood levels or other community records. This information is often required for grant applications.
☐	After Mitigation Damages Data	Statement from the design engineer or documentation verifying the level of effectiveness of the proposed project. This information is often required for grant applications.
☐	Documentation of the Loss of Function	For roads and bridges may include an estimated traffic count from a traffic engineer and an estimated delay due to road closure. For project effectiveness, it may include a statement from the design engineer stating the effectiveness of the project in reducing damages to the road or loss of function.
☐	Project Cost	Detailed cost breakdown (not lump-sum value) from an engineering cost estimate, with a documented source and reasoning estimating maintenance activity costs. If this is not available, there is a cost estimating tool in the software to help the user determine this information.

APPENDIX C

FEMA Standard Values

General FEMA Standard Values

Full Data Modules		
Data Type	**Value**	
Discount Rate	7%	
Building Damage (percentage) that would Result in Demolition	Non-Historic Buildings: 50% Historical Buildings: 50% to 90%	
Contents Value	50% of the Total BRV for Residential structures; non-residential vary based on the primary use of the building. *100% of BRV with Residential and Generic DDF tables from USACE* – All the USACE curves labeled "Generic" give 100%; others range from 50–78%	
Displacement Costs	$1.44/square foot/month	
Subapplicants may use higher values for Displacement and Relocation Costs for commercial/residential buildings with proper documentation.		
Building Type for Flood Modules		
1 Story without a Basement	1 or 2 Story with a Basement	
Split Level without a Basement	Split Level with a Basement	
2 Story without a Basement	Mobile Home	
	Other	
Six of the listed building types have FEMA default DDFs associated with them that appear in Level Two of the Full Data module. When a building type is selected, it sets the FEMA default curves in the Level Two Data. By selecting "Other," the FEMA default values are set to zero and the subapplicant must provide supported user-entered depth damage curves.		
Casualties and Injuries		
Dollar Values for Avoided Casualties	**Injury Severity Level**	**Value**
	Dead – Fatal	$5,800,000
	Hospitalized	$1,088,000
	Treat & Release	$90,000
	Self-Treatment	$12,000

Building Type		Displacement Costs	
HAZUS-MH MR3 Label	Occupancy Class	[A] Rental Cost (2008)	[B] Disruption Costs (2008)
		$/ft²/month	$/ft²
Residential			
RES1	Single Family Dwelling	0.73	0.88
RES2	Mobile Home	0.51	0.88
RES3	Multi Family Dwelling (All Types, includes duplex to 50+ units)	0.65	0.88
RES4	Temporary Lodging	2.19	0.88
RES5	Institutional Lodging	0.44	0.88
RES6	Nursing Home	0.80	0.88
Commercial			
COM1	Retail Trade	1.25	1.17
COM2	Wholesale Trade	0.52	1.02
COM3	Personal and Repair Services	1.46	1.02
COM4	Professional/Technical/Business	1.46	1.02
COM5	Banks	1.82	1.02
COM6	Hospital	1.46	1.46
COM7	Medical Office/ Clinic	1.46	1.46
COM8	Entertainment and Recreation	1.82	0.00
COM9	Theaters	1.82	0.00
COM10	Parking	0.36	0.00
Industrial			
IND1	Heavy	0.21	0.00
IND2	Light	0.29	1.02
IND3	Food/Drugs/Chemicals	0.29	1.02
IND4	Metals/Mineral Processing	0.21	1.02
IND5	High Technology	0.36	1.02
IND6	Construction	0.15	1.02
Agricultural			
AGR1	Agriculture	0.73	0.73
Religious/Non-Profit			
REL1	Church/Membership Organization	1.09	1.02
Government			
GOV1	General Services	1.46	1.02
GOV2	Emergency Response	1.46	1.02
Education			
EDU1	Schools/Libraries	1.09	1.02
EDU2	College/Universities	1.46	1.02

Source: HAZUS-MH MR3 Flood Technical Manual, Table 14.10. The 2006 HAZUS values were inflated using the CPI for 2007 and 2008 from the Bureau of Labor Statistics (bls.gov) Historical CPI Data

FEMA Standard Values for Loss of Service for Utilities

Economic Impacts of Loss of Utility Services
Per Person per Day of Lost Service

Loss of Electric Power	Cost of Complete Loss of Service
Total Economic Impact	**$126**
Loss of Potable Water Service	**Cost of Complete Loss of Service**
Total Economic Impact (all hazards)	**$93**
Loss of Wastewater Service	**Cost of Complete Loss of Service**
Total Economic Impact	**$41**

FEMA Standard Values for Loss of Service for Roads/Bridges

Economic Impacts of Loss of Road/Bridge Services
Per Vehicle per Hour of Lost Service

Loss of Road/Bridge Service	Cost of Complete Loss of Service
Vehicle Delay Detour Time	**$38.15 (per vehicle, per hour)**
Vehicle Delay Mileage	**Use current Federal Mileage Rate (Current June '09 $0..55)**

Value of Services for Critical Facilities

Value of Services	
Type of Facility	**Value of Service**
Police Services	Varies based on number of officers and population served (also type of area)
Fire Services and EMS	Varies based on population served and alternate facilities (also type of area and whether station provides EMS)
Hospital	Varies based on distance traveled and population served

Nonresidential Depth-Damage Functions

Twenty-one default DDF categories were developed for nonresidential structures using Expert Elicitation Panels and industry-recognized research software tools. These will be used by FEMA and USACE.

1. Retail-Furniture
2. Retail-Electronics
3. Retail-Clothing
4. Hotel
5. Fast Food
6. Non-Fast Food
7. Hospital
8. Medical Office
9. Protective Services
10. Correctional Facility
11. Recreation
12. Religious Facilities
13. Schools
14. Service Station
15. Office One-Story
16. Convenience Store
17. Grocery
18. Apartment
19. Industrial Light
20. Warehouse, Refrigerator
21. Warehouse, Non-Refrigerator

Residential Depth-Damage Functions (DDFs)

The default DDF categories were developed for residential structures by the US Army Corps of Engineers and adopted by FEMA to maintain consistency.

1. Mobile Home
2. One-Story with Basement
3. Split-Level with Basement
4. Two or More Stories with Basement
5. One-Story without Basement
6. Split-level without Basement
7. Two or More Stories without Basement

APPENDIX D

Project Useful Life Summary

Project Type	Useful Life (years)		Comment
	Standard Value	Acceptable Limits (documentation required)	
Acquisition/Relocation			
All Structures	100	100	
Elevation			
Residential Building	30	30–50	
Non-Residential Building	25	25–50	
Public Building	50	50–100	
Historic Buildings	50	50–100	
Structural/Non-Structural Building Project			
Residential Building Retrofit	30	30	
Non-Residential Building Retrofit	25	25–50	
Public Building Retrofit	50	50–100	
Historic Building Retrofit	50	50–100	
Roof Diaphragm Retrofit	30	30	Roof hardening and roof clips
Tornado Safe Room – Residential	30	30	
Tornado Safe Room – Community	30	30–50	Retrofit or small community safe room ≤ 16 people (30 yr), New (50 yr)
Non-Structural Building Elements	30	30	Ceilings, electrical cabinets, generators, parapet walls, or chimneys
Non-Structural Major Equipment	15	15–30	Elevators, HVAC, sprinklers
Non-Structural Minor Equipment	5	5–20	Generic contents, racks, shelves
Infrastructure Projects			
Major Infrastructure (minor localized flood reduction projects)	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, 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	Structures
	5	5–30	Equipment
Hurricane Storm Shutters	15	15–30	Depends on type of storm shutter
Utility Mitigation Projects	50	50–100	Major (power lines, cable, hardening gas, water, sewer lines, etc.)
	5	5–30	Minor (backflow values, downspout disconnect, etc.)

Project Type	Useful Life (years)		Comment
	Standard Value	Acceptable Limits (documentation required)	
Miscellaneous Equipment Projects			
Equipment Purchases	2	2–10	Small, portable equipment (e.g., computer)
	30	5–30	Heavy equipment
Wildfire Mitigation Projects			
Defensible Space/Hazardous Fuels Reduction	4	2–4	Brush – Depends on drought conditions
Vegetation Management	1	1	Grass – Depends on geographic location and precipitation
	20	3–20	Forest canopy – Must be maintained every 3 years
Ignition-Resistant Construction	10	10–30	Depends on type of construction and materials used