

FTA

FEDERAL TRANSIT ADMINISTRATION

Unit 3: Overview of the HMCE Tool

Hazard Mitigation Cost Effectiveness Analysis Course

January 2014



U.S. Department of Transportation
Federal Transit Administration

Unit Objectives

- 1) Understand how to use the FTA HMCE BCA Tool
- 2) Review tool data entry highlights
- 3) Discuss other hazards and how to find other hazard-specific data
- 4) Identify the data necessary to complete a successful BCA

Overview of the HMCE Tool

- The FTA Hazard Mitigation Cost Effectiveness Tool (HMCE Tool) is designed to assess the potential cost-effectiveness of transit resilience project grant proposals.
- The HMCE Tool estimates resilience project costs and benefits in the same manner as FEMA's Benefit-Cost Analysis (BCA) software for evaluating hazard mitigation project grant proposals.
- The HMCE Tool may be run, saved and printed as a Microsoft Excel[®] macro-enabled workbook (.xlsm) or as an executable file (.exe), depending on which version you use.

Overview of the HMCE Tool

(continued)

- The HMCE Tool is divided into the following sections:
 - Introduction
 - TAB 1 - Tool Information
 - **TAB 2 – Project Information & Cost Estimate**
 - **TAB 3 – Pre-Resilience Damages**
 - **TAB 4 – Post-Resilience Damages**
 - TAB 5 – Benefit-Cost Analysis Results and Qualitative Benefits

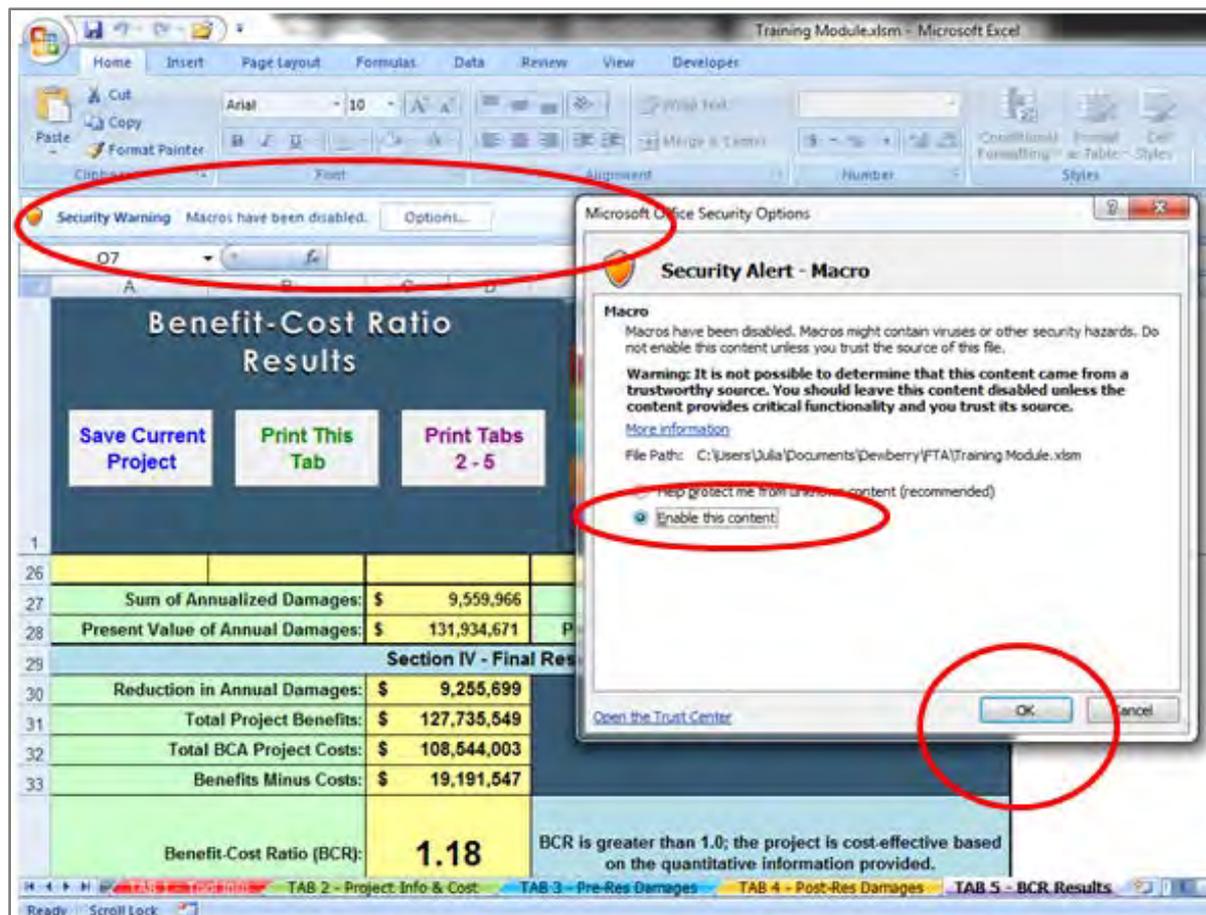
HMCE Tool User Guide

- Provides general information on tool navigation, saving and printing
- Features screen captures with specific information on each of the tool sections:
 - Actions/Inputs
 - Notes and Tips
- Includes appendices with summary guidance on Project Useful Life, Asset Useful Life, and Hurricane Sandy Flood Recurrence Intervals



Getting Started in the Tool - Macros

- When you first open the tool in Excel®, a warning may appear that macros have been disabled.
- Although not needed for calculations, the tool uses macros to facilitate navigation, saving and printing.
- To enable macros, click the **Options** button next to the warning and follow the directions.



Introduction – General Information

Introduction Tab

- This first tab in the HMCE Tool provides general information about the software, including
 - Tool Version
 - Build Date
 - Disclaimer
- Read this information before using the software for the first time.

The screenshot displays the Microsoft Excel interface for the USDOT_FTA_HMCE_Tool_1.0. The spreadsheet is titled "Introduction" and is currently selected. The content of the spreadsheet is as follows:

**U.S. Department of Transportation
Federal Transit Administration
Hazard Mitigation Cost Effectiveness Tool**

This tool may be used for benefit-cost analysis (BCA) of resilience projects submitted to FTA for consideration for funding under the Public Transportation Emergency Relief Program and the Disaster Relief Appropriations Act of 2013 (Pub. L. 113-2) for States, local governmental authorities, tribal governments and other FTA recipients impacted by Hurricane Sandy, which affected mid-Atlantic and northeastern states in October 2012.

Resilience projects are those hazard mitigation projects designed and built to address vulnerabilities to a public transportation facility or system due to future recurrence of emergencies or major disasters that are likely to occur in the geographic area in which the public transportation system is located; or projected changes in development patterns, demographics, or extreme weather or other climate patterns. All proposed projects for funding are required to provide a cost-effectiveness evaluation leading to a benefit-cost ratio (BCR) for the proposed project. This information will be used by FTA to evaluate the cost-effectiveness of the proposed project in reducing an asset's and the public transportation system's vulnerabilities to future disasters. Consistent with Executive Order 12893, selection of projects for funding will be based in part on a systematic analysis of benefits and costs. In general, a BCR of one or greater indicates a project is cost-effective. However, there are additional considerations that may lead to some projects with a BCR of less than one to be considered cost-effective.

Applicants should provide information about the qualitative benefits of the proposed project under Tab 5 of this tool.

The tool provides a framework for applicants to submit quantitative information about the project and its cost-effectiveness, including the estimated damage and losses from specifically identified hazards (recorded historical and/or expected theoretical events) and the reduction in the anticipated losses after such an event as a result of the proposed project. Quantitative information that applicants must submit includes the estimated damage and losses from specifically identified hazards (recorded historical or expected theoretical events) and the reduction in the anticipated damages and losses after such an event as a result of the proposed project.

FTA will review the explanations and justifications provided to determine the reasonableness of the submitted information, as well as the source of the information.

**FTA-HMCE Tool Version: 1.0
Build Date: 1/16/2014**

Click on a tab title to go directly to it:

- TAB 1 - Tool Information**
- TAB 2 - Project Information & Cost Estimate**
- TAB 3 - Pre-Resilience Damages**
- TAB 4 - Post-Resilience Damages**
- TAB 5 - Analysis Results & Qualitative Benefits**

Disclaimer:

The results produced by this tool are not conclusive evidence that a project proposal is or is not cost-effective. Use of this tool does not guarantee that a project is eligible for funding under the FTA Public Transportation Emergency Relief Program. The analysis conducted is dependent upon the quality of the information provided, and will be evaluated in the context of both analysis results and sufficiency of documentation regarding user inputs.

The spreadsheet's tab bar at the bottom shows the following tabs: Introduction (circled in red), TAB 1 - Tool Info, TAB 2 - Project Info & Cost, TAB 3 - Pre-Res Damages, TAB 4 - Post-Res Damages, and TAB 5 - Analysis Results & Qualitative Benefits.

TAB 1 – Tool Information: Tool Navigation

TAB 1 – Tool Information

- Tab 1 in the HMCE Tool provides basic tool information on inputs, file saving and printing

Tool Navigation – Options:

- Click on a tab name to proceed directly to that tab, or...
- You can also navigate through the tool using the tabs at the bottom of the screen

The screenshot displays the 'Tool Information' window. At the top, there is a 'Print This Tab' button. Below it, a list of tabs is shown: 'TAB 1 - Tool Information' (red), 'TAB 2 - Project Information & Cost Estimate' (green), 'TAB 3 - Pre-Resilience Damages' (blue), 'TAB 4 - Post-Resilience Damages' (orange), and 'TAB 5 - Analysis Results & Qualitative Benefits' (purple). A red circle highlights this list. Below the tabs, there is a text box explaining that information on tabs 2, 3, 4, and 5 is inputted into white cells, while other cells are protected. Below this, there are four instructions, each with a corresponding button: 'Save As New Project' (red), 'Save Current Project' (blue), 'Print This Tab' (green), and 'Print Tabs 2 - 5' (purple). A red circle highlights these buttons. At the bottom, a tab bar shows the same five tabs, with 'TAB 1 - Tool Info' selected. A red circle highlights this tab bar.

TAB 1 – Tool Information: Saving and Printing

Saving

- **Save as New Project** creates new project – appears only on Tab 2.
- **Save Current Project** saves your work – on Tabs 2-5.

Printing

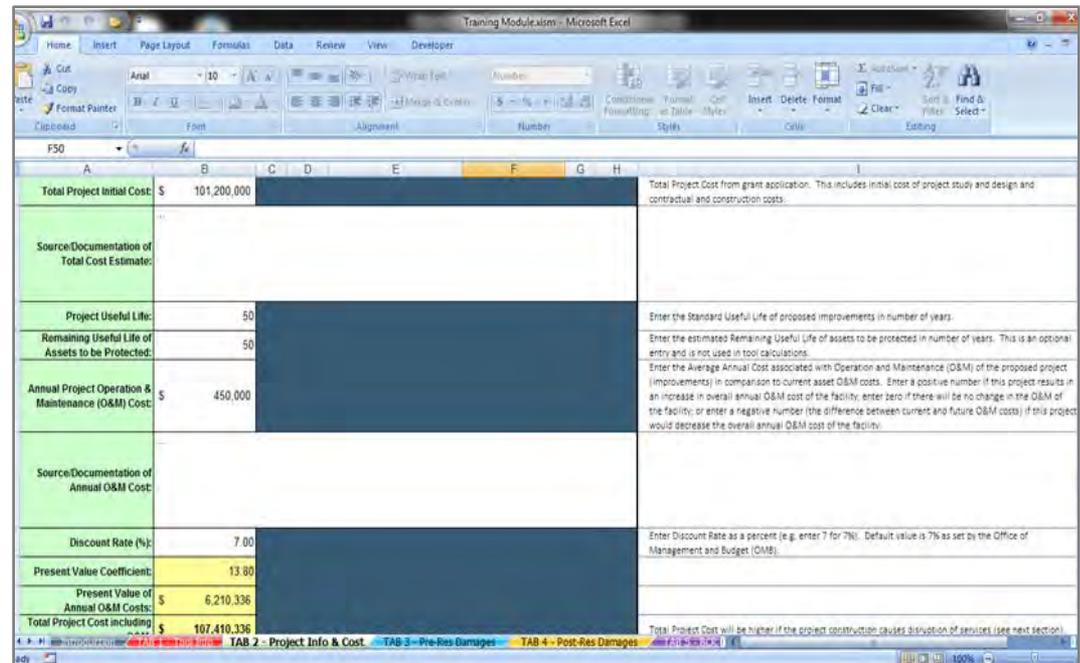
- **Print This Tab** prints the current tab – at top of each tab.
- **Print Tabs 2 -5** – appears only on Tab 5.

The screenshot displays the 'Tool Information' window. At the top right, there is a tab navigation bar with five tabs: 'TAB 1 - Tool Information' (red), 'TAB 2 - Project Information & Cost Estimate' (green), 'TAB 3 - Pre-Resilience Damages' (blue), 'TAB 4 - Post-Resilience Damages' (orange), and 'TAB 5 - Analysis Results & Qualitative Benefits' (purple). Below the navigation bar, a 'Print This Tab' button is visible. The main content area contains several paragraphs of text. A red circle highlights a 'Print This Tab' button in the text. At the bottom of the window, a status bar shows the current tab as 'TAB 1 - Tool Info' and other tabs as 'TAB 2 - Project Info & Cost', 'TAB 3 - Pre-Res Damages', 'TAB 4 - Post-Res Damages', and 'TAB 5 - Analysis Results'. The status bar also shows 'Ready' on the left.

TAB 1 – Tool Information: General Information and Notes

General Information & Notes

- White cells along the left-hand side of screen are typically input cells
- Green cells point to white input cells
- Yellow cells contain values calculated based on user inputs or carried over from previous tabs
- Guidance notes can be found along the right-hand side of the screen



The screenshot shows a Microsoft Excel spreadsheet titled "Training Module.xlsx". The spreadsheet is organized into columns A through I. The data is as follows:

	A	B	C	D	E	F	G	H	I
Total Project Initial Cost:	\$	101,200,000							Total Project Cost from grant application. This includes initial cost of project study and design and contractual and construction costs.
Source/Documentation of Total Cost Estimate:									
Project Useful Life:		50							Enter the standard Useful Life of proposed improvements in number of years.
Remaining Useful Life of Assets to be Protected:		50							Enter the estimated Remaining Useful Life of assets to be protected in number of years. This is an optional entry and is not used in tool calculations.
Annual Project Operation & Maintenance (O&M) Cost:	\$	450,000							Enter the Average Annual Cost associated with Operation and Maintenance (O&M) of the proposed project (improvements) in comparison to current asset O&M costs. Enter a positive number if this project results in an increase in overall annual O&M cost of the facility; enter zero if there will be no change in the O&M of the facility; or enter a negative number (the difference between current and future O&M costs) if this project would decrease the overall annual O&M cost of the facility.
Source/Documentation of Annual O&M Cost:									
Discount Rate (%):		7.00							Enter Discount Rate as a percent (e.g. enter 7 for 7%). Default value is 7% as set by the Office of Management and Budget (OMB).
Present Value Coefficient:		13.80							
Present Value of Annual O&M Costs:	\$	6,210,336							
Total Project Cost including	\$	107,410,336							Total Project Cost will be higher if the project construction causes disruption of service (see next section).

TAB 2 – Project Information & Cost Estimate: Overview

TAB 2 – Project Information & Cost Estimate

- Tab 2 in the HMCE Tool provides information that ties the HMCE analysis to the grant proposal
- Tab 2 also provides details regarding the resilience cost used in the analysis:
 - Initial Project Cost
 - O&M Costs
 - Project-Related Service Interruptions

The screenshot displays the Microsoft Excel interface for the USDOT_FTA_HMCE_Tool_1.0. The active tab is 'TAB 2 - Project Information & Cost Estimate', which is highlighted in red in the tab bar at the bottom. The main content area is divided into several sections:

- Project Information & Cost Estimate**: A header section with buttons for 'Save As New Project', 'Save Current Project', and 'Print This Tab'. A navigation pane on the right lists tabs: TAB 1 - Tool Information, TAB 2 - Project Information & Cost Estimate (selected), TAB 3 - Pre-Resilience Damages, TAB 4 - Post-Resilience Damages, and TAB 5 - Analysis Results & Qualitative Benefits.
- Section I - Applicant Information**: Fields for Applicant, Address Line 1, Address Line 2, City, Select State, Zip, Phone 1, Ext., and Phone 2, Ext.
- Section II - Project Information**: Fields for Project Name, Application Date, Analyst, Analysis Date, and Analysis Year (2014). It includes radio button options for Transit Mode(s) Protected by Project (Suburban/Inner City Rail, Light/Commuter Rail, Intercity/Passenger Rail, Bus, Ferry, Other) and Primary Hazard Protected by Project (Flood, Hurricane/Coastal Storm, Wind, Snow/Ice Storm). It also includes a 'Brief Project Description' field.
- Section III - Cost Information**: A field for Total Project Initial Cost.

Guidance Notes are provided for several fields, such as 'Enter the date from the grant application and the name of the person conducting the analysis.' and 'Select the one primary hazard that the proposed project is designed to protect against.'

TAB 2 - Section I: Applicant Information

Applicant Information

- This section must be completed to tie the HMCE analysis to the grant proposal.
- Enter name of the entity applying for the FTA grant in **Applicant** box
- Enter **Address, City, State, Zip** and contact **Phone** numbers, in the appropriate boxes.

Project Information & Cost Estimate				
Save As New Project		Save Current Project		Print This Tab
Click on a tab title to go directly to it:				
TAB 1 - Tool Information				
TAB 2 - Project Information & Cost Estimate				
TAB 3 - Pre-Resilience Damages				
TAB 4 - Post-Resilience Damages				
TAB 5 - Analysis Results & Qualitative Benefits				
Section I - Applicant Information				
Applicant:				
Address Line 1:				
Address Line 2:				
City:		Select State:	Select State	Zip:
Phone 1:	Ext:	Phone 2:		Ext:
Section II - Project Information				
Project Name:				
Application Date:		Analyst:		
Analysis Year:	2014	Analysis Date:		
Transit Mode(s) Protected by Project:	<input type="checkbox"/> Subway/Inner City Rail <input type="checkbox"/> Light/Commuter Rail <input type="checkbox"/> Intercity Passenger Rail	<input type="checkbox"/> Bus <input type="checkbox"/> Ferry <input type="checkbox"/> Other	If Transit Mode is "Other," please specify:	
Primary Hazard Protected by Project:	<input type="radio"/> Flood <input type="radio"/> Wind	<input type="radio"/> Hurricane/Coastal Storm <input checked="" type="radio"/> Snow/Ice Storm		
Secondary Hazard(s) Protected by Project:	<input type="checkbox"/> Flood <input type="checkbox"/> Wind	<input type="checkbox"/> Hurricane/Coastal Storm <input type="checkbox"/> Snow/Ice Storm		
Introduction TAB 1 - Tool Info TAB 2 - Project Info & Cost TAB 3 - Pre-Res Damages TAB 4 - Post-Res Dam				

TAB 2 – Section II: Project Information and Analysis Details

Project Information

- Enter **Project Name**
- Enter the **Application Date** when you're submitting the application

Analysis Details

- No input required for **Analysis Duration** (2014 used for this FTA grant funding cycle)
- Enter **Analyst** and **Analysis Date**

The screenshot displays a Microsoft Excel spreadsheet with the following sections and fields:

- Section II - Project Information:**
 - Project Name: [Red circle]
 - Application Date: [Red circle]
 - Analyst: [Red circle]
 - Analysis Date: [Red circle]
 - Transit Mode(s) Protected by Project: Subway/Tram/ City Rail, Light/Commuter Rail, Intercity Passenger Rail, Bus, Ferry, Other
 - Primary Hazard Protected by Project: Flood, Wind, Hurricane/Coastal Storm, Snow/Ice Storm
 - Secondary Hazard(s) Protected by Project: Flood, Wind, Hurricane/Coastal Storm, Snow/Ice Storm
 - Brief Project Description: [Text area]
- Section III - Cost Information:**
 - Total Project Initial Cost: [Text area]
 - Source/Documentation of Total Cost Estimate: [Text area]

Instructions for Section II fields:

- Enter the date from the grant application and the name of the person conducting the analysis. The Analysis Year is 2014. Enter the date the analysis was conducted.
- Select the mode or modes of transit that the proposed project is designed to protect against. The transit mode(s) need to be based on the current version of the grant application form from FTA.
- Select the one primary hazard that the proposed project is designed to protect against.
- Select the secondary hazard or hazards that the proposed project is designed to protect against.
- In this section, describe the primary and secondary hazards the system has faced and is likely to face in the future, and what is being proposed to reduce the damages in the future and increase the sustainability of the transit system against the primary hazard.

TAB 2 – Section II: Transit Mode(s), Primary and Secondary Hazards

Transit Mode(s)

- Check **Transit Mode(s) Protected by Project**
 - If not listed, select “Other” and provide description.

Primary and Secondary Hazards

- Select **Primary Hazard Protected by Project** used as basis for analysis
- Check any **Secondary Hazard(s) Protected by Project**

TAB 2 – Section II: Brief Project Description

Brief Project Description

- Use **Brief Project Description** to describe the proposed project.
- This is an opportunity to describe your project qualitatively before you start entering numbers.
- If you like, you can copy and paste the description from the grant proposal.

Application Date:		Analyst:	
Analysis Year:	2014	Analysis Date:	
Transit Mode(s) Protected by Project:	<input type="checkbox"/> Subway/Inner City Rail <input type="checkbox"/> Light/Commuter Rail <input checked="" type="checkbox"/> Inter-city Passenger Rail	<input type="checkbox"/> Bus <input type="checkbox"/> Ferry <input type="checkbox"/> Other	If Transit Mode is "Other," please specify:
Primary Hazard Protected by Project:	<input type="radio"/> Flood <input type="radio"/> Wind	<input type="radio"/> Hurricane/Coastal Storm <input checked="" type="radio"/> Snow/Ice Storm	
Secondary Hazard(s) Protected by Project:	<input type="checkbox"/> Flood <input type="checkbox"/> Wind	<input type="checkbox"/> Hurricane/Coastal Storm <input type="checkbox"/> Snow/Ice Storm	
Brief Project Description:			
Section III - Cost Information			
Total Project Initial Cost:			
Source/Documentation of Total Cost Estimate:			
Project Useful Life (Years):			
Remaining Useful Life of Assets to be Protected (Years):			
Annual Project Operation & Maintenance (O&M) Cost:			

TAB 2 – Section III: Project Cost Information

Cost Information

- Enter **Total Initial Project Cost** including pre-construction, construction, and ancillary costs (cost in the grant proposal form)
- Briefly describe where estimate came from (i.e., local historic costs, current contractor bids, published unit costs) in the **Source/Documentation of Total Cost Estimate**

Application Date:		Analyst:	
Analysis Year:	2014	Analysis Date:	
Transit Mode(s) Protected by Project:	<input type="checkbox"/> Subway/Inner City Rail <input type="checkbox"/> Bus <input type="checkbox"/> Light/Commuter Rail <input type="checkbox"/> Ferry <input checked="" type="checkbox"/> Intercity Passenger Rail <input type="checkbox"/> Other	If Transit Mode is "Other," please specify:	
Primary Hazard Protected by Project:	<input type="radio"/> Flood <input type="radio"/> Hurricane/Coastal Storm <input type="radio"/> Wind <input checked="" type="radio"/> Snow/Ice Storm		
Secondary Hazard(s) Protected by Project:	<input type="checkbox"/> Flood <input type="checkbox"/> Hurricane/Coastal Storm <input type="checkbox"/> Wind <input type="checkbox"/> Snow/Ice Storm		
Brief Project Description:			
Section III - Cost Information			
Total Project Initial Cost:			
Source/Documentation of Total Cost Estimate:			
Project Useful Life (Years):			
Remaining Useful Life of Assets to be Protected (Years):			
Annual Project Operation & Maintenance (O&M) Cost:			

TAB 2 – Section III: Project Useful Life and Remaining Useful Life of Asset

Section III - Cost Information		
Total Project Initial Cost:		
Source/Documentation of Total Cost Estimate:		
Project Useful Life (Years):		
Remaining Useful Life of Assets to be Protected (Years):		
Annual Project Operation & Maintenance (O&M) Cost:		
Source/Documentation of Annual O&M Cost:		
Discount Rate (%):	7.00	
Present Value Coefficient:		
Present Value of Annual O&M Costs:		
Total Project Cost including O&M:		
Section IV - Cost Associated with Interruption in Transit Services during Project Construction/Implementation		
Introduction TAB 1 - Tool Info TAB 2 - Project Info & Cost TAB 3 - Pre-Res Damages TAB 4 - Post-Res Damages		

Project Useful Life

- Enter **Project Useful Life**, in years, over which the project will protect the asset(s).
- Additional guidance in Appendix A of User Guide

Remaining Asset Useful Life

- Enter **Remaining Useful Life of Asset(s) to be Protected**, in years. If unknown, leave it blank
- Additional guidance in Appendix B of User Guide

TAB 2 – Section III: Project Useful Life and Remaining Useful Life of Asset (continued)

Project Useful Life (Appendix A)

Asset Useful Life (Appendix B)

Project Type	Standard Project Useful Life (years)	Acceptable Limits (years)	Comments
Acquisition	100	100	None
Elevation – Non-Residential, Public, and/or Historic Building or Transit Facility	50	50-100	None
Non-Residential Building Retrofit	25	25-50	None
Public and/or Historic Building/Transit Facility Retrofit	50	50-100	None
Roof Diaphragm Retrofit	30	30	Roof hardening and roof clips
Non-Structural Building/Facility Elements	30	30	Ceilings, electrical cabinets, generators, parapets, chimneys
Non-Structural Major Equipment	15	15-30	Elevators, HVAC, sprinklers
Non-Structural Minor Equipment	5	5-20	Generic contents, racks, shelves
Major Infrastructure (minor localized flood reduction projects)	50	35-100	None
Concrete Infrastructure, Flood Walls, Roads, Bridges, Major Drainage Systems	50	35-50	None
Culverts (concrete, PVC, CMP, HDPE, etc.) with end treatments	30	25-50	End treatment (wing walls, end sections, head walls, etc.)
Culverts (concrete, PVC, CMP, HDPE, etc.) without end treatments	10	5-20	End treatment (wing walls, end sections, head walls, etc.)
Pump Stations, Substations, Wastewater Systems, or Equipment such as Generators	50	50	Structures
Pump Stations, Substations, Wastewater Systems, or Equipment Such as Generators	5	5-30	Equipment
Hurricane Storm Shutters	15	15-30	Depends on type of storm shutter
Utility Mitigation/Resilience Projects	50	50-100	Major (e.g., power lines, cable, hardening gas, water, sewer lines, etc.)
Utility Mitigation/Resilience Projects	5	5-30	Minor (e.g., backflow valves, downspout disconnect, etc.)
Equipment Purchases	2	2-10	Small, portable equipment (e.g., computer)
Equipment Purchases	30	5-30	Heavy equipment

Asset Type	Minimum Useful Life (years)	Comments
Buses		
Large, heavy-duty transit buses including over the road buses	12	Approximately 35'–40', and articulated buses
Small size, heavy-duty transit buses	10	Approximately 30'
Medium-size, medium-duty transit buses	7	Approximately 25'–35'
Medium-size, light-duty transit buses	5	Approximately 25'–35'
Light Duty Vehicles		
Other light-duty vehicles	4	Other light-duty vehicles used as equipment and in transport of passengers (revenue service) such as regular and specialized vans, sedans, and light-duty buses including all bus models exempt from testing in the current 49 CFR part 665
Trolleys		
Fixed guideway steel-wheeled "trolley"	25	Streetcar or other light rail vehicle
Fixed guideway electric trolley-bus with rubber tires obtaining power from overhead catenary	15	
Simulated trolleys, with rubber tires and internal combustion engine	Refer to criteria for buses	Often termed "trolley-replica buses"
Rail Vehicles		
All rail vehicles	25	At time of grant application, the grantee may propose alternative useful life to be reviewed by FTA
Ferries		
Passenger Ferries	25	
Other Ferries (without refurbishment)	30	
Other Ferries (with refurbishment)	60	
Other Facilities		
Railroad or highway structure	50	
Other buildings and facilities	40	Concrete, steel, and frame construction
<p>NOTE: Per FTA Circular 5010, grantees should identify the method used to determine the asset useful life. Acceptable methods life include, but are not limited to: 1) Generally accepted accounting principles; 2) Independent evaluation; 3) Manufacturer's estimated useful life; 4) Internal Revenue Service guidelines; 5) Industry standards; 6) Grantee experience; 7) The grantee's independent auditor who needs to concur that the useful life is reasonable for depreciation purposes; or 8) Proven useful life developed at a Federal test facility.</p>		

TAB 2 – Section III: Operation & Maintenance (O&M) Costs

O&M Costs

- Enter **Annual O&M Cost** based on the difference between average annual O&M costs associated with proposed project and current average annual O&M costs for asset(s) to be protected by project.
 - Value can be positive, zero, or negative, depending on the project
- Briefly describe the **Source/Documentation of Annual O&M Cost**

Section III - Cost Information	
Total Project Initial Cost:	
Source/Documentation of Total Cost Estimate:	
Project Useful Life (Years):	
Remaining Useful Life of Assets to be Protected (Years):	
Annual Project Operation & Maintenance (O&M) Cost:	
Source/Documentation of Annual O&M Cost:	
Discount Rate (%):	7.00
Present Value Coefficient:	
Present Value of Annual O&M Costs:	
Total Project Cost including O&M:	
Section IV - Cost Associated with Interruption in Transit Services during Project Construction/Implementation	
Introduction TAB 1 - Tool Info TAB 2 - Project Info & Cost TAB 3 - Pre-Res Damages TAB 4 - Post-Res Dar	
Ready	

TAB 2 – Section III: Discount Rate

Discount Rate

- No input is required for the Discount Rate. For this FTA funding cycle, the discount rate is pre-populated at 7 percent (7.00%) per OMB Circular A-94 guidance.
- As discussed in Unit 2, the discount rate accounts for the time value of money.

Section III - Cost Information	
Total Project Initial Cost:	
Source/Documentation of Total Cost Estimate:	
Project Useful Life (Years):	
Remaining Useful Life of Assets to be Protected (Years):	
Annual Project Operation & Maintenance (O&M) Cost:	
Source/Documentation of Annual O&M Cost:	
Discount Rate (%):	7.00
Present Value Coefficient:	
Present Value of Annual O&M Costs:	
Total Project Cost including O&M:	
Section IV - Cost Associated with Interruption in Transit Services during Project Construction/Implementation	
Introduction TAB 1 - Tool Info TAB 2 - Project Info & Cost TAB 3 - Pre-Res Damages TAB 4 - Post-Res Dam	
Ready	

TAB 2 – Section IV: Interruption of Transit Service Costs

Interruption of Service Costs

- Section allows input of costs to interruption of transit service associated with construction or implementation of the proposed project.
- Enter **Cost of Loss of Services for Transit Passengers** if different from default value.
- Enter **Current Federal Mileage Rate** if different from default value.

The screenshot shows a Microsoft Excel spreadsheet titled "USDOT_FTA_HMCE_Tool_1.6.xlsx". The active sheet is "TAB 2 - Project Info & Cost". The main section is "Section IV - Cost Associated with Interruption in Transit Services during Project Construction/Implementation".

Key input fields and their values are:

- Cost of Loss of Services for Transit Passengers (\$/Passenger/Hour): 15.500
- Current Federal Mileage Rate (\$/Mile): 0.560
- Duration of Loss or Reduction of Services (Days): [Blank]
- Delay or Extra Travel Time (Hours): [Blank]
- Average Daily Number of Passengers: [Blank]
- Loss of Transit Services Cost: [Blank]
- Additional Time per One-way Trip (Hours): [Blank]
- Additional Travel Miles: [Blank]
- Alternate Transit Mode (Rail, Ferry, Buses): [Blank]
- Number of One-way Traffic Trips per Day (Rail/Ferry/Buses): [Blank]
- Average Number of Passengers per Trip: [Blank]
- Loss of Services Cost (Rail/Ferry/Buses): [Blank]
- Other Alternate Transit Mode (Vehicles): [Blank]
- Number of One-way Traffic Trips per Day (Vehicles): [Blank]
- Average Number of Passengers per Vehicle: 1.67
- Loss of Services Cost (Vehicles): [Blank]

The spreadsheet also includes explanatory text for various sections, such as "Enter costs due to project construction resulting in temporary loss of transit services..." and "The default value per unit of services is \$33.58/passenger/hour for all transit modes...".

TAB 2 – Section IV: Duration of Transit Service Interruption

Duration of Transit Service Interruption

- Enter **Duration of Loss or Reduction of Services** in days, defined as the **length of time during resilience project construction or implementation that passenger travel will be impacted.**

Section IV - Cost Associated with Interruption in Transit Services during Project Construction/Implementation			
Cost of Loss of Services for Transit Passengers (\$/Passenger/Hour):	\$	15.580	
Current Federal Mileage Rate (\$/Mile):	\$	0.560	
Duration of Loss or Reduction of Services (Days):			
Impacts Due to Delay and/or Extra Travel Time for Transit Mode Under Project Construction			
Delay or Extra Travel Time (Hours):			
Average Daily Number of Passengers:			
Loss of Transit Services Cost:			
Impacts Due to Delay and/or Extra Travel Time and Miles for Alternate Transit Modes			
Additional Time per One-way Trip (Hours):			
Additional Travel Miles:			
Alternate Transit Mode (Rail, Ferry, Buses)		Other Alternate Transit Mode (Vehicles)	
Number of One-way Traffic Trips per Day (Rail/Ferry/Buses):		Number of One-way Traffic Trips per Day (Vehicles):	
Average Number of Passengers per Trip:		Average Number of Passengers per Vehicle:	1.67
Loss of Services Cost (Rail/Ferry/Buses):		Loss of Services Cost (Vehicles):	
Total Cost due to			
Introduction TAB 1 - Tool Info TAB 2 - Project Info & Cost TAB 3 - Pre-Res Damages TAB 4 - Post-Res Dam			
Ready			

TAB 2 – Section IV: Interruption of Transit Mode Under Project Construction

Interruption of Transit Mode Under Project Construction

- Enter estimated **Delay or Extra Travel Time** in hours and **Average Daily Number of Passengers** using transit line during project construction
- Applicable for service interruptions involving an alternate route on the same transit mode or reduced transit speeds during construction.

Section IV - Cost Associated with Interruption in Transit Services during Project Construction/Implementation			
Cost of Loss of Services for Transit Passengers (\$/Passenger/Hour):	\$	15.580	
Current Federal Mileage Rate (\$/Mile):	\$	0.560	
Duration of Loss or Reduction of Services (Days):			
Impacts Due to Delay and/or Extra Travel Time for Transit Mode Under Project Construction			
Delay or Extra Travel Time (Hours):			
Average Daily Number of Passengers:			
Loss of Transit Services Cost:			
Impacts Due to Delay and/or Extra Travel Time and Miles for Alternate Transit Modes			
Additional Time per One-way Trip (Hours):			
Additional Travel Miles:			
Alternate Transit Mode (Rail, Ferry, Buses)		Other Alternate Transit Mode (Vehicles)	
Number of One-way Traffic Trips per Day (Rail/Ferry/Buses):		Number of One-way Traffic Trips per Day (Vehicles):	
Average Number of Passengers per Trip:		Average Number of Passengers per Vehicle:	1.67
Loss of Services Cost (Rail/Ferry/Buses):		Loss of Services Cost (Vehicles):	
Total Cost due to			
Introduction TAB 1 - Tool Info TAB 2 - Project Info & Cost TAB 3 - Pre-Res Damages TAB 4 - Post-Res Damages			
Ready			

TAB 2 – Section IV: Extra Travel Time and Miles on Alternate Transit Modes

Project Impacts on Alternate Transit Modes

- Enter the **Additional Time per One-Way Trip** in hours for the alternative transit mode and **Additional Travel Miles** per one way trip in miles for passenger vehicles
- Applicable for projects impacting an alternative mode of transit including passenger vehicle traffic.

Section IV - Cost Associated with Interruption in Transit Services during Project Construction/Implementation			
Cost of Loss of Services for Transit Passengers (\$/Passenger/Hour):	\$	15.580	
Current Federal Mileage Rate (\$/Mile):	\$	0.560	
Duration of Loss or Reduction of Services (Days):			
Impacts Due to Delay and/or Extra Travel Time for Transit Mode Under Project Construction			
Delay or Extra Travel Time (Hours):			
Average Daily Number of Passengers:			
Loss of Transit Services Cost:			
Impacts Due to Delay and/or Extra Travel Time and Miles for Alternate Transit Modes			
Additional Time per One-way Trip (Hours):			
Additional Travel Miles:			
Alternate Transit Mode (Rail, Ferry, Buses)		Other Alternate Transit Mode (Vehicles)	
Number of One-way Traffic Trips per Day (Rail/Ferry/Buses):		Number of One-way Traffic Trips per Day (Vehicles):	
Average Number of Passengers per Trip:		Average Number of Passengers per Vehicle:	1.67
Loss of Services Cost (Rail/Ferry/Buses):		Loss of Services Cost (Vehicles):	
Total Cost due to			
Introduction TAB 1 - Tool Info TAB 2 - Project Info & Cost TAB 3 - Pre-Res Damages TAB 4 - Post-Res Da			
Ready			

TAB 2 – Section IV: Interruption of Alternative Transit Modes

Interruption of Alternate Transit Modes

- Enter **Number of One-way Traffic Trips per Day (Rail/Ferry/Buses)** and **Average Number of Passengers per Trip** if alternative transit modes will be impacted
- Enter **Number of one-way Traffic Trips per Day (Vehicles)** if passenger vehicles will be impacted

Cost of Loss of Services for Transit Passengers (\$/Passenger/Hour):	\$ 15.580				The default value is 15.580 (\$/Passenger/Hour) and is based on the selected value for the federal mileage rate. The federal mileage rate is looked up on the
Current Federal Mileage Rate (\$/Mile):	\$ 0.560				
Duration of Loss or Reduction of Services (Days):					
Impacts Due to Delay and/or Extra Travel Time for Transit Mode Under Project Construction					
Delay or Extra Travel Time (Hours):					If the transit mode is a bus, the delay time is the delay time for the alternate transit mode. If the transit mode is a rail or ferry, the delay time is the delay time for the alternate transit mode. For average daily number of passengers per trip, the default value is 1.67.
Average Daily Number of Passengers:					
Loss of Transit Services Cost:					
Impacts Due to Delay and/or Extra Travel Time and Miles for Alternate Transit Modes					
Additional Time per One-way Trip (Hours):					If the transit mode is a bus, the additional time per one-way trip is the additional time per one-way trip for the alternate transit mode. If the transit mode is a rail or ferry, the additional time per one-way trip is the additional time per one-way trip for the alternate transit mode.
Additional Travel Miles:					
Alternate Transit Mode (Rail, Ferry, Buses)			Other Alternate Transit Mode (Vehicles)		
Number of One-way Traffic Trips per Day (Rail/Ferry/Buses):			Number of One-way Traffic Trips per Day (Vehicles):		
Average Number of Passengers per Trip:			Average Number of Passengers per Vehicle:	1.67	The default value is 1.67 (passengers per vehicle).
Loss of Services Cost (Rail/Ferry/Buses):			Loss of Services Cost (Vehicles):		
Total Cost due to Interruption of Services:					
Total BCA Project Costs: Total Project Cost including O&M and Interruption of Services Loss:					This is the cost of the project.
<div style="display: flex; justify-content: space-between; font-size: small;"> Introduction TAB 1 - Tool Info TAB 2 - Project Info & Cost TAB 3 - Pre-Res Damages TAB 4 - Post-Res Damages TAB 5 - Summary </div>					

TAB 2 – Section IV: Project Cost Summary

Project Cost Summary

- The Total BCA Project Costs will be displayed at the bottom of Tab 2 and be used in the evaluation of the benefit-cost ratio (BCR).
- No additional inputs are required for Tab 2.
- Remember to **Save As New Project** (if you have not done so) before proceeding to Tab 3.

Cost of Loss of Services for Transit Passengers (\$/Passenger/Hour):	\$ 15.580				The default value is based on the current national average (see Appendix A) and is a selected value.
Current Federal Mileage Rate (\$/Mile):	\$ 0.560				The federal mileage rate is looked up on the internet.
Duration of Loss or Reduction of Services (Days):					
Impacts Due to Delay and/or Extra Travel Time for Transit Mode Under Project Construction					
Delay or Extra Travel Time (Hours):					If the transit mode is not a bus, the transit mode is assumed to be a bus. If the transit mode is a bus, the delay time is the delay time associated with the alternate transit mode.
Average Daily Number of Passengers:					For average daily number of passengers, see Appendix A.
Loss of Transit Services Cost:					For average daily number of passengers, see Appendix A.
Impacts Due to Delay and/or Extra Travel Time and Miles for Alternate Transit Modes					
Additional Time per One-way Trip (Hours):					If the transit mode is not a bus, the transit mode is assumed to be a bus. If the transit mode is a bus, the delay time is the delay time associated with the alternate transit mode.
Additional Travel Miles:					
Alternate Transit Mode (Rail, Ferry, Buses)			Other Alternate Transit Mode (Vehicles)		
Number of One-way Traffic Trips per Day (Rail/Ferry/Buses):			Number of One-way Traffic Trips per Day (Vehicles):		
Average Number of Passengers per Trip:			Average Number of Passengers per Vehicle:	1.67	The default national average is 1.67.
Loss of Services Cost (Rail/Ferry/Buses):			Loss of Services Cost (Vehicles):		
Total Cost due to Interruption of Services:			Total Cost due to Interruption of Services:		
Total BCA Project Costs: Total Project Cost including O&M and Interruption of Services Loss:			Total BCA Project Costs: Total Project Cost including O&M and Interruption of Services Loss:		

Ready | Introduction | **TAB 1 - Tool Info** | **TAB 2 - Project Info & Cost** | TAB 3 - Pre-Res Damages | TAB 4 - Post-Res Damages | TAB 5 - Summary

TABs 3 and 4 - General Notes: Entering Damage Information

TAB 3 – Pre-Resilience Damage: the current (as-is) situation

- Two basic options for inputting damage:
 - 1) Historic Damages, based on records from actual past disaster events
 - Need a minimum of one known RI event or three unknown RI events occurring in different years
 - 2) Expected Damages, based on damages predicted from a theoretical model or engineering analysis.
 - Need a minimum of one or more events with known RIs

TAB 4 – Post-Resilience Damage: residual damage (project effectiveness)

- Input damages based Expected Damages only

TABs 3 and 4 - General Notes: Entering Damage Information (continued)

Tab 3 and 4 Both Allow Input of the Following Damages (Unit 2):

- Physical Damages Costs – permanent repair/replacement
 - Fixed Structures - transit stations, tracks, maintenance facilities, substations
 - Rolling Stock – rail cars, buses, ferries
- Response and Recovery Costs – emergency repairs and other temporary measures
- Other Damage Costs – miscellaneous costs (debris, cleanup)
- Economic Impacts of Lost Transit Service (Non-Physical Damages) – service losses/delays, alternate transit, additional mileage

General Notes: Expected vs. Historic Damages

Historic vs. Expected Damage (Pre-Resilience)

- In **TAB 3, Section I**, select Expected Damages or Historic Damages from the drop-down menu.
- If you select “Historic Damages”, click the [GO TO HISTORIC DAMAGES](#) button to skip to the appropriate section. Otherwise, proceed with the Expected Damages questionnaire below.

The screenshot shows the 'Pre-Resilience Damages' interface. At the top, there are navigation buttons: 'Save Current Project' and 'Print This Tab'. To the right, a list of tabs is visible: TAB 1 - Tool Information, TAB 2 - Project Information & Cost Estimate, TAB 3 - Pre-Resilience Damages (highlighted), TAB 4 - Post-Resilience Damages, and TAB 5 - Analysis Results & Qualitative Benefits. Below the tabs, 'Section I - General Information' is displayed. The 'Analysis Year' is set to 2014, and the 'Damage Type' dropdown menu is open, showing 'Historic Damages' selected. A yellow callout box with a red border contains the text: 'You have selected Historic Damages. Click the link below to go to the Historic Damages section. Complete the questionnaire, and then enter data into Parts A, B, C, and D.' Below this box is a blue button labeled 'GO TO HISTORIC DAMAGES.'

The screenshot shows the 'Pre-Resilience Damages' interface. At the top, there are navigation buttons: 'Save Current Project' and 'Print This Tab'. To the right, a list of tabs is visible: TAB 1 - Tool Information, TAB 2 - Project Information & Cost Estimate, TAB 3 - Pre-Resilience Damages (highlighted), TAB 4 - Post-Resilience Damages, and TAB 5 - Analysis Results & Qualitative Benefits. Below the tabs, 'Section I - General Information' is displayed. The 'Analysis Year' is set to 2014, and the 'Damage Type' dropdown menu is open, showing 'Expected Damages' selected. A yellow callout box with a red border contains the text: 'You have selected Expected Damages. Click the link below to go to the Expected Damages section. Complete the questionnaire, and then enter data into Parts A and B.' Below this box is a blue button labeled 'GO TO EXPECTED DAMAGES.'

Below the callout box, 'Section II - Expected Damages' is displayed, starting with the 'Expected Damages Questionnaire'. The first question is: 'How many documented expected damage events do you have? (This may include Hurricane Sandy or some other large, catastrophic event)'. The second question is: 'For how many of these expected damage events do you know the Recurrence Intervals (RIs)?'. Below the questions, there is a red error message: 'Insufficient number of expected damage events of known RIs to conduct a valid analysis!'. Below the error message, there is a green warning message: 'Warnings: (must be corrected to proceed with analysis)'. Below the warning message, there is a yellow box with the text: 'Errors: (must be corrected to proceed with analysis)'. Below the errors box, there is a yellow box with the text: 'Warnings:'.

General Notes: Response and Recovery Costs

Response and Recovery Costs

- Enter the **Response and Recovery Costs** for each event.
 - Can include emergency protective measures (such as sandbags) and temporary repairs that can be avoided by the proposed project.
- Enter the four-digit year in which damages were calculated in **Base Year for Response and Recovery Estimation**.

Expected Damages Part A			
Response and Recovery Costs			
(includes costs of emergency protective measures and temporary repairs or measures that can be avoided by the proposed project)			
Physical Damages (Inflated to Analysis Year)	Response and Recovery Costs (\$)	Base Year for Response and Recovery Estimation (4-digit Year)	Response and Recovery (Inflated to Analysis Year)

General Notes apply to Expected and Historical Damages in Tab 3 and Post-Resilience Damages in Tab 4

TAB 3 – Section II: Pre-Resilience Expected Damages Questionnaire

Expected Damages Questionnaire – Number of Events, RIs

- After selecting Expected Damages in Section I, begin Section II by entering **How many documented expected damage events your have?** (This may include one or more catastrophic events of known RI) and **For how many of these expected damage events do you know the RIs?**

Section II - Expected Damages Expected Damages Questionnaire	
How many documented expected damage events do you have? (This may include Hurricane Sandy or some other large, catastrophic event.)	For how many of these expected damage events do you know the Recurrence Intervals (RIs)?
Errors: (must be corrected to proceed with analysis)	Insufficient number of expected damage events of known RIs to conduct a valid analysis!
Warnings: (must be addressed to conduct a valid analysis)	
Conclusions: (provide directions on analysis approach based on completed questionnaire)	A valid analysis cannot be conducted without at least one or more damage events of known RIs.
Source/Documentation of Expected Damages:	

TAB 3 – Section II: Expected Damages Questionnaire (continued)

Expected Damages Questionnaire – Rules on Number of Events, RIs

- You need between 1 and 12 expected damage events, and you must know the RI for each event to be included in your analysis.
- If your entries do not meet the criteria, then Errors, Warnings and/or Conclusions will appear.
 - **Errors** must be corrected to proceed with analysis
 - **Warnings** must be addressed to conduct a valid analysis
 - **Conclusions** provide directions on analysis approach
- Analyses based on one damage event of known RI are of limited accuracy and are not recommended.
- Analyses based on two or more expected damage events of known RIs are preferred, especially if one or more are based on Hurricane Sandy or some other large, catastrophic event

TAB 3 – Section II: Source of Expected Damages

Source/Documentation of Expected Damages

- Describe or list the **Source/Documentation of Expected Damages**
- Expected damages (including service losses) and event RIs may be documented using transit agency studies, DOT traffic studies, engineering reports or other sources (building damage functions from FEMA BCA or HAZUS-MH, FEMA flood hazard RI data, ASCE 7 wind RI data)
- Include copies of studies or reports with the source and methodology used to determine expected damages as separate attachments.

Section II - Expected Damages		Th
Expected Damages Questionnaire		Re
How many documented expected damage events do you have? (This may include Hurricane Sandy or some other large, catastrophic event.)	For how many of these expected damage events do you know the Recurrence Intervals (RIs)?	
Errors: (must be corrected to proceed with analysis)	Insufficient number of expected damage events of known RIs to conduct a valid analysis!	
Warnings: (must be addressed to conduct a valid analysis)		
Conclusions: (provide directions on analysis approach based on completed questionnaire)	A valid analysis cannot be conducted without at least one or more damage events of known RI.	
Source/Documentation of Expected Damages:		

Expected Damages Part A

TAB 3 – Section III: Pre-Resilience Historic Damages – Analysis Duration

Historic Damages – Analysis Duration

- After selecting Historic Damages in Section I, begin Section III by entering the 4-digit **Year Built** of the facility being protected to determine the Analysis Duration.
- Regardless of your entry for the Year Built, the Analysis Duration does not go back before 1908, and the calculations will use a Analysis Duration is 10 years.

Section III - Historic Damages	
Analysis Year :	2014
Year Built (4-digit Year):	
Analysis Duration (Years):	
User Input Analysis Duration (Years):	
Selected Analysis Duration (Years):	
Historic Damages Questionnaire	
How many documented historic damage events do you have? (This may include Hurricane Sandy or some other large, catastrophic event.)	For how many of these historic damage events do you know the Recurrence Intervals (RIs)?
Errors: (must be corrected to proceed with analysis)	Insufficient number of historic damage events of known RIs to conduct a valid analysis!
Warnings: (must be addressed to conduct a valid analysis)	
Conclusions: (provide directions on analysis approach based on completed questionnaire)	A minimum of one historic event of known RI or three historic events of unknown RI are needed to conduct a valid analysis.
Source/Documentation of Historic Damages:	

TAB 3 – Section III: Historic Damages – Analysis Duration Adjustments

Historic Damages – Number of Events, RIs

- Enter a **User Input Analysis Duration** in years if you choose to adjust the Analysis Duration from the duration based on the Year Built.
- User Input Analysis Duration may be used with supporting documentation for the following situations:
 - 1) Discontinuities in damage records
 - 2) Replacement of facility
 - 3) Change in local flow conditions
 - 4) Structure age is old or hard to determine (use 50 years)

Analysis Year :		2014
Year Built (4-digit Year):		
Analysis Duration (Years):		
User Input Analysis Duration (Years):		
Selected Analysis Duration (Years):		

NOTE: Significant documentation requirements apply for User Input Analysis Durations of less than 30 years

TAB 3 – Section III: Historic Damages Questionnaire

Historic Damages Questionnaire – Number of Events, RIs

- After selecting Historic Damages in Section I and determining the Analysis Duration, continue Section III by entering **How many documented historic damage events your have?** (This may include one or more catastrophic events of known RI) and **For how many of these historic damage events do you know the RIs?**

Section III - Historic Damages	
Analysis Year :	2014
Year Built (4-digit Year):	
Analysis Duration (Years):	
User Input Analysis Duration (Years):	
Selected Analysis Duration (Years):	
Historic Damages Questionnaire	
How many documented historic damage events do you have? (This may include Hurricane Sandy or some other large, catastrophic event.)	For how many of these historic damage events do you know the Recurrence Intervals (RIs)?
Errors: (must be corrected to proceed with analysis)	Insufficient number of historic damage events of known RIs to conduct a valid analysis!
Warnings: (must be addressed to conduct a valid analysis)	
Conclusions: (provide directions on analysis approach based on completed questionnaire)	A minimum of one historic event of known RI or three historic events of unknown RI are needed to conduct a valid analysis.
Source/Documentation of Historic Damages:	

TAB 3 – Section III: Historic Damages Questionnaire (continued)

Historic Damages Questionnaire – Rules on Number of Events, RIs

- You must have between 1 and 12 historic damage events that meet one of the following situations.
 - 1) At least 3 historic events with unknown RIs occurring in different years
 - 2) At least 1 (no more than 2) historic events with known RIs
 - 3) A combination of historic events with known and unknown RIs as described in situations 1) and 2), where the total values of the known RI events exceed the values of all unknown RI events
- Entries that do not meet the criteria will generate Errors, Warnings and/or Conclusions
 - **Errors** must be corrected to proceed with analysis
 - **Warnings** must be addressed to conduct a valid analysis
 - **Conclusions** provide directions on analysis approach

TAB 3 – Section III: Historic Damages Questionnaire (continued)

Historic Damages Questionnaire – Preferred Approaches

- As with expected damages, analyses based on one historic damage event of known RI are of limited accuracy and are not recommended.
- Analyses based on two historic events of known RIs are better, especially if one of the known historic event RIs is for Hurricane Sandy (or some other large, catastrophic event) and the other known historic event RI is based on a more frequently occurring event.
- Analyses based on three or more historic events with a combination of up to two known RIs are preferred, especially if one or more of the known historic event RIs is for Hurricane Sandy or some other large, catastrophic event and the other historic event RIs are based on more frequently occurring events.

TAB 3 – Section III: Source of Historic Damages

Source/Documentation of Historic Damages

- Describe or list the **Source/Documentation of Historic Damages**
 - Historic damages – including service losses - may be documented using disaster damage worksheets, insurance claims, repair records, news articles citing credible sources, transit agency statistics, maps, or annual reports
 - Historic event RIs may be documented using stream or tide gage data, FEMA FIS data, agency/expert determination, climatological data, rain gauge data, FEMA BCA information, or ASCE data
- Include copies of studies or reports with the source and methodology used to determine historic damages as separate attachments.

Historic Damages Questionnaire	
How many documented historic damage events do you have? (This may include Hurricane Sandy or some other large, catastrophic event.)	For how many of these historic damage events do you know the Recurrence Intervals (RIs)?
Errors: (must be corrected to proceed with analysis)	Insufficient number of historic damage events of known RIs to conduct a valid analysis!
Warnings: (must be addressed to conduct a valid analysis)	
Conclusions: (provide directions on analysis approach based on completed questionnaire)	A minimum of one historic event of known RI or three historic events of unknown RI are needed to conduct a valid analysis.
Source/Documentation of Historic Damages:	

Historic Damages Part A (Unknown Recurrence Intervals)

TAB 3 – Section III: Historic Damages and Service Losses with Known RIs

Historic Damages & Service Losses (Known RIs)

- Follow General Notes on Entering Damages to complete Historic Damages Part C (damages) and Part D (service losses)
- Remember if you start a row in Part C, you must enter values in every white cell in that row in Parts C and D, even if the value is 0.

Historic Damages Part C (Known Recurrence Interval)											
		Physical Damage Costs				Response and Recovery Costs			Other Damage Costs		
		(includes permanent repairs to damaged fixed structures and rolling stock)				(includes costs of emergency protective measures and temporary repairs or measures that can be avoided by the proposed project)			(enter description of other damages below)		
Damage Year (4-digit Year)	Known Recurrence Interval (Years)	Physical Damage Costs for Fixed Structures (\$)	Physical Damage Costs for Rolling Stock (\$)	Base Year for Physical Damages Estimation (4-digit Year)	Physical Damages (Inflated to Current Year)	Response and Recovery Costs that can be Avoided by Proposed Measures (\$)	Base Year for Response and Recovery Estimation (4-digit Year)	Response and Recovery (Inflated to Current Year)	Other Damage Costs (\$)	Base Year for Other Damages Estimation (4-digit Year)	Other Damages (Inflated to Current Year)

Historic Damages Part D (Known Recurrence Interval)											
Cost of Loss of Transit Services for Passengers (\$/Passenger/Hour):		\$	15.580								
Current Federal Mileage Rate (\$/Mile):		\$	0.560								
		Damages Due to Delay and/or Extra Travel Time for Passengers in Rail or Ferry Services					Damages Due to Delay and/or Extra Travel Time and Miles for Passengers in Buses				
Damage Year (4-digit Year)	Known Recurrence Interval (Years)	Delay or Extra Travel Time (Hours)	Average Daily Number of Passengers	Duration of Loss or Reduction of Rail or Ferry Services (Days)	Loss of Services Damages (Rail or Ferry)	Additional Time per One-way Trip (Hours)	Additional Travel Miles	Duration of Loss or Reduction of Services (Days)	Number of One-way Traffic Trips Per Day (Buses)	Average Number of Passengers per Bus	Loss of Services Damages (Buses)

TAB 4: Post-Resilience Damages

TAB 4 – Post-Resilience Damages

- Tab 4 in the HMCE Tool provides data on post-resilience damages
- Post-resilience damages are damages expected to occur after the resilience project design level of effectiveness been reached. For instance, if a project is designed to protect up to the 500-year event, there should be some post-resilience damages beginning at the 500-year event

Post-Resilience Damages

Save Current Project
Print This Tab

Click on a tab title to go directly to it:

- TAB 1 - Tool Information
- TAB 2 - Project Information & Cost Estimate
- TAB 3 - Pre-Resilience Damages
- TAB 4 - Post-Resilience Damages
- TAB 5 - Analysis Results & Qualitative Benefits

Section I - General Information

Applicant:	
Project Name:	

Section II - Post-Resilience Expected Damages

Post-Resilience Damages Part A

Physical Damages Costs				Response and Recovery Costs				Other Damage Costs			Total Part A Damages
(includes permanent repairs to damaged fixed structures and rolling stock)				(includes costs of emergency protective measures and temporary repairs or measures that can be avoided by the proposed project)				(enter description of other damages below)			
Recurrence Interval (Years)	Physical Damage Costs for Fixed Structures (\$)	Physical Damage Costs for Rolling Stock (\$)	Base Year for Physical Damages Estimation (4-digit Year)	Physical Damages (Inflated to Analysis Year)	Response and Recovery Costs (\$)	Base Year for Response and Recovery Estimation (4-digit Year)	Response and Recovery (Inflated to Analysis Year)	Other Damage Costs (\$)	Base Year for Other Damages Estimation (4-digit Year)	Other Damages (Inflated to Analysis Year)	

TAB 4: Post-Resilience Damages – Basic Guidance Assumptions

Post-resilience damages estimation guidance assumptions based on project type, design level of effectiveness, and pre-resilience damages:

- Acquisition/Relocation: Zero post-resilience damages
- Elevation: No post-resilience damages until design level of effectiveness is reached, then use minimum pre-resilience damages beginning at design level of effectiveness
- Flood barriers/Dry floodproofing: No pre-resilience damages until design level of effectiveness is reached, then apply pre-resilience damages that would occur at that flood level
- Wet floodproofing: Reduce pre-resilience damages to reflect reduced cleanup or downtime costs until design level of effectiveness is reached, then apply maximum pre-resilience damages that would occur for that flood level
- Other projects: Generally use no post-resilience damages until design level of effectiveness is reached, then either conservatively assume the maximum pre-resilience damages once the design level of effectiveness is reached or incrementally increase pre-resilience damages as RIs increase.

TAB 5 – Section IV: Final Results of BCA (Benefit-Cost Ratio)

Final Results of BCA: Expressed as a Benefit-Cost Ratio (BCR)

- BCR > 1.0 indicates the project is cost-effective
- BCR < 1.0 indicates that although the project is not considered cost-effective based on the quantitative information provided, it may be cost-effective based on a review of the qualitative information provided.
- A negative BCR (< 0.0) indicates the project is not effective at reducing damages and losses.

Remember: The BCR is one of seven factors that will be considered in grant proposal reviews; so a BCR less than 1.0 will not automatically remove a proposal from consideration

Analysis Results & Qualitative Benefits		Click on a tab title to go directly to it:	
Save Current Project	Print This Tab	Print Tabs 2 - 5	TAB 1 - Tool Information
			TAB 2 - Project Information & Cost Estimate
			TAB 3 - Pre-Resilience Damages
			TAB 4 - Post-Resilience Damages
			TAB 5 - Analysis Results & Qualitative Benefits
*Pre-Resilience Damages are based on Expected Damages.			
Section IV - Final Results of BCA			
Reduction in Annual Damages:			
Total Project Benefits:			
Total BCA Project Costs:			
Benefits Minus Costs:			
Benefit-Cost Ratio (BCR):			BCR is not evaluated.

TAB 5 – Section V: Qualitative Benefits

Qualitative Benefits

- Input **Qualitative Benefits of the Proposed Project** that are not reflected in the qualitative analysis portions of the tool
- Qualitative Benefits are other direct or indirect project benefits that cannot or have not been quantified in dollar value in other parts of the BCA, but would contribute to the general goal of sustainability of the facility or transit system to be protected.

Analysis Results & Qualitative Benefits		Click on a tab title to go directly to it:
Save Current Project	Print This Tab	TAB 1 - Tool Information
		TAB 2 - Project Information & Cost Estimate
	Print Tabs 2 - 5	TAB 3 - Pre-Resilience Damages
		TAB 4 - Post-Resilience Damages
		TAB 5 - Analysis Results & Qualitative Benefits
Benefit-Cost Ratio (BCR):		BCR is not evaluated.
Section V - Qualitative Benefits		
Qualitative Benefits of the Proposed Project:		
Average Loss of Transit Revenue (\$/day):		
Source/Documentation of Qualitative Benefits:		

TAB 5 – Section V: Average Daily Loss of Transit Revenue

Average Daily Loss of Transit Revenue

- Enter the estimated **Average Loss of Transit Revenue** to the transit agency in dollars per day due to a shutdown of the transit line or asset to be mitigated by the proposed resilience project.
- This input allows for accounting of lost revenue to the transit line and associated businesses due to a transit line shutdown.

Section V - Qualitative Benefits	
Qualitative Benefits of the Proposed Project:	These are other direct value in other parts of the transit system to be listed above. You may include lost revenue due to a shutdown.
Average Loss of Transit Revenue (\$/day):	Input the estimated amount of revenue lost to be mitigated by the project.
Source/Documentation of Qualitative Benefits:	

Navigation: Introduction | **TAB 1 - Tool Info** | TAB 2 - Project Info & Cost | TAB 3 - Pre-Res Damages | TAB 4 - Post-Res Damages | TAB 5 - Analysis Results

Ready

TAB 5 – Section V: Source of Qualitative Benefits

Source/Documentation of Qualitative Benefits

- Describe or list the **Source/Documentation of Qualitative Benefits**
 - Qualitative benefits may be documented using many of the sources listed for other damages and losses in the HMCE Tool, as well as non-engineering studies of societal and economic impacts
- Include copies of studies or reports with the source and methodology used to determine historic damages as separate attachments.

Section V - Qualitative Benefits		
Qualitative Benefits of the Proposed Project:		These are other direct value in other parts of transit system to be listed above. You may factors include lost re shutdown.
Average Loss of Transit Revenue (\$/day):		Input the estimated mitigated by the prop
Source/Documentation of Qualitative Benefits:		

Ready | Introduction | TAB 1 - Tool Info | TAB 2 - Project Info & Cost | TAB 3 - Pre-Res Damages | TAB 4 - Post-Res Damages | TAB 5 - Analysis Results

Questions and Answers