JOB AID 5-1: CONFLICTS AND RESOLUTIONS TOOL

Job Aid 5-1 provides information to help you to consider the possible synergy between mitigation options across hazards, as well as potential conflicts for the particular combination of hazards that you face. It is intended to provoke thought and design integration, but does not provide absolute restrictions or recommendations. In general, reinforcement between hazards may be gained, and undesirable conditions and conflicts can be resolved, by coordinating mitigation measures and consulting your community experts. You are encouraged to use the list as a basis for discussion relative to specific projects and to structure the evaluation of the benefits and conflicts of multi-hazard design depending on local hazards. The vertical columns show the three primary hazards. Columns are also included for the blast and fire hazards as these hazards also have pertinence for structural mitigation. The horizontal rows show methods of protection for the building systems and components that have significant interaction, either desirable (reinforcing) or undesirable (conflicting).

Key	
✔	Indicates desirable condition or method for designated component/system
✘	Indicates undesirable condition or method for designated component/system
❑	Indicates little or no significance for designated component/system
	Split box indicates significance may vary, see Discussion Issues

Building System Protection Methods: Reinforcements and Conflicts							
System ID	Existing Conditions or Proposed Protection Methods	The Hazards					
		Earth-quake	Flood	Wind	Security/Blast (FEMA 428)	Fire	Discussion Issues
1	Site						
	1-1 Building elevated on fill	❑	✔	❑	❑	❑	Excellent solution for flood.
	1-2 Two means of site access	✔	✔	✔	✔	✔	Provides positive protection across hazards.
	1-3 In close proximity to other facilities that are high-risk targets for attack	❑	❑	❑	✘	❑	Presents a high risk for blast hazard; can present a somewhat increased risk for fire and earthquake damage.

Building System Protection Methods: Reinforcements and Conflicts (continued)							
System ID	**Existing Conditions or Proposed Protection Methods**	**The Hazards**					
		Earth-quake	Flood	Wind	Security/Blast (FEMA 428)	Fire	Discussion Issues
2	**Architectural**						
2A	Configuration						
	2A-1 Large roof overhangs	✘	❑	✘	✘	❑	Possibly vulnerable to vertical forces in earthquake, uplift wind forces.
	2A-2 Re-entrant corner (L-, U-shape, etc.) building forms	✘	❑	✘	✘	❑	May concentrate wind or blast forces; may cause stress concentrations and torsion in earthquakes.
	2A-3 Enclosed courtyard building forms	✘	❑	✔	✔ ✘	❑	May cause stress concentrations and torsion in earthquakes; courtyard provides protected area against high winds.
	2A-4 Very complex building forms	✘	✘	✘	✘	✘	May cause stress concentrations and torsion in highly stressed structures. Complicates flood resistance by means other than fill.

Building System Protection Methods: Reinforcements and Conflicts (continued)								
System ID	Existing Conditions or Proposed Protection Methods	The Hazards						
		Earth-quake	Flood	Wind	Security/Blast (FEMA 428)		Fire	Discussion Issues
2B	Planning and Function (No significant impact)							
2C	Ceilings (No significant impact)							
2D	Partitions							
	2D-1 Block, hollow clay tile partitions	✘	✔	✘	✘		✔	Wind and seismic force reactions would be similar for heavy unreinforced wall sections, with risk of overturning.
	2D-2 Use of non-rigid connections for attaching interior non-load bearing walls to structure	✔	❑	✔	✔		✘	Non-rigid connections are necessary to avoid partitions influencing structural response.
	2D-3 Gypsum wallboard partitions	✔	✘	❑	✘		✘	Such partitions can be more easily damaged or penetrated during normal building use.
	2D-4 Concrete block, hollow clay tile around exit ways and exit stairs	✘	❑	❑	✘	✔	✔	May create torsional structural response and/or stress concentration in earthquakes in frame structures unless separated and, if unreinforced, wall is prone to damage.

Building System Protection Methods: Reinforcements and Conflicts (continued)								
System ID	Existing Conditions or Proposed Protection Methods	The Hazards						
		Earth-quake	Flood	Wind	Security/Blast (FEMA 428)	Fire		Discussion Issues
2E	Other Elements							
	2E-1 Heavy roof (e.g., slate, tile)	✘	❑	✘	✘	✘	✔	Hea vy roofs are undesirable in earthquakes; slates and tiles may detach. Almost always used on steep-sloped roofs; if wind-blown debris hits them, they become flying debris and dangerous to people outside the building.
	2E-2 Parapet	✘	✔	❑	✔	✘	✔	Properly engineered parapet is OK for seismic; unbraced unreinforced masonry (URM) is dangerous.
3	Structural Systems							
	3-1 Heavy structure: reinforced concrete (RC) masonry, RC or masonry fireproofing of steel	✘	✔	✔	✔	✔		Increases seismic forces, but generally beneficial against other hazards.
	3-2 Light structure: steel/ wood	✔	✘	✘	✘	✘		Decreases seismic forces, but generally less effective against other hazards.
	3-3 URM exterior load bearing walls	✘	✘	✘	✘	✘		
	3-4 Concrete or reinforced CMU exterior structural walls	✔	✔	✔	✔	✔		
	3-5 Soft/weak first story	✘	✘	✔	✘	✘		Very poor earthquake performance. Generally undesirable for flood and wind. Elevated first floor is beneficial for flood if well constructed, but should not be achieved by a weak structure that is vulnerable to wind or flood loads.

Building System Protection Methods: Reinforcements and Conflicts (Continued)							
System ID	Existing Conditions or Proposed Protection Methods	The Hazards					
		Earth-quake	Flood	Wind	Security/Blast (FEMA 428)	Fire	Discussion Issues
	3-6 Indirect load path	✘	❑	✘	✘	✘	Undesirable for highly stressed structures. Not critical for floods.
	3-7 Discontinuities in vertical structure	✘	❑	✘	✘	✘	Undesirable for highly stressed structures, causes stress concentrations. Not critical for floods.
	3-8 Seismic separation joints	✔	❑	❑	❑	✘	Possible path for toxic gases to migrate to other floors.
	3-9 Ductile detailing and connections/steel	✔	❑	✔	✔	❑	Provides a tougher structure that is more resistant to collapse.
	3-10 Ductile detailing/RC	✔	❑	✔	✔	❑	Provides a tougher structure that is more resistant to collapse.
	3-11 Design for uplift (wind)	✔	❑	✔	✔	❑	Necessary for wind; may assist in resisting seismic or blast forces.
	3-12 Concrete block, hollow clay tile around exit ways and exit stairs	✘	❑	❑	✘	✔	May create torsional structural response and/or stress concentration in earthquakes in frame structures unless separated, and if unreinforced wall is prone to damage.

Building System Protection Methods: Reinforcements and Conflicts (coninued)							
System ID	Existing Conditions or Proposed Protection Methods	The Hazards					
		Earth-quake	Flood	Wind	Security/Blast (FEMA 428)	Fire	Discussion Issues
4	**Building Envelope**						
4A	Wall Cladding						
	4A-1 Masonry veneer on exterior walls	✘	✘	✘	✘	❑	In earthquakes, material may detach and cause injury. In winds, may detach and become flying debris hazard. Flood forces can separate veneer from walls.
4B	Glazing						
	4B-2 Impact-resistant glazing	❑	❑	✔	✔	✘	Can cause problems during fire suppression operations, limiting access and smoke ventilation.
	4B-1 Metal/glass curtain wall	✔	❑	✘	✘	✘	Light weight reduces earthquake forces.
5	**Utilities** (No significant impact)						
6	**Mechanical**						

Notes:
The table refers to typical school structures: steel frame, concrete block or RC walls, wood frame, 1-2 stories suburban, 2-4 stories urban.

JOB AID 5-2: SUMMARY OF DMA REQUIREMENTS AND HAZUS-MH SUPPORT

Step and Related DMA 2000 Requirement(s)	Outputs from HAZUS-MH, How-To-Guide, and Risk Assessment Tool	Application to Mitigation Plan
INTRODUCTION		
Planning process description and plan adoption process	Worksheet 1: risk assessment team	This output helps to illustrate the types of persons who supported the risk assessment portion of your planning process. Accompanying text can explain how these parties were involved in your planning process.
STEP 1: IDENTIFY HAZARDS		
Geographic region description	Base map with local GIS data overlain in HAZUS-MH	Your base map can be used to help illustrate the area being addressed in your hazard mitigation plan. The Risk Assessment Tool (RAT) will also produce a map of your study region (see Appendix F for a list of RAT outputs).
Overview and descriptions of hazards of concern in your area	Worksheet 1-1, Identify Hazards	This worksheet can be used to summarize the results of your initial hazard identification and initial data sources used. Accompanying text will explain how this list was developed using available resources and the professional knowledge of your risk assessment team.
STEP 2: PROFILE HAZARDS		
Overview and descriptions of hazards	Worksheet 2-1 and HAZUS-MH provided hazard event data	Worksheet 2-1 supports profiling efforts and can be used to document the total hazards considered and those carried forward for further study.
	Worksheet 2-2 and hazard maps	Worksheet 2-2 should be completed for each hazard retained on Worksheet 2-1. These worksheets combined with any attached hazard area maps and other figures to describe the hazard serve as the hazard profile and will help you address the same types of data for each hazard.
	Worksheet 2-3 with prioritized hazards	This worksheet helps you document your preliminary ranking of hazards based on your profile efforts. Accompanying text will help explain your team's ranking approach and results.

Step and Related DMA 2000 Requirement(s)	Outputs from HAZUS-MH, How-To-Guide, and Risk Assessment Tool	Application to Mitigation Plan
STEP 3: INVENTORY ASSETS		
Overview and analysis of vulnerability; description of important and critical areas	Updated HAZUS-MH data • General building stock • Demographic data • Critical facilities • Lifeline utility and transportation systems	These data serve as your inventory for the risk assessment. You can use HAZUS-MH to create tables and maps of inventory to support your plan.
	Worksheets 3-1, 3-2, and 3-3 • Building value • Content value • Demographic data • Lifeline utility and transportation systems	These worksheets summarize the inventory data for the risk assessment. Your plan text should describe this data and also should address development trends that may increase or decrease inventory within your study area and discuss how these trends relate to your hazards of concern.
STEP 4: ESTIMATE LOSSES		
Overview and analysis of potential losses; review of loss estimates	Analysis type, scenario inputs	Text in your plan should describe the analyses and inputs selected for this risk assessment. Review hazard characteristic data used, mean return periods selected, hazard areas used to estimate exposure and other factors, as appropriate.
	HAZUS-MH outputs (Models, Risk Assessment Tools, Flood Wizard)	These outputs can be used to support plan development. Specifically, the RAT provides summary text, tables and maps designed to support your DMA plan.

Step and Related DMA 2000 Requirement(s)	Outputs from HAZUS-MH, How-To-Guide, and Risk Assessment Tool	Application to Mitigation Plan
STEP 5: CONSIDER MITIGATION OPTIONS		
Mitigation strategy (basis)	Use the HAZUS-MH Risk Assessment Tool (RAT) to produce various risk assessment maps, graphics, and data that can be directly used in your mitigation plan.	As stated for Step 4, the RAT provides outputs to support your plan. These outputs also serve as the foundation to begin identifying mitigation goals, objectives, and actions as discussed in Step 4.
Mitigation strategy (foundatrion and focus for mitigation actions)	Worksheets 5-1A and 5-1B	These worksheets can be used in your mitigation strategy to support documentation of mitigation focus areas and options for the built environment.
Mitigation strategy (assessment)	Worksheet 5-2	This worksheet will help you document the option evaluation process for FEMA - recommended evaluation criteria and your community's particular criteria and mitigation priorities.
Mitigation strategy (action plan)	Worksheet 5-3	The consolidated list of options and accompanying text will support documentation of your basis for retaining particular mitigation options for implementation. This supports your mitigation action plan.