AIA

Hazard and Climate Risk: a user's guide and form for acknowledging risk

Introduction

The best time to incorporate this document into your client discussions is as soon as possible: during pre-design or preferably in the development stage prior to site selection. Ideally, an integrated design team meeting would explore project risks and opportunities alongside sustainability goals. Discuss with the team the level of detail that is recommended given the criticality of the building and general hazard exposure of the site and its surroundings. Firms may feel more comfortable utilizing this document after a conversation with their professional liability insurance provider. This User's Guide provides additional context and considerations, reference material, and talking points for completing and discussing the Hazard and Climate Risk Acknowledgement Form. When completed, the form will represent a snapshot in time based on the referenced, currently available data and will not account for ongoing or future development and environmental condition changes.

Section 1

Estimated building service life; design date

Hazard and climate risk is innately tied to a time scale. Document the anticipated service life for the building to inform hazard event probability. The service life of the building may be longer than the current client plans to own and operate the building. While most assets are designed with a 20–25-year useful service life, the average service life[1] of a building is 80 years. Choose a "design date" or year to establish future conditions for which the building will be designed to accommodate.

Example:
50-year service life; design date 2075

Resources:
Building Component Lifespans by Carbon Leadership Forum
ISO 15686 Buildings and Constructed Assets—Service Life Planning

Section 2

Primary source(s) of hazard risk identification

A primary source of hazard[2] information is likely the hazard mitigation plan[3] associated with the lowest level of government for the project location (city, county, or state plan). Hazard mitigation plans and other regulations typically identify observed risk as opposed to expected risk. A similar approach can be applied for climate change conditions by referring to local, state, or national climate change projections, adaptation plans, or risk models. These plans may reference a variety of

1 rdh.com/blog/long-buildings-last/
2 A *hazard* is the potential occurrence of a natural or human-induced physical event that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, and environmental resources. [IPCC]
3 Hazard mitigation plans are developed by state, county, local, and tribal governments and can be referenced by design teams to understand observed hazard risk.

maps, plans, or data sets, and these can be specified in the hazard risk profile matrix. For project-specific data, *a site or building vulnerability assessment* can be performed to identify impacts to the site/building from a given hazard scenario.

Resources:
State hazard mitigation planning requirements
FEMA Hazard Mitigation Plan Status
The National Risk Index

Section 3

Hazard risk profile

The hazard risk profile format will vary by jurisdiction but will include hazard identification, assets, risk analysis, and a summary of vulnerability.

Hazard type	Magnitude	Notes	Risk rating	Source/date
Watershed Flooding	.2% (500-year)	Special flood hazard "A" BFE is to be determined Potential for dam failure	Moderate	FIRMette; August, 19, 2020
Tornado		This is a low-probability/ high consequence event.	Moderate	NOAA/ NWS/Storm Prediction Center
Earthquake		Shaking; 10% chance of exceeding in 50 years	High	Seattle Hazard Explorer; November, 10, 2020
Liquefaction		Geotechnical assessment required	High	GIS map

Hazard type – Natural and human-caused hazards to be identified include, but are not limited to:

Atmospheric Climate and weather-related hazards	Flood, extreme rain event, flash flooding, ground saturation, severe storm (wind, rain, lightning, hail, severe winter weather), snow, ice, freezing temperatures, avalanche, hurricane, typhoon, tropical cyclone, storm surge, sea-level rise, tornado, wildfire, extreme heat, drought, avalanche, derecho
Geologic Geologic and seismic hazards	Earthquake, tsunami/seiche, volcanic eruption/lahar, landslide, mudflow/debris flow, liquefaction, land subsidence/sink hole/trough
Technological & anthropogenic Human-caused hazards	Power outage, fires, explosion, urban flooding, war, terrorism, civil unrest, infrastructure failure (grid failure, satellite/wireless failure, water supply failure, sewer system failure, levee failure, dam and bridge collapse, mine subsidence/collapse, structural failures), hazardous materials (HAZMAT) event, environmental pollution (air, water, soil, nuclear accident), sea-level rise, earthquakes due to certain fracking wastewater injection
Biological + pathogenic Global public health	Global pandemics, local outbreaks of deadly diseases, seasonal resurgences, biological contamination of shared water/air/soil resources, insect/reptile/rodent invasion, etc.

Notes section of hazard risk profile

The notes section may include additional information from authoritative sources such as:

- **Scenario** associated with risk (e.g., 100-year flood [1% chance of annual occurrence] or 500-year flood [0.2% chance of annual occurrence]) such that likely scenarios and maximum-risk scenarios are distinguished.
- **Probability** of a future hazard event to understand the characteristics of the most significant risks.
- **Expected frequency** of a given hazard event. Hazards can be ranked according to maximum credible scenario or most likely scenario.
- **Impact** (or consequences) to the building, including cascading effects.[4]
  This can include frequency, geographic extent, duration, health effects, displacement and suffering, and economic effects.

4 Cascading effects are the dynamics present in disasters in which the impact of a physical event or the development of an initial technological or human failure generates a sequence of events in human subsystems that result in physical, social, or economic disruption. Thus, an initial impact can trigger other phenomena that lead to consequences with significant magnitudes.

Risk rating summarizes vulnerability by ranking the identified hazards according to the impact of the hazard event, probability of occurrence, amount of warning time before a hazard event, duration of the hazard event, and cascading effects. This information is to be copied from the authoritative plans and resources. The format and inputs will vary from plan to plan but should result in the ability to assess low to high risks and conduct a discussion with the client and design team. The client confirms the highest priority hazard risks.

Source and date of authoritative documents referenced for climate and hazard risk data, including locally approved plans, data, and maps. Prioritize locally sourced data. Note the publication date of each source. Your state or local jurisdiction may provide customized risk information.

Note that hazard exposure is constantly changing, and not just climate change. For example, earthquakes release pressure and reduce future earthquake risk. Building development reduces soil permeability and therefore increases surrounding flood risk.

Resources:
FEMA Flood Map Service Center: Search by Address
USGS Maps and Data
The Climate Explorer

Section 4

Future climate conditions, based on design year and mid-to-high-risk future climate scenarios

Reference the hazard mitigation plan or climate risk/adaptation plan for future climate conditions. This could be a comparison of current and future temperature changes and precipitation changes and which hazard events are most likely to change and in what ways. Because model codes reflect historic data, future climate conditions are assessed in correlation to a projected service life. Deciding which climate scenario to use may be a question and should be directed by the client. Typically, the mid-range scenario (RCP 4.5) and high future scenario (RCP8.0) are more useful than the low scenario. So let's say your design year is 2100 (80-year life cycle), you would be able to say that the range of high temperature was around +1.4–4.8° F based on those scenarios globally. The Climate Explorer has regional U.S. data to help you complete this. A maximum rain event can be thought of as either or all of the following: maximum one-hour volume, maximum two-day event, maximum five-day event, or some variation thereof. The architect should clearly explain that this future conditions analysis will be based on authoritative sources and the data provided by those entities.

Resources:
National Climate Assessment
Climate Science Special Report
U.S. Climate Resilience Toolkit

Section 5

Project resilience performance requirements

Similar to a traditional code analysis, use this section to document regulations affecting the new or existing building. Depending on the knowledge level of the client, a discussion on the opportunities and limitations of the building code may be desirable to clarify that building codes are intended to protect life safety, not property. By understanding the protection and performance afforded by applicable regulations, the owner can decide on risk tolerance, continuity of operations, functional recovery targets, and desired performance.

- **Building Risk Category**: Per the International Building Code – 2018 IBC Section 1604.5 Risk Category, Table 1604.5 and ASCE 7, Table 1.5-1.
- **For existing buildings**: Document the code enforced at the time of original construction and substantial alterations, if any. This information, even without destructive testing, can illuminate general expectations for building performance.
- **Local building and zoning codes**: Document the applicable local codes and any amendments that strengthen or weaken the model code. Some jurisdictions have made certain sections of the code optional. Confirm that local modifications that lessen the effectiveness of the code are understood by the client.
- **Local overlay district**: Note any special cultural, historical, or environmental overlays within the applicable zoning ordinance, including covenants, campus master plan, or similar, that apply to this site.
- **Current model code version**: The locally enforced code may not be the most current edition of the model codes. Document the most recently published model codes so the client is aware of the most current, comprehensive, and coordinated codes.
- **Other applicable state/local resilience regulations**: This may include critical areas such as waterfront, steep slopes, and habitat. For example, is an environmental impact statement required?
- **Describe owner’s performance-based requirements** (e.g., resilience requirements): In addition to meeting the code minimum, discuss what the owner’s acceptable risk is for financial, legal, brand, and operational impacts that may stem from a disruption. Consider business continuity, post-disaster reoccupancy, and *functional recovery*.[5] Specific client-identified project design requirements can be included elsewhere in the contract, such as in the E204-2017 Sustainable Projects Exhibit, which documents building performance objectives.

Conduct a meeting to review this document. Discuss risk and professional liability. Ensure that the client is engaged and in agreement with the information documented and priorities established. Understand and discuss how this document informs and fits with other contractual obligations. Explore risk transfer options for insuring the building.

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5 Functional recovery is a performance state in which a building is maintained, or restored, to safely and adequately support the basic intended functions.

Resources:
FEMA Nationwide Building Code Adoption Tracking
FEMA 452: Risk Assessment
NIST-FEMA Recommended Options for Improving the Built Environment for Post-Earthquake Reoccupancy and Functional Recovery Time

Section 6

Project team acknowledgement

Provide a space for each team member to confirm that this document was received, discussed, and read. A list of typical project team members is provided in the form. Augment this section to include the full project team. Additional project team members may include: *archaeologist, historic preservation, risk management consultant, hazardous materials consultant, surveyor, geotechnical engineer, environmental consultant, etc.*

Other resources
AIA Architect's Guide to Business Continuity
AIA Hazard Mitigation Design Resources
AIA Climate Change Adaptation Design Resources
AIAU Resilience and Adaptation Online Certificate Program
Good citizenry and good business: Minimizing risk when designing for climate change

Hazard and Climate Risk Acknowledgement Form

Introduction

Buildings and communities are subjected to the destructive forces of natural and human-caused disasters. AIA supports policies, programs, and practices that promote adaptable and resilient buildings and communities. Architects design projects that reduce harm and property damage, adapt to evolving conditions, and more readily, effectively, and efficiently recovery from adverse events. Assessing risk is the first step in the design process and informs programmatic and building-performance requirements. Risk is constantly evolving, especially with a changing climate, and depends upon the behaviors and function of several interrelated components. AIA's Code of Ethics on climate change *calls upon members to incorporate adaptation strategies with their clients to anticipate extreme weather events and minimize adverse effects on the environment, economy, and public health*. To meet this charge, architects must rely on authoritative sources of climate data and present this information to their clients and project team. It is the client's responsibility to determine the Owner's Project Requirements. When clients and design teams are mutually aware of hazard and climate risk, they become empowered to make informed choices.

This document is for conversation purposes and will allow the architect and the client to reach and document a mutual understanding of the hazard and climate risk that will inform project requirements. It is not a substitute for a building or site vulnerability assessment. Further, this document represents a snapshot in time based on the referenced, currently available data and does not account for ongoing or future development and environmental condition changes.

Project details

1. Estimated building service life; design date ________________________________

2. Primary source(s) of hazard risk identification ______________________________

3. Hazard risk profile

Hazard type	Magnitude	Notes	Risk rating	Source and date

4. Future extreme conditions, based on design date and mid-to-high-risk future climate scenarios:

   a. Estimated range of high temperature; estimated cooling degree days

   b. Estimated range of low temperature; estimated heating degree days

   c. Estimated maximum annual precipitation; max rain event

   d. Estimated minimum annual precipitation

   e. Notes on climate change impacts

5. Project resilience performance requirements:

   a. ICC building risk category

   b. For existing buildings, the code enforced for original construction and substantial alterations

   c. Local building and zoning codes

   d. Local overlay district, if any

   e. ICC current model code

   f. Other state/local resilience regulations

g. Describe performance-based requirements (e.g., resilience requirements; note that these will be further defined elsewhere in the contract)

6. Project team acknowledgement: List each project team member company name and contact; provide a signature and date. Your project team might include:

Client

Architect

Civil engineer

Structural engineer

Mechanical engineer

Electrical engineer

Plumbing engineer

Landscape architect

Lender(s)

Owner's insurance broker

Owner's provided consultants

Other

At this time are additional consultants, studies, or information recommended or required to further understand project risks? Note: throughout the project process, additional consultation or service needs may be identified.

Acknowledgements

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With the 2021 AIA Risk Management Committee