Resilient Project Process Guide

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AIA

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Introduction

We are in a climate emergency. The earth is experiencing a period of dramatic change, resulting in climate system impacts to temperature, sea level, storms, wildfires, food production, and human conflict. Population growth, aging infrastructure, and other social and economic conditions also place strain on the built environment. Compounding the problem, earthquakes, tornados, and other natural hazards continue unabated.

This crisis underscores the need for a resilient and climate-adaptive built environment. Architects have a critical role in designing a future that can withstand sudden shocks and chronic stresses. The profession has the power to address resilience challenges by understanding project risks and vulnerabilities, advising clients about climate-adaptive alternatives, supporting performance goals through the design phase, implementing them in construction, and leading stakeholder engagement efforts throughout. During this process, architects create projects that transform the lives of their clients, building occupants, and their communities and prepare for the future.

WHAT ARE RESILIENT AND CLIMATE-ADAPTIVE PROJECTS?

A resilient project is one that has the ability to resist, absorb, accommodate, and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.[1] Climate-adaptive architecture adjusts in response to a new or changing environment that exploits beneficial opportunities or moderates negative effects.[2] Resilient thinking is the foresight to see how changes might affect the built environment and respond with designs that accommodate or recover from the effects of a hazardous event in a timely and efficient manner. Architects have unique capabilities to transform the built environment so that it safeguards people and communities.

The Resilient Project Process Guide outlines a design approach for integrating resilience and climate adaptation into projects that is rooted in the Fundamentals of Resilient and Climate Adaptive Design. The Fundamentals of Resilient and Climate Adaptive Design includes eight design attributes to reduce harm and property damage, adapt to evolving conditions, and more readily, effectively, and efficiently recover from adverse events.

[1] United Nations International Strategy for Disaster Reduction, UNISDR Terminology on Disaster Risk Reduction, 2009. preventionweb.net/files/7817_UNISDRTerminologyEnglish.pdf

[2] U.S. Global Change Research Program, Glossary. globalchange.gov/climate-change/glossary

THE FUNDAMENTALS OF RESILIENT & CLIMATE ADAPTIVE DESIGN

Duany Plater-Zyberk & Company + AIA

At the foundation of resilient and climate-adaptive design are three critical questions to ask on every project:

1. What are the hazard and climate projections for this site?
2. What are the vulnerabilities based on the projections and the cascading consequences, meaning the ways in which the people and the built environment are susceptible to adverse effects?
3. What are the design solutions that address hazard and climate projections and vulnerability?

Adapting to change is embedded in an architect's design process. The AIA Code of Ethics and Professional Conduct references, among other considerations, the role of the architect in addressing equity and justice, climate change, and adaptation.[3] These commitments underpin the architect's work in protecting the health, safety, and welfare of the public. This obligation is also reflected in the state laws that govern an architect's work.

As more architects integrate resilience into the design process, architects may incorporate more stringent requirements for occupant safety and building performance. There is growing concern within the design community that architects and other design professionals need to be mindful of potential liability issues relative to whether climate impacts are reflected in the design of the built environment. The release of each new Intergovernmental Panel on Climate Change report and the quadrennially updated National Climate Assessment increases such foreseeability, and, as a result, design professionals should design for climate change.

Clients may not understand the critical importance of incorporating the efforts that make a project more climate adaptive, as these measures may compromise their project vision or affect the capital improvements budget. As architects marshal the creativity and courage necessary to advance climate action, firm leadership must articulate their commitment to apply consistency across their portfolio of projects. Architects are charged with protecting public safety, and if the client's project site or program challenges the tenets of responsible practice, the architect may choose to withdraw from a project.

[3] Code of Ethics and Professional Conduct Standards 2.4 Environmental Equity and 6.5 Climate Change address the Institute's position. content.aia.org/sites/default/files/2020-12/2020_Code_of_Ethics.pdf

RESOURCES FOR RESILIENT AND CLIMATE-ADAPTIVE DESIGN

AIA is committed to a zero-carbon, equitable, resilient, and healthy built environment as defined in the Framework for Design Excellence. The framework represents the principles of good design and is intended to be accessible and relevant to every architect, every client, and every project. It establishes the starting point of the architect's journey to harness the power of design to contribute solutions that address the most significant needs of our time.

The Resilient Project Process Guide builds on the Framework for Design Excellence by exploring a series of questions intended for architects to initiate conversations with clients, colleagues, occupants, and the community. When integrated into the design process, these questions help architects and their clients make informed decisions in an era of rapid change.

AIA FRAMEWORK FOR DESIGN EXCELLENCE

MEASURE 1
Design for integration

MEASURE 2
Design for community

MEASURE 3
Design for ecology

MEASURE 4
Design for water

MEASURE 5
Design for economy

MEASURE 6
Design for energy

MEASURE 7
Design for wellness

MEASURE 8
Design for resources

MEASURE 9
Design for change

MEASURE 10
Design for discovery

The Resilient Project Process Guide addresses climate adaptation as well as other shocks[4] and stresses, such as:

- **geophysical**
  earthquakes, landslides, tsunamis, volcanic activity
- **hydrological**
  avalanches, floods, sea-level rise
- **climatological**
  extreme temperatures, drought, wildfires
- **meteorological**
  hurricanes, storms/wave surges
- **biological**
  disease epidemics, insect/animal plagues
- **technological**
  cyber-attacks, industrial accidents, transport accidents
- **geopolitical**
  conflicts, famine, displaced populations
- **social**
  population growth, aging
- **environmental**
  contamination, degradation, habitat loss
- **economic**
  affordability, unemployment, inequity

[4] https://www.aia.org/resources/164876-designing-for-resilience--architects-addres:56

The Resilient Project Process Guide is an advanced-level resource within the AIA resources around resilience and adaptation, which supports progress toward a resilient built environment. The resource elements are listed below in order of complexity, including resources for exploring new ideas, opportunities to learn more, and guides for action. The Resilient Project Process Guide is in the third tier, building on the resources that facilitate exploration and learning.

Explore

- Understanding Resilience
- Shocks & Stresses
- Fundamentals of Resilient & Climate Adaptive Design
- How to integrate resilience into your practice
- What architects need to know about hazard and climate risk
- Fourth National Climate Assessment (NCA4)

Learn

- Resilience & Adaptation Certificate Series
- Hazard Mitigation Design Resources
- Climate Change Adaptation Design Resources
- Community Resilience Design Resources

Act

- Architect's Guide to Business Continuity
- Risk Awareness Template Letter
- Resilience Project Process Guide

USEFUL TERMINOLOGY

Capacity The combination of all the strengths, attributes, and resources available to an individual, community, society, or organization, which can be used to achieve established goals. (IPCC)

Cascading effects Events that occur as a direct or indirect result of an initial event. For example, if a flash flood disrupts electricity to an area and, as a result of the electrical failure, a serious traffic accident involving a hazardous materials spill occurs, the traffic accident is a cascading event. (FEMA)

[Climate change] adaptation The adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. (IPCC)

[Climate change] mitigation A human intervention to reduce the sources or enhance the sinks of greenhouse gases that reduce hazard, exposure, and vulnerability. (IPCC)

Design-basis event An event scenario used to establish the acceptable performance requirements of the structures, systems, and components, such that it can withstand the event and not endanger the health or safety of the occupants or the wider public. (Adapted from the U.S. Nuclear Regulatory Commission)

Exposure The presence of people; livelihoods; environmental services and resources; infrastructure; or economic, social, or cultural assets in places that could be adversely affected. (IPCC)

Functional recovery [time] Performance state in which a building or lifeline infrastructure system is maintained, or restored, to safely and adequately support the basic intended functions associated with the pre-[event] use or occupancy of a building, or the pre-[event] service level of a lifeline infrastructure system. (FEMA)

Hazard 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)

USEFUL TERMINOLOGY CONTINUED

Hazard mitigation The lessening of the potential adverse impacts of physical hazards (including those that are human-induced) through actions that reduce hazard, exposure, and vulnerability. (IPCC)

Recovery time objective The prioritized time frame for resuming disrupted activities at a specified minimum acceptable capacity. The time frame should be less than the maximum tolerable period of disruption. (ISO 22301)

Resilience The ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration, or improvement of its essential basic structures and functions. (IPCC)

Risk The potential for an unwanted outcome resulting from an incident, event, or occurrence, as determined by its likelihood and the associated consequences. (DHS)

Risk category The International Code Council (ICC) establishes Risk Categories for different types of buildings and the nature of occupancy. For example, Risk Category III includes “Buildings and other structures that represent a substantial hazard to human life in the event of failure.”

Shocks Sudden-onset events that impact the vulnerability of the system and its components.

Stresses Chronic, long-term trends that undermine communities and impact their ability to respond to a shock.

Vulnerability The degree to which a system is susceptible to, and unable to cope with, adverse effects. (IPCC)

GETTING STARTED

Architectural projects include a variety of requirements and functions, preferences and precedents, and ideas and visions, so the questions in this guide offer the initial scaffolding on which to support informed decisions and build a practice that designs more resilient and climate-adaptive projects. This guide does not include the typical steps within an architect's project process but rather identifies the points at which resilience and climate adaptation can be layered in.

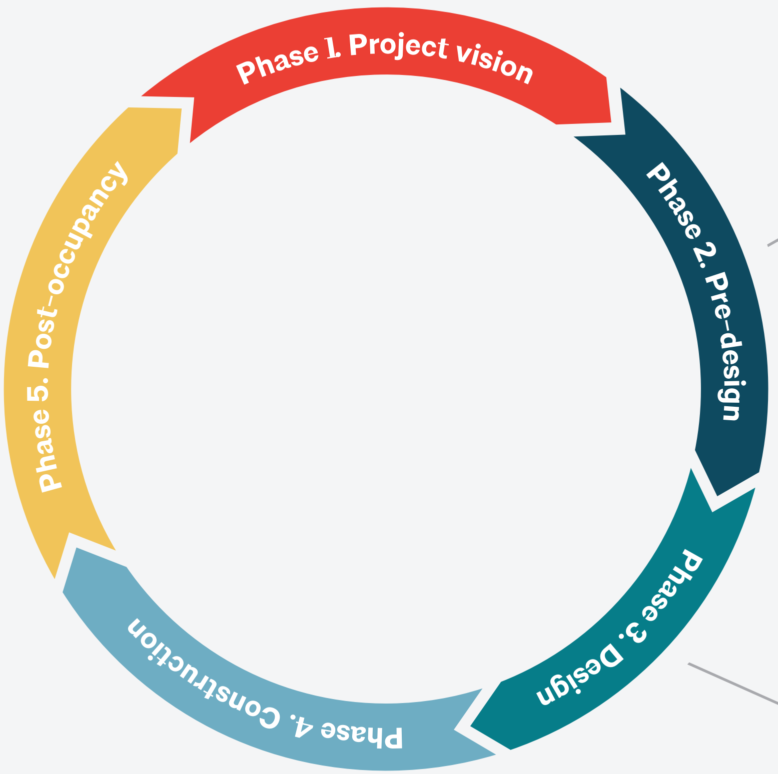
This guide is organized by project phase to make it easy for architects to implement throughout the design process. Also, recognizing that projects often begin before the architect is under contract, this guide includes a Project Vision + Pursuit Phase with questions to define resilience goals and benefits.

Each phase includes:

- A description of resilient practice within the phase
- Collaborators and stakeholders who share responsibility for developing the resilient standards and measures
- Questions to guide design decisions about project conditions, client needs, and community values
- Guidance for documenting the decision-making process
- Tools and resources for further investigation

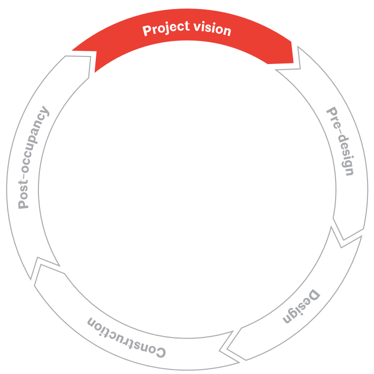
Architects have the responsibility and capacity to improve resilience, and this guide can help to integrate climate-adaptive practices throughout the design process.

Let's get started.



Programming, site evaluation, and existing facility surveys.

Schematic design, design development, and construction documents.



Phase 1: Project vision

The project vision + pursuit phase typically happens before an architect is under contract. This early point in a project includes investigations that establish the parameters for resilience; define the historic and projected climate; evaluate hazard risk, exposure, social/economic/environmental vulnerability; and explore potential adaptation strategies.

A project vision that considers shocks, stressors, and climate impacts provides a resilient framework to assess design and construction decisions. Clients seek data-driven teams to ensure that building performance goals, such as resilience, enhance the client's return on investment.

Collaborators

- Design team
- Ecologist/environmental engineer
- Historic preservation consultant (if applicable)

Stakeholders

- Client and users
- Building and zoning officials, resilience/hazard mitigation officer, and other regulators

"Our client's project was a manufacturing facility planned for 24/7/365 operation. They have a company matrix they use to select building sites that includes practicalities such as proximity to other company buildings, public and regional transit access, flood risk, capacity for on-site renewable energy sources and rainwater capture, etc. The design team all weighed in to complete the matrix, and our client made the site selection accordingly. This is the way all projects should start."

—Gail Napell, AIA

QUESTIONS FOR PROJECT VISION

Identifying risks, vulnerabilities, and opportunities

- What are the current hazards and future climate projections in the project area?
- What is the potential for exposure to hazards if this project is built?
- Should this project be built on the selected site given those exposures?
- What are the social, economic, and environmental vulnerabilities that characterize the project and its context?
- What is the standard service life for this building type? Is this building's anticipated service life longer or shorter than the standard?
- Does the building need to continue operations during and immediately after a hazard event?
- What other considerations will help the design team understand the specific hazards and vulnerabilities of this project?
- How will a more resilient building affect clients, tenants, and building operations?
- How might cascading consequences affect the site, occupants, and community?

Establishing performance goals

- Which hazards are the highest priority to address in design?
- What is the ICC Risk Category for the project?
- Which design strategies might be considered to manage the hazards at this site?
- Which building materials and passive systems will enhance performance goals?
- What external systems does the building rely on and how might the design reduce this dependence?
- How will performance goals be tracked throughout the design and construction process?

Improving community resilience

- What are the community's adaptation and resilience plans?
- What community conditions will affect this project over its service life?
- How will this project enhance community resilience?
- Are there ways to increase the strength and diversity of the community through this project?

DOCUMENTATION

1. Document conversations with potential clients about risk and the range of potential resilience and adaptation measures.

2. Outline performance goals developed by the design team.

3. Establish an understanding of:

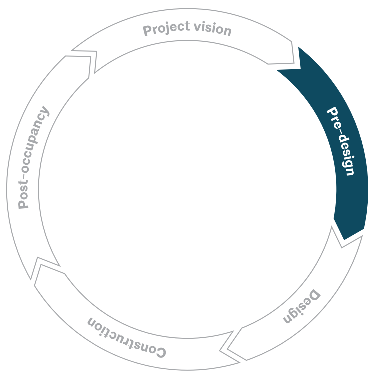
    - climate and hazard exposure related to environmental conditions (resulting from climate change, seismic faults, coastal/riverine/flash flooding, extreme weather/temperature, drought, wildfire, landslide, etc.)
    - climate and hazard exposure related to economic conditions (resulting from demographic shifts, changes in property values, etc.)
    - climate and hazard exposure related to social conditions (resulting from civil unrest, crime, inequality, etc.)

TOOLS + RESOURCES

AIA Hazard and Climate Risk: A user's guide and form for acknowledging risk supports the architect and client to reach and document a mutual understanding of hazard and climate risk that will inform project requirements.

AIA Risk Management series Good Citizenry and good business: Minimizing risk when designing for climate change discusses risk management best practices for architects in light of the increase in design risk triggered by climate change.

Phase 2: Pre-design



Pre-design is the information-gathering phase that forms the basis for the design phases to follow. Pre-design includes programming, site evaluation, and existing facility surveys. An analysis of risk informs every action in a resilient project, characterizing the client's capacity to manage risk, assessing site hazards and vulnerability at finer resolution than in the Project Vision + Pursuit, and creating a basis of design that clearly presents the parameters for a project that reflects the Fundamentals of Resilient and Climate Adaptive Design. This phase offers the opportunity to consider a wide range of options and alternatives before evaluating them in the design phase.

The AIA B101 Standard Form of Agreement Between Owner and Architect lists programming, site evaluation + planning, and existing facilities surveys as supplemental services.

Collaborators

- Design team
- Ecologist/environmental engineer
- Geotechnical engineer
- Historic preservation consultant (if applicable)

Stakeholders

- Client and users
- Building and zoning officials, resilience/hazard mitigation officer, and other regulators
- Insurance broker, agent, or insurance risk management consultant
- Lender or project financier (bank or investment firm)

"An example of a client's willingness to absorb the risks associated with hazards: The Miami Beach Code of Ordinances requires new construction to have a finished floor elevation a minimum of 1 foot to a maximum of 5 feet (freeboard) above the Base Flood Elevation. Some property owners choose to build at the minimum elevation, assuming that if their property floods at that elevation the entire city will be under water, accepting a general state of emergency as inevitable. Other property owners adopt the maximum freeboard in an attempt to protect their property as much as they possibly can."

—Elizabeth Camargo, AIA

QUESTIONS FOR PROGRAMMING

Determining risks and consequences

- Are there additional sources for climate, hazard, and vulnerability information that were not consulted in the project vision + pursuit phase?
- What are the identified hazards?
- Which of these are priority hazards to address (the most frequent events or the largest potential impacts)?
- What vulnerabilities stem from those hazards?
- What are the risks to occupant safety, mission continuity, and property damage that may impact this project in a hazard event?
- What is the client's willingness to absorb the risks associated with the identified hazards?
- Does the client have direct experience with extreme events? What were the impacts and what vulnerabilities were exposed? What lessons were learned and what motivates performance goals for the new facility?
- Will supply chain interruptions impact the building functions? Do these interdependencies indicate more storage, shipping, or production space is needed?
- How do the client's existing facilities contribute to understanding resilience issues?
- What is the recovery time objective? See the Architect's Guide to Business Continuity for more information.
- Is insurance available and affordable for the proposed function at the selected site location?
- Does the client believe that risk transfer methods such as insurance will cover losses? Discuss the need for further analysis with the owner, risk manager, user/operator, and finance team.
- What is the client's liability as a building owner? Could the failure of this building adversely impact occupants, neighboring buildings, or infrastructure?
- Does this project warrant enhanced protection due to critical facility designation, significant investment costs, or other reasons?
- Will a benefit-cost analysis for potential adaptation measures be created to outline initial costs, operational impacts, and avoided losses?

QUESTIONS FOR PROGRAMMING CONTINUED

- Are there financial incentives (e.g., grants, funding for hazard mitigation, insurance premium discounts, etc.) for incorporating resilience?
- Are there financial disincentives (e.g., insurance surcharges, zoning overlay with additional requirements, financing penalties such as a carbon tax, etc.) associated with the site/project?

Establishing performance standards

- What are the climate projections over the project's service life, and how will the project adapt to future conditions?
- How does the project's service life affect decisions about materials, systems, and other building components?
- How important is it for the building to maintain occupiable conditions in the event of an extended loss of power, water, or sewer?
- To what degree should adaptability be considered for the project? Can the project's service life be extended if adaptability is incorporated at the beginning of the project?

- Does the project include additional services, such as landscape architecture or energy modelling, that often have a significant impact on resilience?
- Will a post-occupancy evaluation (POE) measure performance at the conclusion of the project? What data will be measured to indicate resilient and climate-adaptive performance?

Improving community resilience

- Are there local plans related to adaptation, resilience, or hazard mitigation that might affect the vulnerability or resilience of the project during its lifetime?
- How will the building or project accommodate changes to the community throughout its service life?
- Does the health and welfare of the community depend on this building remaining operational following hazard events?
- Will the project provide community amenities in an emergency (e.g., temporary shelter, uninterruptible exterior

QUESTIONS FOR PROGRAMMING CONTINUED

power outlets, community heating/cooling center, public restrooms, etc.)?

- Who are the diverse co-creators who might enrich the list of project stakeholders?
- What discussions with the community could help the design team better understand shocks and stresses?
- How will the design team integrate ideas and reconnect with stakeholders at each phase of the project?

QUESTIONS FOR SITE EVALUATION

Physical conditions

- What are the physical risks and vulnerabilities at the site: subsurface/soil conditions, seismic zones, wetlands, floodplains, heat islands, etc.?
- What features of the site and its surroundings may impact building performance?
- What are the interdependent external systems on which the building relies: transportation, utilities, stormwater, etc.?
- How might cascading consequences from system failures affect resilience at the site?
- Are there alternative sites that would minimize physical risks?
- What adaptation strategies might reduce physical risks from the hazards identified?
- Social and economic vulnerability
- What are the social vulnerabilities the project might address? For example: demographic changes, terrorism, civil unrest, climate migration, etc.
- What are the economic vulnerabilities the project might address? For example: economic variability, property values, unemployment, etc.

QUESTIONS FOR SITE EVALUATION CONTINUED

- Does the project area have the potential for demographic shifts as a result of accelerating hazards?
- How might social and economic vulnerabilities affecting the region, county, city, and project site evolve with climate change?
- What are the cascading consequences from changes in the social or economic systems that might affect the community? For example: receiving areas might experience high demand for property, resulting in increased prices, gentrification, displacement, traffic, and the loss of scenic or cultural sites to development.
- What are the existing social assets and opportunities the project might leverage to further improve the project area? For example: additional public gathering spaces to increase community connectivity, walkable streets, public transit routes, open space, amenities within a half-mile radius (library, community center, etc.).
- What are the economic assets and opportunities the project might leverage to further improve the project area? For example: ability to meet daily needs within a half-mile radius, workforce development resources, increasing density to support a higher level of service.
- How can this project contribute to repairing chronic stresses such as inequities, scarcity, and infrastructure gaps?

Environmental conditions

- What are the environmental vulnerabilities the project might address? For example: drought, flooding from extreme precipitation or riverine/coastal sources, extreme temperatures, wildfire, habitat loss, etc.
- What are the cascading consequences stemming from environmental vulnerabilities?
- How might environmental vulnerabilities affecting the region, county, city, and project site evolve with climate change? Consider a range of possibilities from inconvenient to deadly: utility failure, drought, wildfire, etc.
- What are the environmental assets and opportunities the project might leverage to further improve the project area? For example: parks and safe outdoor spaces, community agriculture, street trees, habitat restoration, renewable energy.

QUESTIONS FOR EXISTING FACILITIES

- Has the building experienced a hazard event? How did it perform? Was it damaged and not repaired? If it was damaged and repaired, what is the current physical condition?
- Have conditions in the surrounding area changed since the building was constructed? If so, how do those changes increase or decrease vulnerability?
- Have the minimum design loads (wind, snow, cooling) changed since the building was constructed? Are regulatory changes likely to happen in the future?
- What are the characteristics of the existing building that may adversely affect building performance in a hazard event?
- Are there hazardous materials or materials with Red List ingredients present in the building that may pose a greater threat to human and environmental health if they are subjected to a hazard (a fire might release toxins, flooding might leach chemicals, etc.)?
- What adaptation strategies specific to adaptive-reuse projects reduce risk from the identified hazards?
- In historic structures, how can hazard-mitigation strategies align with the Secretary of the Interior's Standards for Rehabilitation?

DOCUMENTATION

1. Programming document with hazard information, performance goals, basis of design narratives, and a list of hazard-mitigation and climate-adaptation strategies to be considered in the design phase.

2. Site analysis, including hazards, climate projections, risks, and vulnerabilities. The scope includes physical, social, economic, and environmental vulnerabilities.

3. Existing facility survey if building(s) are scheduled for adaptive reuse, including a vulnerability assessment.

4. Owner's project requirements, including resilient and climate-adaptive performance goals and metrics.

TOOLS + RESOURCES

AIAU Resilience and Adaptation Series Course 5: Conducting Vulnerability Assessments discusses how to conduct vulnerability assessments in new and existing buildings using a step-by-step process to make informed decisions about site selection, retrofits, renovations, and repairs to reduce damage from any hazard.

FEMA Benefit-Cost Analysis is a method that determines the future risk reduction benefits of a hazard mitigation project and compares those benefits to its costs.

Owners project requirements defines the functional expectations and performance criteria to be met by the design, sustainable objectives to be achieved, cost considerations, and maintenance expectations.

USCRT Steps to Resilience describes a methodical approach communities can use to identify their valuable assets, determine which climate-related hazards could harm them, and then identify and take effective actions to reduce their risk.

BENEFIT-COST ANALYSIS

Benefit-Cost Analysis[5] compares the risk reduction benefits to the costs of addressing hazard risks. Architects can use the process to demonstrate the cost-effectiveness of various hazard mitigation elements in a project.

1. What is the problem we are trying to solve by planning for adaptation?
   What are the existing physical risks and hazards in the area?
   What are the existing social conditions?
   What are the environmental conditions?

2. What are the key adaptation objectives?
   What are the main adaptation strategies in the project?
   What is the budget for capital construction?
   What is the budget for adaptation measures?
   What is the budget for operations?
   What is the budget for rehabilitation if adaptation measures are not implemented?
   What is the adaptation plan and period for re-investment?

3. Who are the key stakeholders in our project?
   What are the interests that may affect the project with positive or negative results? This may include the neighborhood, municipality, county, state, federal, and NGO partners.

4. What is the reference situation?
   What is the current spatial, economic, environmental, and social quality?
   What will happen in 5/25/50/100 years if adaptation measures are not implemented?

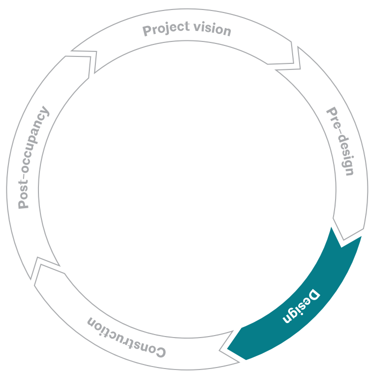
5. What are the positive and negative impacts of implementing adaptation compared to the reference situation?
   Will the project add social value (identity, cohesion, affordability, recreation, cultural, health, scenic, lower crime)?

[5] FEMA, Benefit-Cost Analysis. fema.gov/grants/guidance-tools/benefit-cost-analysis

BENEFIT AND COST ANALYSIS CONTINUED

Will the project add environmental value (biodiversity, improved air quality, energy efficiency, reduced noise, lower emissions)?
Will the project add economic value (local economy, competitiveness, employment, property value, transportation efficiency)?

6. Is the project robust and flexible (future-proof)?
   What are the key risks and uncertainties that may affect the project? What are the technical or implementation challenges?



Phase 3: Design

The design phase gives form to the performance goals and supports the discoveries made during pre-design. The design team refines the response to shocks and stresses; researches durable, high-performance materials, forms, and assemblies; and recommends solutions for adapting to changing conditions.

This section integrates all three design phases described in the AIA Contract Documents: schematic design, design development, and construction documents.

Collaborators

- Design team
- Client, users, tenants, and the operations team, including facilities staff

Stakeholders

- Community members and stakeholders defined by the engagement plan
- Floodplain manager, hazard mitigation officers, building officials

In order for a project to truly be resilient, stakeholders and/or community members must be engaged in the design process. During a project, we regularly walked the site with the client and community to discuss how the design could reflect neighborhood values and improvements such as public access and views of the Boston Harbor, while also providing protection from near- and long-term flooding. As the design progressed, community members felt invested in the project, which achieved the goals of all the stakeholders involved.

—Robin Seidel, AIA

QUESTIONS FOR THE DESIGN PHASE

Integrating resilience in design

- What resilience strategies address the hazards and vulnerabilities identified in pre-design? Outline this list at the beginning of the design phase and maintain it throughout the design process. The list of approved and rejected strategies should be created with and formally accepted by the client.
- How will design excellence be achieved? Design excellence is a complementary resilience strategy, as beautiful and functional projects are more likely to be loved by the community and maintained by the owners.
- How will the hazards inspire design responses? Will strategies be integrated invisibly or will the building use performance requirements as an unmistakable generator of form?
- Where can critical systems be located to avoid flooding, extreme weather, or other impacts?
- How might the project integrate natural or regenerative solutions that will grow more robust and stronger over time?
- Are there potential conflicts between design strategies to address identified hazards and programmatic functions or operations?
- What design strategies incrementally prepare the building for climate change? What is the projected timeline and the conditions that trigger modifications to the building?

Resilient materials and details

- Which materials can withstand the identified hazards?
- How will construction details affect performance during a hazard event?
- Do any design details, materials, or systems selected to mitigate one risk create vulnerabilities to another hazard?
- Are project specifications written to include hazard-resistant materials and assemblies?
- Can Red List chemicals be eliminated from project specifications to reduce potential impacts to human health during or after a hazard event?

QUESTIONS FOR THE DESIGN PHASE CONTINUED

- Does the material life cycle align with the anticipated service life of the building? How do the building materials align with regular replacement cycles to minimize cost and retain adaptability?
- Which materials can be easily decommissioned and reused at the end of the building's service life? Can fastening systems streamline the process of salvage and reuse?
- Will environmental sensors be utilized to record quantitative information such as air quality, temperature, relative humidity, moisture in materials, or other critical indicators?
- Will real-time building performance be displayed in a public display or dashboard?
- Can the project utilize materials and construction techniques that strengthen the local workforce and economy?

Learning from the community

- What questions will help the design team understand local shocks and stresses?
- How might a community engagement plan gather insights and perspectives to shape the project characteristics and strengthen community resilience?
- Are there vernacular or indigenous design solutions to mitigate hazards that are employed in the community? Can similar techniques be adapted to this project?
- How can the project design strengthen connections in the community?
- In the aftermath of disasters, will the building accommodate community gatherings, information and distribution hubs, or recharge points?
- Will the design team communicate hazard, vulnerability, and resilient design strategies to the community? Can the structure serve as a model for the community?
- Are there modifications to the infrastructure serving the building that would improve resilience? Can the design team advocate for improvements that strengthen the community?

QUESTIONS FOR THE DESIGN PHASE CONTINUED

Preparing for construction

- Are there potential conflicts between hazard mitigation or climate-adaptation design strategies and budget parameters?
- Will the cost information developed in the design phase modify the benefit-cost analysis?
- Will the hazard mitigation or climate-adaptation design strategies employed affect construction methods or scheduling?
- How will the commissioning process capture and measure performance goals?
- Do local building officials require additional investigations or certifications for permitting (such as a No-rise Certification[6] or FORTIFIED[7] standards)?
- How will the design team communicate hazard, vulnerability, and resilient design strategies to building officials, contractors, and subcontractors?

[6] No-rise Certification: Projects in a floodway must be reviewed to determine if the project will increase flood heights through an engineering analysis before a permit can be issued. The No-rise Certification must be supported by technical data and signed by a registered professional engineer. (FEMA)

[7] FORTIFIED is a voluntary construction and re-roofing program designed to strengthen homes and commercial buildings against specific types of severe weather, such as high winds, hail, hurricanes, and even tornadoes. (IBHS)

WHAT IS AN ADAPTATION PLAN?

An adaptation plan identifies the climate change "signals" that determine when action should be taken and the potential time frames for key decision points. It identifies the key future variables that influence when investment is the most effective. For example, if a flood-resistant access route is planned, will it or will it not be built by the time flood-resilient access is needed? This requires considering the decision trajectory, or time frame over which a decision is implemented; planning, funding, and construction stages translate into capital expenditures over many years.

A pivot point or tipping point happens when an external variable has the potential to affect the feasibility of an action, potentially changing the timing of implementation. For example, if observed sea-level rise is much greater than projected under the current scenarios, does that accelerate the actions in the adaptation plan? These pivot points are not limited to climate projections and may also include available technology, community land use patterns, infrastructure, or funding sources.

An adaptation plan is a portfolio of strategic actions that address uncertainties. The actions are proven to be feasible, with time frames for implementation and clearly identified costs and benefits that may be framed as a series of "if ... then" statements, such as:

If flood risk increases to interrupt operations more than once every three years due to sea-level rise and more extreme storm surge conditions, then a decision will have to be made about whether to invest in construction of a seawall or relocate the facility.

Several types of strategies are included:

1. No-regrets strategy yields benefits even if climate does not change to the degree projected. For example: improving building envelopes to deal with higher temperatures and controlling leaks in water pipes.

2. Reversible and flexible strategies minimize the cost if climate impacts are not as severe as projected. For example: restrictive urban planning, insurance rate adjustments.

3. Safety margins to allow for increased capacity take advantage of lower initial investment costs to overdesign a system instead of rebuilding it later or responding to failure. For example: planning stormwater drainage systems to accommodate greater runoff, increasing wind design pressures.

4. Reduced-time horizons call for short-term investments rather than long-term commitments. For example: use of temporary or movable structures. Note: this strategy may conflict with other performance goals, such as embodied or operational carbon.

DOCUMENTATION

1. A list of approved and rejected resilient and climate-adaptive design strategies included in the project, signed and accepted by the client.

2. Construction documents that illustrate and describe the resilient and climate-adaptive design strategies, setting forth in detail the performance criteria, materials, systems, and other requirements.

3. Adaptation plan that outlines the conditions that inform changes to the structure in order to maintain operations at the site or that recommend decommissioning and relocation.

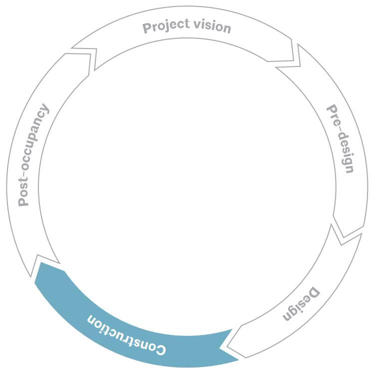
TOOLS + RESOURCES

AIA Resilience and Adaptation Certificate Series Course 6: New Construction Hazard Mitigation Strategies presents case studies of successful mitigation strategies for new construction.

AIA Resilience and Adaptation Certificate Series Course 7: Existing Buildings Hazard Mitigation Retrofits presents case studies of successful mitigation strategies for existing buildings.

AIA Guides for Equitable Practice Chapter 8: Engaging Community outlines the expectations for community engagement and prepares architects for reciprocal engagement.

Phase 4: Construction



The construction phase realizes the building and includes regulatory approval, procurement, construction, commissioning, and facility management. The design team monitors and manages the project, documents design issues, makes changes to drawings and specifications, and verifies that the construction documents are followed. Many unforeseen issues can arise during this phase, and it's therefore important for design teams to communicate with the client and construction team at regular intervals to ensure implementation aligns with the intended project goals.

This section addresses the procurement phase and construction phase services outlined in the AIA B101 Standard Form of Agreement Between Owner and Architect. Commissioning and facility support are listed as supplemental services in the B101.

Collaborators

- Design team
- Client and operations team, including facilities staff
- Commissioning agent
- General contractor and subcontractors
- Construction project manager, if applicable

Stakeholders

- Building users and tenants
- Community partners and neighbors

During the construction phase of a project, our client team changed and began removing a lot of the resilient design features as they said resilience "wasn't important to the new direction of the project." Then Hurricane Harvey made landfall. We received a phone call from the client asking our team to come down to discuss resilience. The building shell withstood the storm and managed all the storm water on-site without any issues, even though it wasn't complete. The client asked us to restore all the resilient features.

—Megan Recher, AIA

QUESTIONS FOR THE CONSTRUCTION PHASE

Bidding + negotiation

- Can the client prequalify contractors with experience working on projects with resilient or climate-adaptive features or with predefined skill sets?
- Can the design team provide information during the bid phase to reduce the uncertainty, which leads to higher costs?
- Does the contractor's bid align with expectations or is there a penalty for innovation built into the price?
- How can resilient and climate-adaptive performance goals be prioritized if value engineering is necessary to meet the budget?
- If bid pricing affects the scope of the resilient and climate-adaptive design features, can the design team move items into the adaptation plan for future implementation?
- Will fast-track design services or multiple bid packages affect the installation or protection of resilient and climate-adaptive design features?
- If contingency funds are available at the end of construction, can they be applied to resilient and climate-adaptive design features?
- How do front-end specifications support community-based hiring for contractors? Has the client set contracting goals for disadvantaged business enterprises or work re-entry programs?

Construction

- How does the general contract for construction ensure design and performance goals are achieved?
- Will the contractor's schedule of values list resilient assemblies as separate line items for tracking or are they included in other line items (windows, doors, etc.)?
- Once the project footprint is established, does seeing it in place create new ideas for resilient and climate-adaptive design measures?

QUESTIONS FOR THE CONSTRUCTION PHASE CONTINUED

- How will changes made during construction affect performance or modify the adaptation plan?
- How will the design team review shop drawings, product data, and substitution requests to maintain identified performance standards?
- How will delegated-design submittals be reviewed for adherence to specified performance standards?
- What additional construction observation points are necessary to ensure resilient and climate-adaptive design features are installed correctly?
- Is the contractor required to field test any materials or assemblies to ensure identified performance goals are achieved?
- Are there increased safety concerns at the construction site due to hazards? Can these be addressed in the project schedules or construction methods?
- Does the contractor have an established protocol for securing materials in the case of severe weather impacts?
- Do resilient and climate-adaptive materials and assemblies have specialized identification that must remain in place? If so, share this information with the client, contractor, and construction administration team.
- Will all resilient and climate-adaptive assemblies be in place prior to substantial completion?
- Do construction contracts or performance bonds cover delays and/or losses as a result of severe weather or other hazard events?

QUESTIONS FOR THE CONSTRUCTION PHASE CONTINUED

Facility support

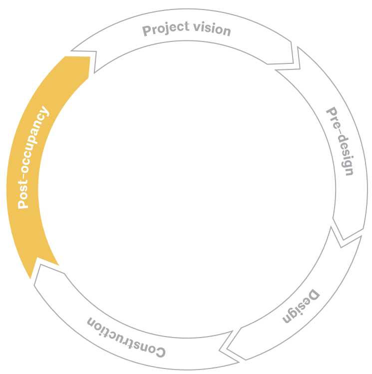
- What metrics are included in the commissioning process to ensure the identified performance goals are met?
- What are the procedures for testing or commissioning resilient or climate-adaptive materials and assemblies, such as field testing of mockup panels or in-situ testing for openings, flood barriers, and critical envelope components?
- How are facility managers involved through the construction phase? How can they become enthusiastic adopters of resilient and climate-adaptive design features in order to operate buildings effectively?
- How will resilient and climate-adaptive design features and required maintenance be documented in operations and maintenance manuals?
- What user training is necessary to assure resilient and climate-adaptive systems and processes are maintained? How often will the training be repeated?
- How often will facilities staff regularly test backup and emergency systems?
- Will the facilities staff organize a “disaster drill” to fully deploy flood panel systems or other systems so that adequate time can be allotted in the future?
- Is regular servicing or testing required to meet the conditions of a selected product warranty?
- Are resilient and climate-adaptive design features clearly designated in the building information model?
- Is information about how the building will operate during and after a disaster included in the facility operations plan?
- Can the facilities team offer a construction tour of resilient and climate-adaptive design strategies to the community?

DOCUMENTATION

1. Identification of resilient and climate-adaptive materials and assemblies in field reports, as-built drawings, product data, shop drawings, and other requirements of the construction administration phase.
2. Operations and maintenance manual with clear protocols for deploying, testing, maintaining, and replacing resilient and climate-adaptive materials and assemblies.
3. Warranty and supporting information for resilient and climate-adaptive design features, including protocols for testing and replacement.

TOOLS + RESOURCES

Section 3 of the Housing and Development Act requires that recipients of certain U.S. Department of Housing and Urban Development (HUD) financial assistance provide training, employment, contracting, and other economic opportunities to low- and very low-income persons. These principles can be applied to every project to improve economic resilience by providing professional development and workforce solutions within local communities. Building construction offers rewarding careers and many trades are in high demand.



Phase 5: Post-occupancy

Evaluating building performance and collecting user feedback are key strategies for making continuous improvement in building design. Collecting post-occupancy information helps identify problems in buildings, respond to user needs, support adaptation, and inform the design process. Incorporating innovative solutions in the design creates an even greater need to monitor how buildings function in everyday use as well as under disaster conditions.

Post-occupancy Evaluation is listed as a supplemental service in the B101.

Collaborators

- Professionals who delivered the building (architect, engineer, builder)
- The professionals who manage, operate, lease, and maintain the buildings (building managers, leasing agents, tradespeople, cleaners, etc.)

Stakeholders

- Residents, employees, and clients who visit the building to receive a service (customers, shoppers, students, patients, etc.)

QUESTIONS FOR THE POST-OCCUPANCY PHASE

Evaluating success

- Will the architect perform a formal post-occupancy evaluation? If so, what is the timeline for evaluations after the building is delivered (e.g., operational review at 3-6 months, project review at 12-18 months, and strategic review at 3-5 years)? Can the post-occupancy evaluation include multiple reviews?
- Does the project achieve the original objectives? What lessons can be learned from successes and failures?
- Does the project achieve design excellence? How is this measured (e.g., client feedback, economic or social value, awards, or publications)?
- Do the resilient and climate-adaptive design features support the building functions and occupants as required by the owner's project requirements?
- If furniture, fixtures, and equipment (FFE) were included in the supplemental services, do they support the building performance objectives?
- How has the project impacted the community?

After a hazard event

- Did the building perform better or worse than other structures in the area?
- Which building elements were designed for hazard mitigation? How did they perform?
- Did the building operate as planned?
- What problems need to be tackled quickly to prevent further damage or to restore basic services?
- How long did it take for the building to return to full functionality? Are there opportunities to improve this time frame?
- Did pre-event building preparations occur as planned? Are there issues that should be addressed before the next event?
- If there were building failures, can they be traced back to specific details or materials?
- Were adjustments to the building utilities or services necessary after an event to return to operability?
- Did the building users' needs change after the event?
- Did avoided losses match predictions?

QUESTIONS FOR THE POST-OCCUPANCY PHASE CONTINUED

- Is there an opportunity to collect information about the damage costs, avoided losses, and the period of interruption? Can the team analyze the cost of improvements versus payback to the client to calculate the actual return on investment?
- Does the building information model accurately indicate areas where damage occurred and maintenance was required?

Adaptation planning

- Are there rapidly changing conditions, such as flooding or subsidence, that indicate a change to risks, probability, or consequence?
- Has there been a change in ownership, change of occupancy, change in insurance, or a planned retrofit to the building that indicates the need for an updated vulnerability assessment?
- Are new resources available to implement the next steps outlined in the adaptation plan?
- Are there changes to the community hazard mitigation plan that support new measures?
- Are there new technologies or solutions that might be implemented?
- Can lessons from the project be shared with others?

DOCUMENTATION

1. If a post-occupancy evaluation (POE) is authorized, issue a final report to the owner, facilities staff, and design team.

2. If a formal POE has not been authorized, create a document for internal purposes that includes a summary of resilient and climate-adaptive strategies along with their costs, tradeoffs, and performance goals. Identify elements of the plan that were not implemented but planned. Identify key points in the future to check back with the owner to collect information and review building performance.

3. Hold a debriefing session with the design team to examine questions about the design process: What did the team learn on this project about incorporating resilience? What does the team need to learn to make the project more efficient next time? Who was most helpful and easy to engage in the process? Who was difficult to work with and how could they have been approached differently? What other factors might have been included in the analysis to make it more compelling? Asking these questions at the end of the design process helps the team prepare for the next project.

TOOLS + RESOURCES

Guide to Post Occupancy Evaluation, Higher Education Funding Council for England. This toolkit on post-occupancy evaluation was developed for higher education but has broad application to other sectors.

Center for the Built Environment developed a web-based survey that preserves the confidentiality of respondents and controls access in order to maintain data integrity.

AIAU Resilience and Adaptation Series Course 5: Conducting Vulnerability Assessments. This course discusses how to conduct vulnerability assessments in existing buildings using a step-by-step process to make informed decisions about retrofits, renovations, and repairs to reduce damage from any hazard.

Conclusion

Resilience and climate adaptation is not a prescriptive checklist but an approach that must be customized for different project types and locations. With impacts from climate change increasing, it's not enough to select the easy solutions and ignore the rest, as this may leave people and investments at risk. On the other hand, don't be discouraged if the full complement of resilient and climate-adaptive design strategies can't be included in every design project. Incremental steps are still progress.

The Resilient Project Process Guide is an advanced-level resource. It might seem like a lot to add to an already demanding project process, but the questions cover a broad list of hazards and conditions; experienced architects will understand which questions apply to which projects. AIA offers a solid foundation for resilience education in the AIAU Resilience and Adaptation Online Certificate Program Series.

Integrating resilience and climate-adaptive steps into the design process helps create a built environment with greater capacity to recover quickly from hazards and prepare for the future. Whether you are undertaking your first project or the latest in a portfolio of projects that are prepared for the future, this resource will help organize questions at each phase of the project for the design team, client, and community. Architects are encouraged to share examples, case studies, and comments through the AIA Resilience Network.

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