

California has been experiencing intensified impact from climate changes to our buildings and communities. These impacts have created both challenges and opportunities for California architects in many ways: design processes, stakeholder engagement, regulatory compliance, and standard of care.

AIACA assumes leadership in providing California architects with resources they need to strengthen their practice and to protect Health, Safety, and Welfare of Californians.

Learning Objectives



Recognize and distinguish how industry practice is changing in response to worsening climate conditions (Industry Standard of Care), and how courts view the responsibilities of design firms in designing to account for future climate risks (Legal Standard of Care).

Understand the five steps in the Tool Kit methodology used to create mitigation strategies for high-performance buildings that include Sustainability and Net Zero Carbon Design components.

Know the impact of choices made in a project from Scope to Project Integration.

Identify opportunities and provide examples for clients that embrace resilience goals and risks that may come with ignoring shocks and stresses.

Understand the role and use of the REDi[™] Rating System.

AIA Continuing Education Provider

Attendees will earn **1.5 AIA LU/HSW** for attending this presentation live. AIA CA will submit you for AIA credit.

Housekeeping Reminders









ARUP

Resources will be made available on our website Today's session qualifies for 1.5 AIA HSW/LU & 1.5hrs of ZNCD

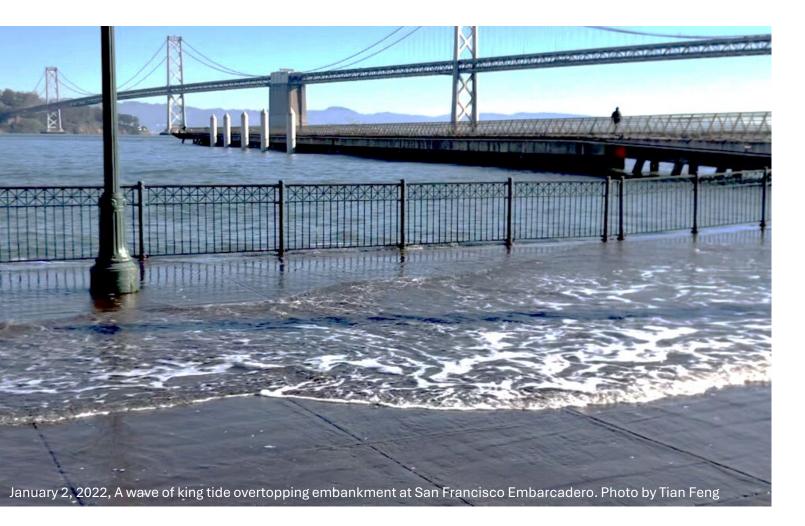
Use the Q&A to ask questions for today's presenters Cultivate a positive learning environment Sustainable Development is Everything.

Moderator: Tian Feng, FAIA



Agency Architect for the San Francisco Bay Area Rapid Transit District (BART)

AIACA & Resilient Design Committee



Since 1967, **AIA California** has been in the forefront of shaping and designing buildings and communities for the Health, Safety, and Welfare of Californians.

Intensified climate hazards not only impact our environment but also our practice of architecture. They demand architects to be equipped with ability for applying resilient design concept in their practice – a professional competence issue; they also demand architects to be knowledgeable about climate hazards' impact to their client's human and property wellbeing – a standard of care issue.

Resilience & The Evolving Standard of Care

Introduction

By AIACA staff and Moderator

Practice Resources – AIA & HKS Resilient Design Toolkit

Presented by HKS

Resilience Design Tools – **REDi[™] Rating System** Presented by ARUP

Trends & Case Studies - An Evolving Standard of Care for Design Firms Presented by Victor Insurance Managers LLC

Discussion

Moderated by Tian Feng, FAIA, FCSI

Presenters

Sammy Shams, AIA – Sustainable Design Leader, HKS Amanda S. Barton, AIA, RID – Project Designer, HKS Josephine Hsu, AIA – Architect, HKS

Andreanna Tzortzis, SE, PE – Associate Structural Engineer, ARUP Ana Moura-Cook, PE – ARUP Alum

Yvonne Castillo, Esq. – Sr. Vice President, Director of Risk Management & Global ESG Chair, Victor Insurance

Resilience and the Evolving Standard of Care

Session 01 –

Integrating Resilience Design Into Your Architectural Projects

Wednesday, September 18, 2024 12:00 Noon – 1:30 PM PST Learning Units [1.5 Credit Hour]



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Questions related to specific products and services may be addressed at the conclusion of this presentation.



Speakers











Sammy Shams, AIA, Sustainable Design Leader, HKS Amanda Barton, AIA, RID Project Designer, HKS Josephine Hsu, Assoc. AIA Architect, HKS

Ana Moura-Cook, PE Arup Alumna

Andreanna Tzortzis, SE, PE Associate Structural Engineer, Arup



Course / Learning Objectives

- 1. Recognize and distinguish how industry practice is changing in response to worsening climate conditions (Industry Standard of Care), and how courts view the responsibilities of design firms in designing to account for future climate risks (Legal Standard of Care).
- 2. Understand the five steps in the Tool Kit methodology used to create mitigation strategies for high-performance buildings that include Sustainability and Net Zero Carbon Design components.
- 3. Know the impact of choices made in a project from Scope to Project Integration.
- 4. Identify opportunities and provide examples for clients that embrace resilience goals and risks that may come with ignoring shocks and stresses.
- 5. Understand the role and use of the REDi Rating System.



Agenda

- Resilience Overview
- Resilience Design Toolkit
 - $_{\odot}$ Step 01: Resilience Scope Assessment
 - Step 02: Team Alignment & Project Planning
 - \odot Step 03: Identify Hazards
 - \circ Step 04: Integrate Resilience
 - Step 05: Evaluate + Nurture
- REDi[™] Resilience-Based Design Guideline
- Best Practices & Closing Thoughts

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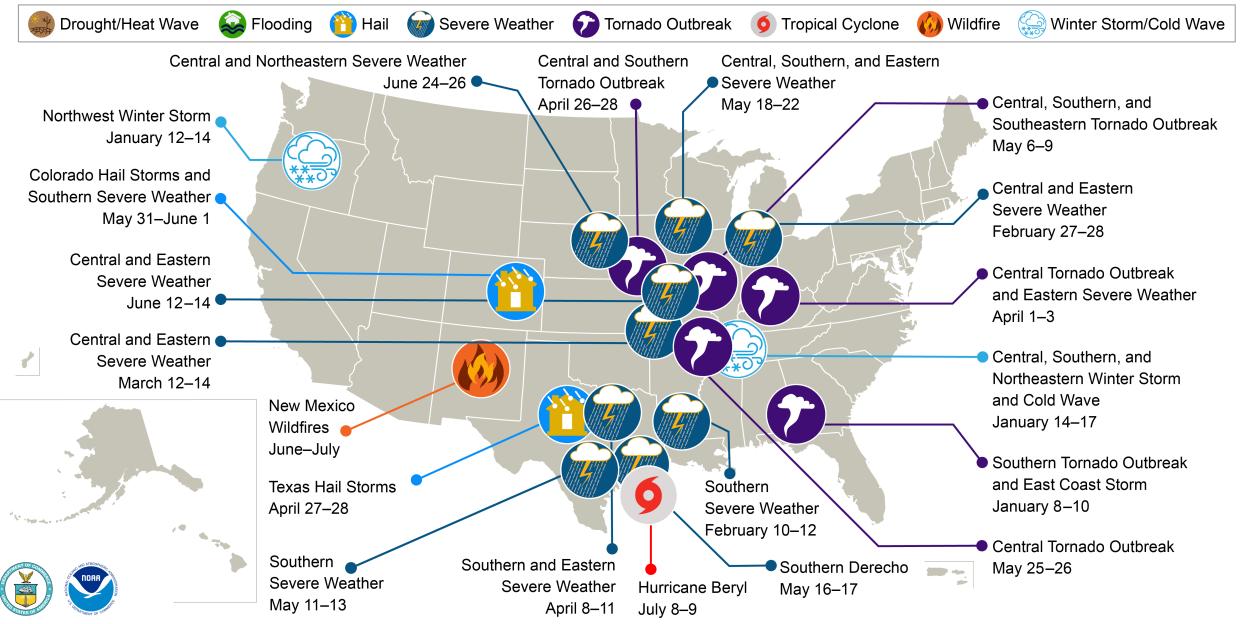


Resilience Overview

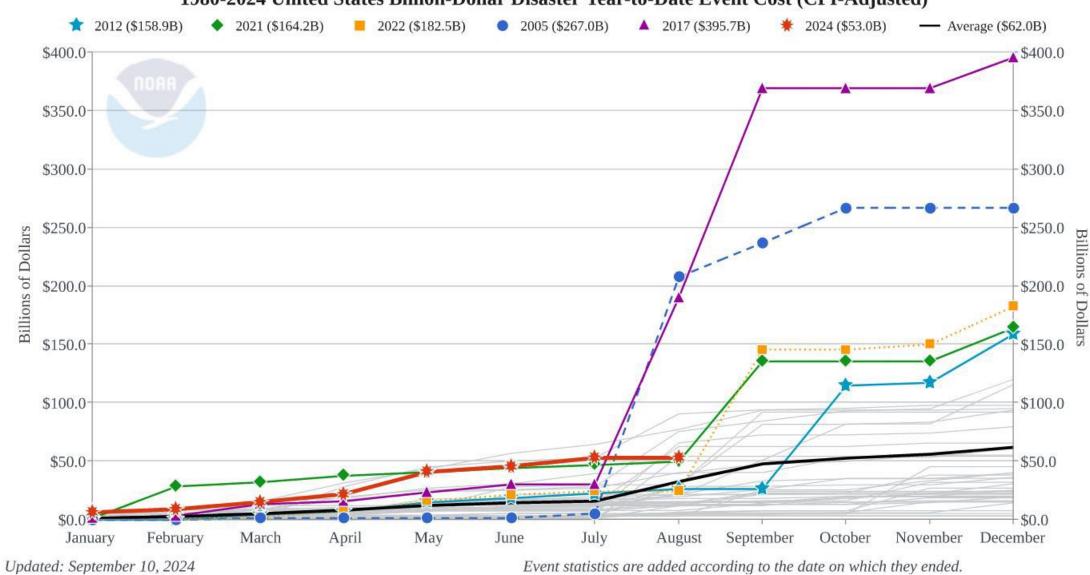
Why Resilience?

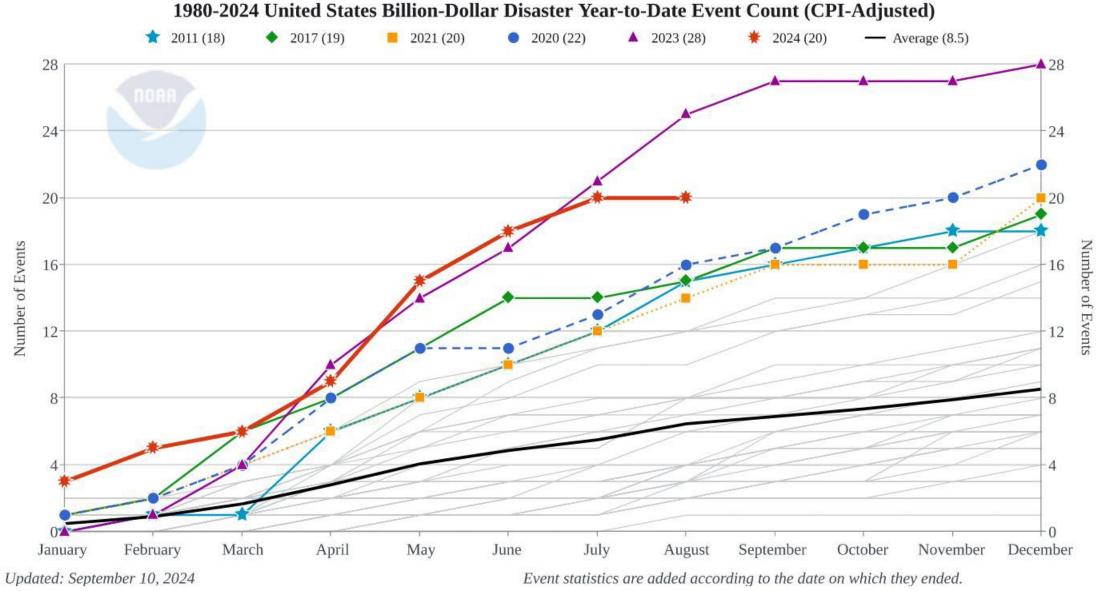


U.S. 2024 Billion-Dollar Weather and Climate Disasters



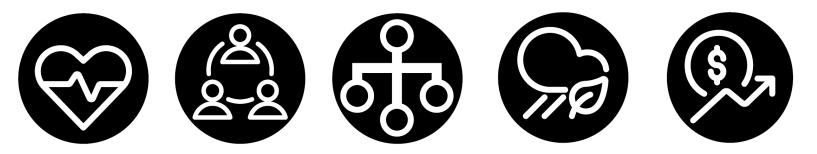
This map denotes the approximate location for each of the 20 separate billion-dollar weather and climate disasters that impacted the United States through August 2024.





-iks

5-Forms of Resilience



Health Resilience refers to the physical, mental, and social health of individuals of a place. Social Resilience health of a community to maintain cultural and historical traditions that can define a sense of a place.

Infrastructure Resilience focuses on the physical infrastructure of a place.

Environmental Resilience includes climate and weather impacts on an ecosystem as well as all the native flora and fauna species of a place.

Economic Resilience Ability to prepare, endure, and operate through adversity.





Resilient design follows a weak-link model

The gains from each sustainable design choice are not explicitly dependent on all other choices.

All systems work together to maintain the building's essential functions across all aspects.



Sustainability

- Reduced Energy & Water Demand
- Renewable Energy
- Passive Building Systems
- Restore and protect site
 ecosystems
- Support community culture, customs, and needs

- Utility Grid
 Independence
- Habitat
 Protection
- Carbon
 Reduction

Resilience

- Multiple Energy & Water Sources
- Passive Survivability
- Leverage strengths of natural ecosystems
- Support Community connections and infrastructure





Mexico City Beach, FL after Hurricane Michael (Cat. 5) in 2018.

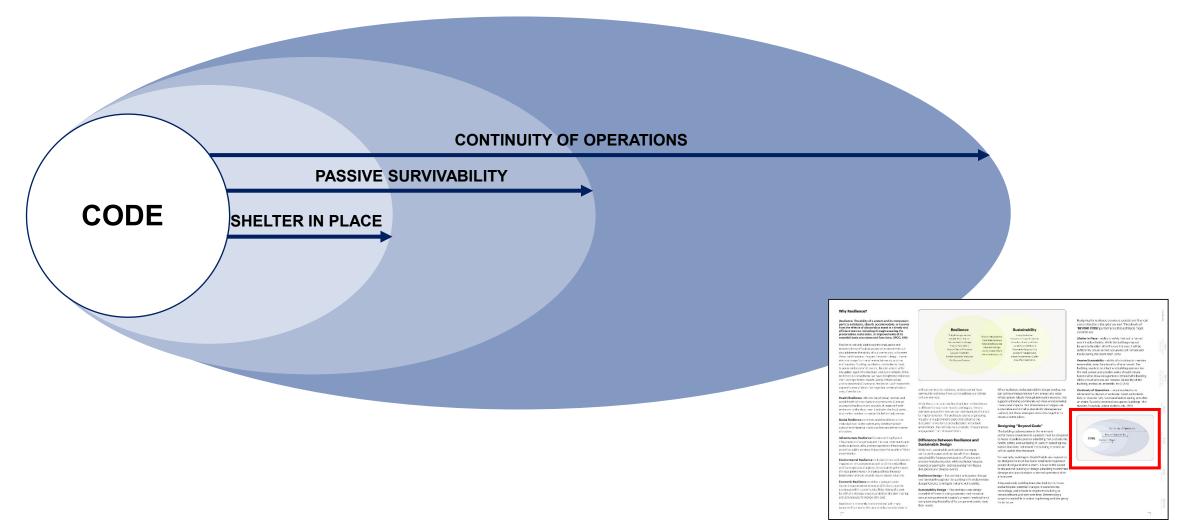


Resilience Design Toolkit

Introduction



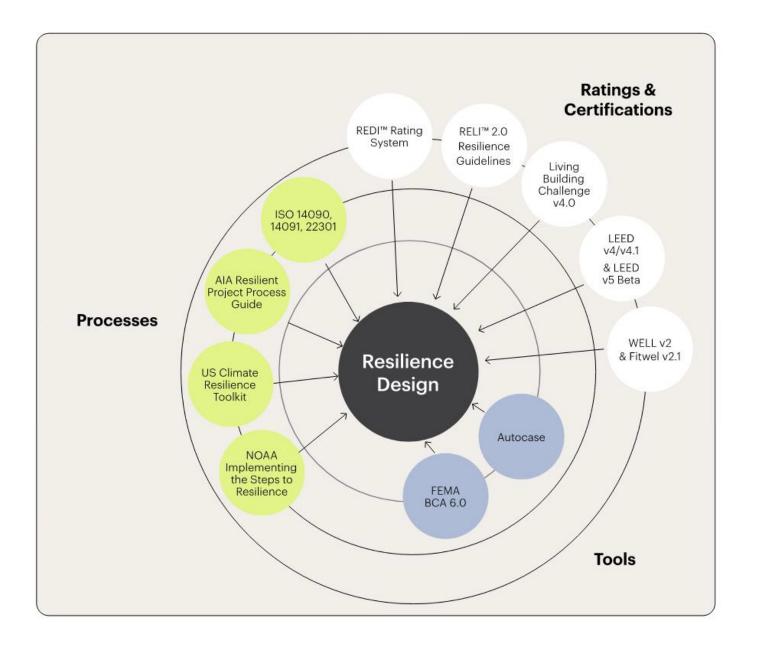
Designing Beyond Code



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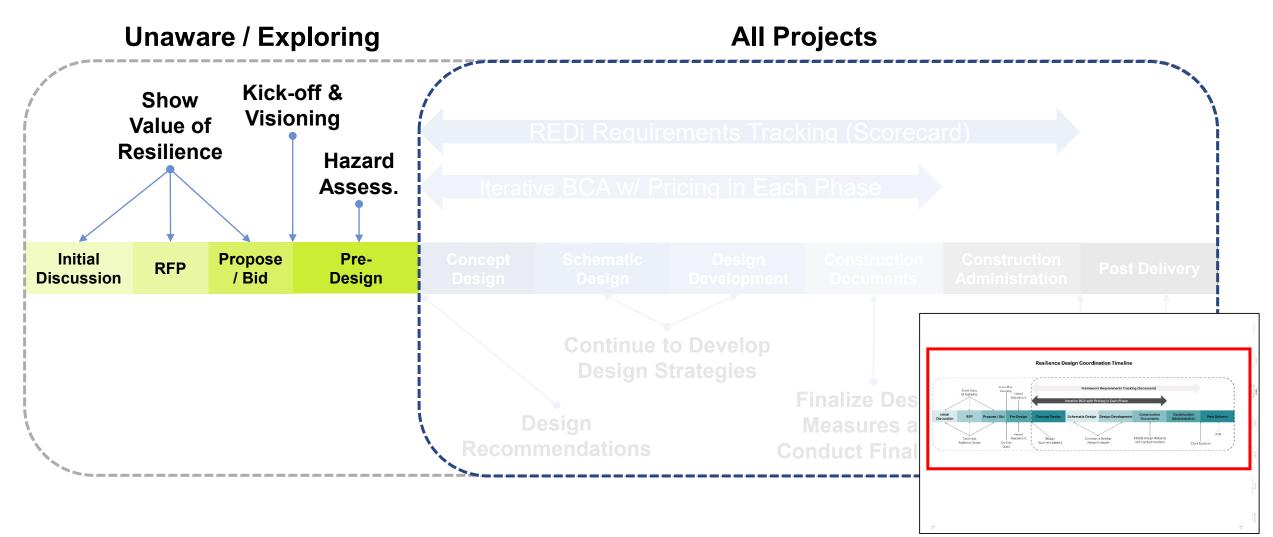
Resilience Design Landscape



A variety of its is and processes exist to help guide realience projects, Sach has unique cualities to entenne projects, yet the Realience Design Tookist provides a range of hools and concesses to determine gaps and introducers methodology that "U" is a news, in design	achitects, and any reases to implement frail ance based design." The RED' guide intestome a transmooth for instructive based design for the built entromet for exchanges, extent entoms, and hooling REU** 2.0 Rating Guidelines for Resilient	ISO 14090, 14091, & 22301 ISO has meaned itense its to help define Adapterian to Dimate Dianage with principles, guidater as and receivements for white ability, this assessments, and here by stress portinuity should be add readed.	Resilience Design Tookit This toolist has been developed expending for architecture and designers to it request resilience design into projects, it uses insight from all of the toos and particulations provide a perpendential
US Climate Resilience Toolkit	Design and Construction	FEMA BCA 5 0	and agile process that can work for any projecting size or location.
In 2514, NOAA Clinate Program Office Banched the US Classifier Resilients Tool (1) to improve government organizations are planners ability to understand and menage the clinate-existent and source control in the netral too falls under communications and fluorinesses man analised to external works. The tability area as force processor and endorstand risk encourses analogo force processor and endorstand risk encourses analogo	The REUP 2.0 Rating System is a realizance based rating system into combines despin obtained with integrative desays or bases for the global model. So, the realization is the realization of the realizat	PEMA BICA 6.0 PEMA has conside a board's cost analysis real through a plag in feature to Microsoft Deol [®] that can use formulae and user inguit to partition (CAL). This is a resource assessment for feature projects.	site of location.
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and take botton for resilience.	UCD technen theoranded for green backing		
AIA Resilient Project Process Guide	perfiltrational or over 20 years and has included self-size as a Pilot Orod 1 in v4Pill. These clothic conditis integrate		Ratings & Certifications
In 2027, the AVA missions the Realise t Project Process Guide to provide a torks of quarkform for architects to engage clients poughed with additional researces for architects to act upon. The document is equilable by	risk and vulnariasility assessment into project goals. LEED v5 is summitly in development and is belowed to have more realitonic requirements when released.	Res 1	(* introp inter = RE(*2.5) kectoree Datables - Leve herbore
project phase and identifies points where resilience	WELL v2 & Fitwel v2.1		
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	that require emorpency operations planning for		
NOAA Implementing the Steps to Resilience	buildings. Both arm to enhance social and community real ence by moking buildings more conducive to	All Bridgers	
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the Boops to Replience (BCR) it is assessment and depision augport from work to help as de desision	FEMA Integrating Historic Property and	Processes	
msking and strategy development. The guide is written	Cultural Resource Considerations into		I L MCW
for dimate scient-tion and neckersholding experta- to analyze beditate and as the project development.	Hazard Mitigation Planning		esilience strawid21
	FENA developed tool that provides a four step	Tax Serie	Design
Living Building Challenge v4.0	process to consider hazard millipation planning for testoris baildings. Das a delis written for planners.		
Using Building Challenge is the most comprehensive	and emergency managers but has some relevance to		Automas / /
and programs wigners building partilization system. It reaction projects to enforce building performance	natescentheproject process.	Processing in the second	
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that innately uses real ence leatures.	Autocase is travely a web and patients, because that quartifies		RASE
REDI** Rating System	and monetices excellent threath thereits, whole life participants		
The Real arrow based the income Design Initiative (RIDP)	lootprint, and bloog de finiencial impacts for the built		Tools
Rating System, developed by Arup's Advanced Technology	ervicement. It uses a benefit cost analysis tool to evaluate projects using a triple bottom line age tooch and is a useful		
and Research team, process-a framework for owners,	asset to understanding the impacts of resilient design	5	

MARKS ARUP

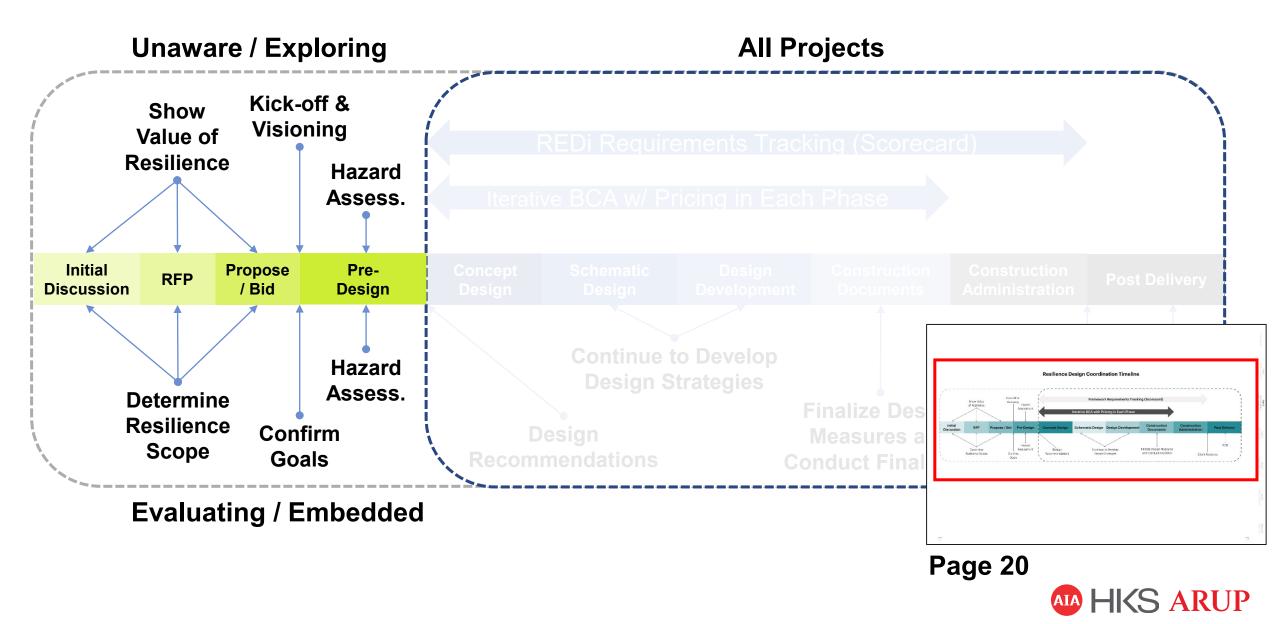
Resilience Design Coordination Timeline



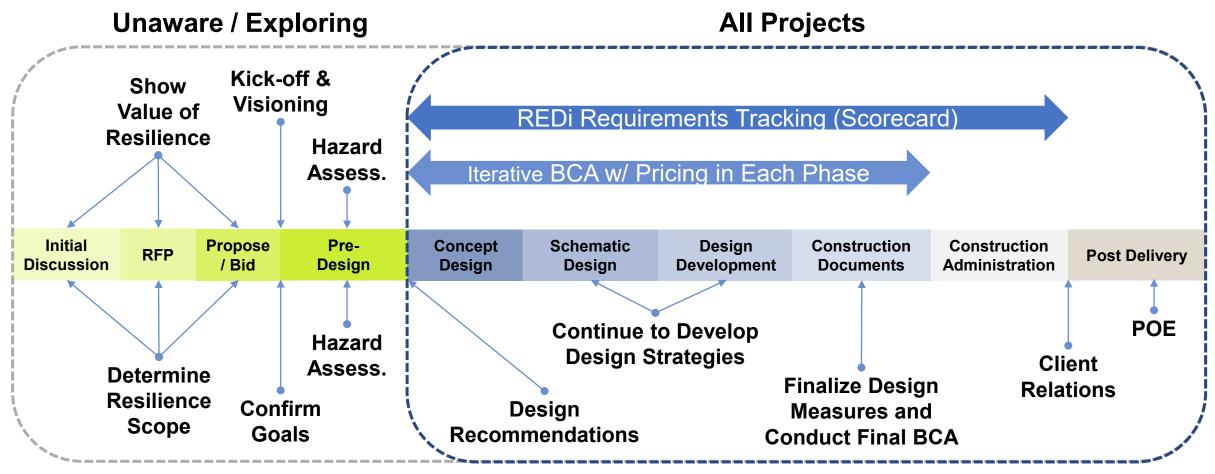
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Resilience Design Coordination Timeline



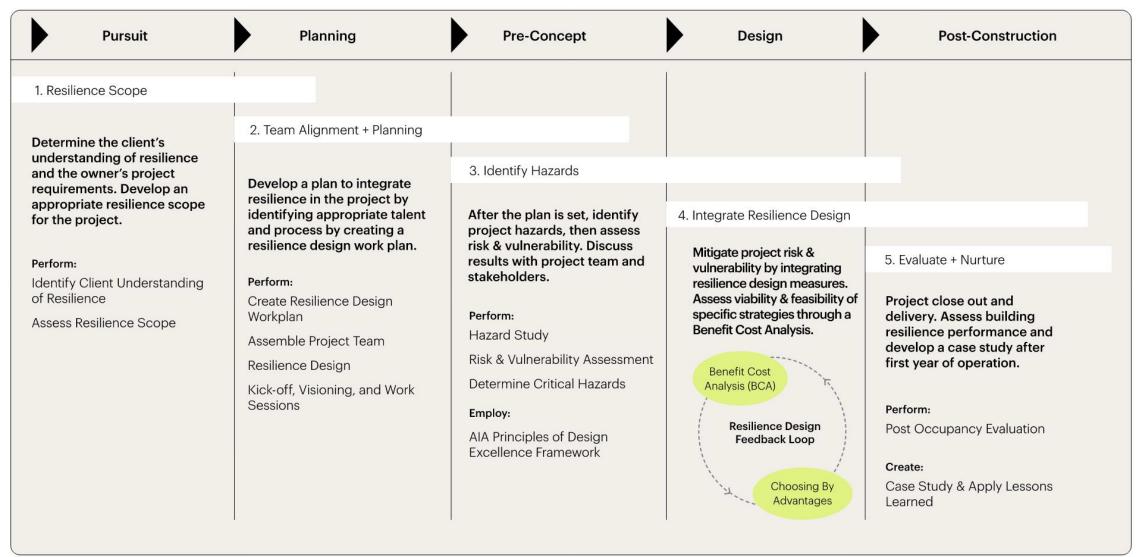
Resilience Design Coordination Timeline



Evaluating / Embedded



Resilience Design Toolkit – 5 Steps



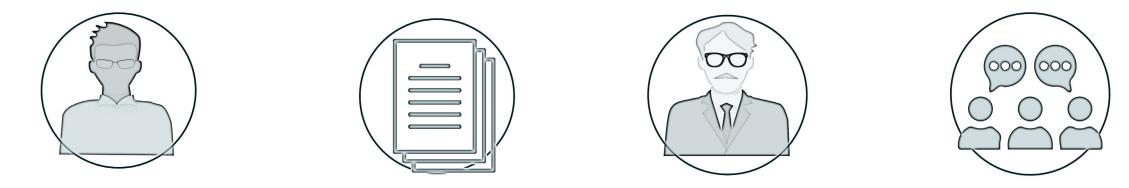


Step 01

Resilience Scope Assessment



Step 01 – Resilience Scope Assessment



Private Conversations

Embedded in an RFP/RFQ

Added to an Existing Project

Stakeholder Meeting

Client Characteristics

Unaware	Unaware of resilience as an issue Resilience may have not been mentioned in an RFP/RFQ or come up in conversation. Opportunity to lead with knowledge May not have an appetite for resilience	
Exploring	Aware of resilience as a concern but may not know what it is totally about or how it is performed	
	Needs guidance in understanding on how hazards might put their project at risk	
	Could be an opportunity to lead with knowledge	
	Need to understand client's position on resilience	
Evaluating	Client has a position on resilience and understands base concepts	
	Client has an idea on what they want in the project	
	Project team needs to build confidence in the client that they can provide resilience design services	
Embedded	Client is familiar with resilient design and knows what the final deliverable should be	
	Project team should determine the capabilities of the team and ability to provide desired services for the client	



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HKS ARUP

Example RFP

Activities:

- Define organizational and decision-making structure
- Establish project team
- · Verify clinical, education, sustainability, and research goals
- · Review and analyze historic volume, and utilization
- Review and analyze current state of the Strategic Plan and fully understand its goals and objectives
- · Confirm schedule including milestones and deliverables

Deliverables:

Current state summary

Project Phase: Basis of Plan/Design

Activities:

- Lead steering committee meetings
- Tour facilities
- Consult with service line leadership on willingness/opportunities to explore campus decanting strategies
- Confirm Critical Success Factors
- Confirm current care model and best practices
- Complete site investigation
- Interview with key staff members
- Review and refine scenarios for future inpatient and relevant outpatient volumes and utilization for programs
- · Prioritize drivers/key considerations to reach critical success factors
- Define scenarios for optimal program sites of service on both the main campus and greenfield campus location. Off-campus ambulatory (OCCs) sites only need service and volume definition, no facility master planning.
- Define resiliency goals
- Confirm zoning requirements and identify any constraints
- Review owner-supplied code and regulatory deficiency list and incorporate corrections into master plan

Deliverables:

Reports resulting from the activities above

Project Background

- Confidential Client
- Healthcare Master Planning
- Main Campus and smaller Outpatient facilities
- 5–10-year planning horizon
- **Exploring Resilience**

Deciphering Resilience Scope

- 1. Identify resilience scope in RFP
- 2. Ask questions
- 3. Compile information
- 4. Develop a proposal response



Example Scope of Work

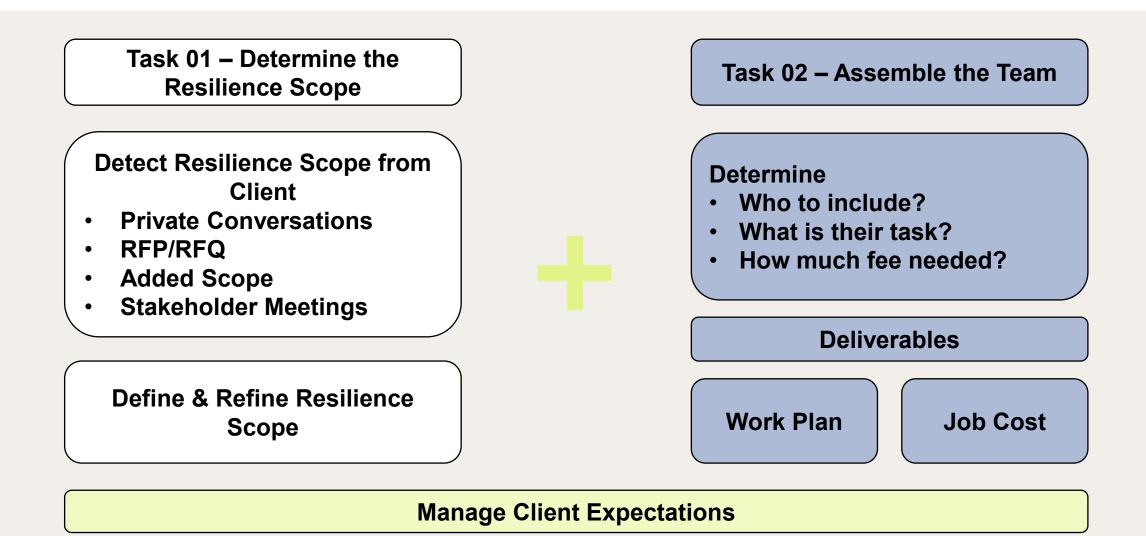
	SCOPE	TASK	DELIVERABLES
Resilience Assessment	 Review Current State of campuses and policies Determine potential hazards, risks and vulnerabilities Develop a plan to mitigate risk and vulnerabilities 	 Current State Analysis Assess Potential Hazards, Risk & Vulnerabilities Determine Resilience Goals Identify Strategies to Achieve Goals 	 Stakeholder Goal Setting Session Risk & Vulnerability Assessment Report for each campus Comprehensive Resilience Plan providing strategies to mitigate risk for each campus





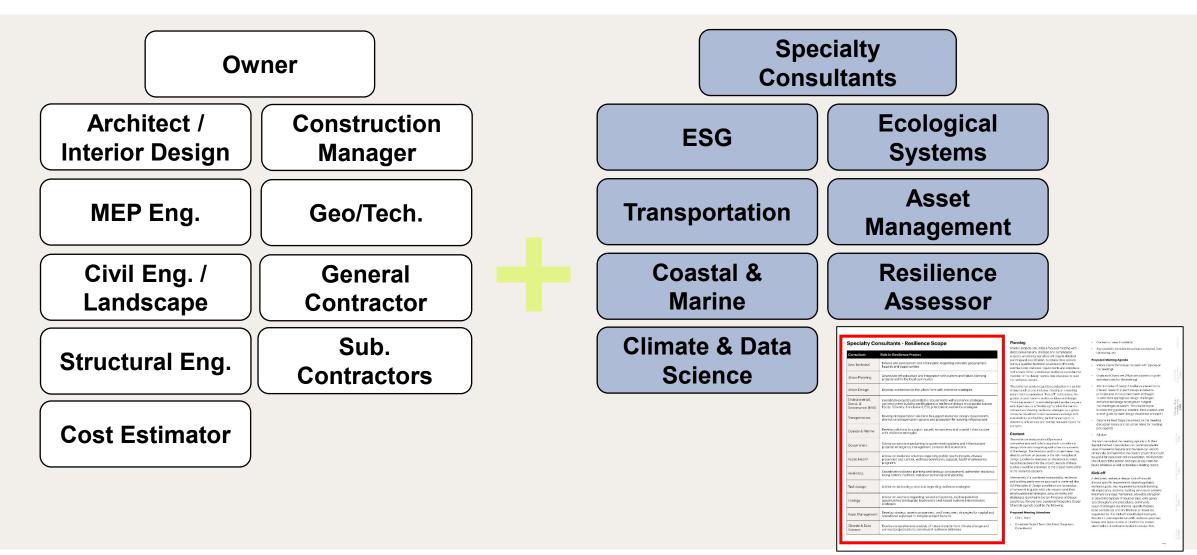


What Does This Mean For My Project?





Step 02 – Team Alignment & Project Planning



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Building the Team

Typical Project Team - Resilience Scope

Consultant	Role In Resilience Project
Architecture	Coordinate resilient strategies with building design features, integrate BCA into design strategy development
Civil Engineering	Develop site infrastructure and stormwater design with resilience strategies
Landscape Architecture	Design site solutions to accommodate resilience features and promote biodiversity
Mechanical, Electrical, Plumbing, Fire Protection Engineering	Develop building system design with resilience requirements, plan for power, potable water and process water emergency and back-up systems for the desired self-sufficiency period, support resilience design strategies and future retrofit opportunities, conduct project energy models and assess project performance
Structural Engineering	Design building structure to accommodate potential seismic, wind and other structural hazards, design site structures and coordinate infrastructure design
Interior Design	Design interior spaces to support resilient features and requirements
Contractor	Provide feedback on what is feasible in construction
Cost Estimating	Provide cost estimates for design components and strategies
Facility Management	Provide feedback for building operations and incorporate design strategies in building operation

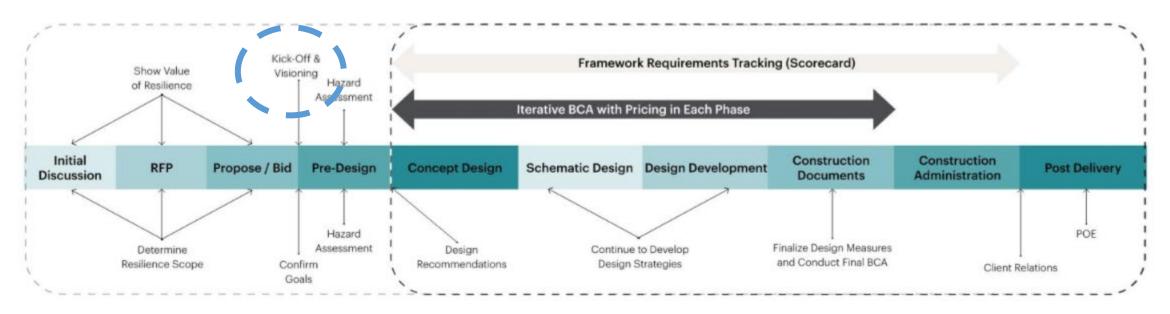
Specialty Consultants - Resilience Scope

Consultant	Role In Resilience Project	
Geo-Technical	Provide site assessment and information regarding potential geographical hazards and opportunities	
Urban Planning	Assess site infrastructure and integration with current and future planning projects within the local community	
Urban Design	Develop connection to the urban form with resilience strategies	
Environmental. Social, & Governance (ESG)	Coordinate project sustainability requirements with resilience strategies, connect green building certifications to resilience design, incorporate Justice, Equity, Diversity, & Inclusion (JEDI) principles to resilience strategies	
Transportation	Develop transportation solutions to support resilience design requirements, alternative transportation options and protection for existing infrastructure	
Coastal & Marine	Develop solutions to support aquatic ecosystems and coastal infrastructure with resilience strategies	
Government	Advise on solutions pertaining to government systems and infrastructure projects, emergency management protocol and operations	
Public Health	Advise on resilience solutions regarding public health impacts, disease prevention and control, wellness community support, health maintenance programs	
Resilience	Coordinate resilience planning and strategy development, administer resilience rating system, facilitate resilience workshop and visioning	
Technology	Advise on technology solutions regarding resilience strategies	
Ecology	Advise on solutions regarding natural ecosystems, explore potential opportunities to integrate biodiversity and natural systems into resilience strategies	
Asset Management	Develop strategy, asset management, and investment strategies for capital a operational expenses to mitigate project hazards	
Climate & Data Science	Provide comprehensive analysis of future impacts from climate change and connect project data to climate and resilience initiatives	



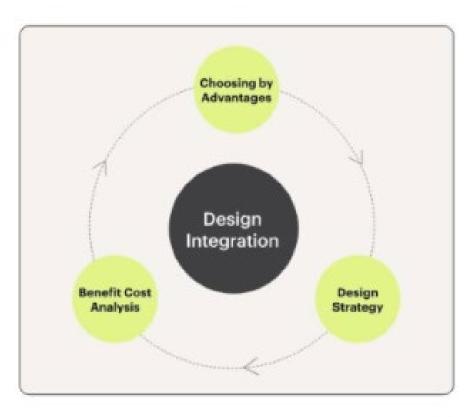
Aligning the Team

Meeting types	Time	Accomplishments
Kick-off	1-2 hours	Discuss Resilience Goals
Visioning	1-2 hours	Develop a Resilience Plan
Workshop	1-2 hours or Series of Meetings	Team Collaboration and Development of Resilience Strategies





Project Planning - Workplan & Job Cost Budget



Injecting what we learned about the hazards into our iterative design process enables us to envision a more resilient future.



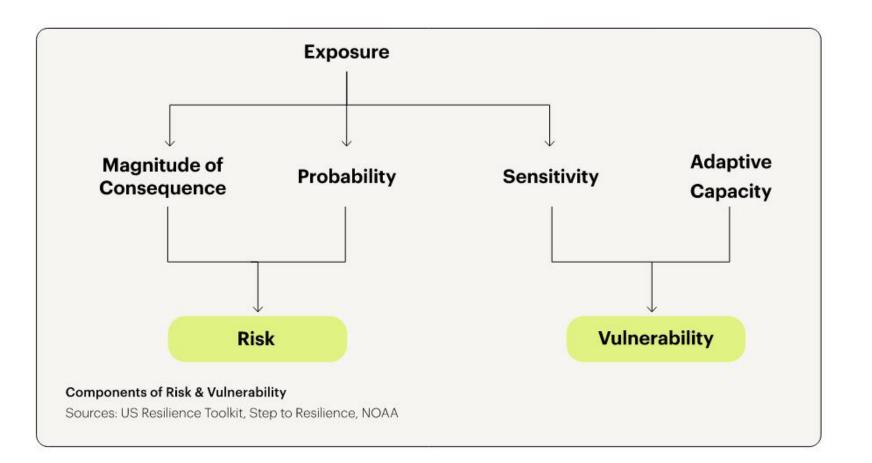


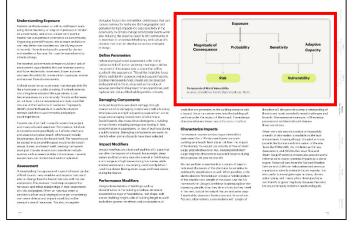
Step 03

Identify Hazards



Step 03 – Hazard Assessment and Identifying Risk/ Vulnerability







Step 03 – Identify Hazards

Avalanche

$\mathbf{A}_{\mathbf{x}}^{*}$	A large mass of snow traveling down an inclined slope
Causes	Snowstorms, heavy snowfall, human activity, vibration, steep slopes, warm temperatures
Concerns	Recreational activity, property damage, burial
Damaging Components	Velocity, weight

Earthquake

Hail

A.	A sudden and violent shaking of the ground, due to tectonic movement
Causes	Volcanic Activity, Tectonic Movement, Geological Faults, Landslides, Explosions
Concerns	Structural Damage, Tsunami, Rockfalls, Liquefaction
Damaging Components	Landslides/Mudslides, Avalanches, Shaking Vertical/Horizontal Displacement, Compromised Adjacent Structures with Fall Risk

Ice Storms

Ϋ́́Ϋ́	A storm of freezing rain that leaves a coating of ice
Causes	Freezing rain, near freezing temperatures
Concerns	Road conditions, weight on trees/roofs, utility damages
Damaging Components	Weight of ice, slick conditions for roads, freezing

Landslide

<u>ب</u> ب	The sliding down of a mass of earth or rock from a mountain or cliff
Causes	Disturbances on slopes, rapidly accumulated water, destruction of vegetation
Concerns	Disruption of Utilities, Road Blockage, Rapidly Moving Water and Debris
Damaging Components	Mass and Velocity of Debris, Rockfalls

+ 10 more Hazards in the FEMA National Risk Index

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Coastal Flooding

	Sea water flooding of coastal, low lying regions			
Causes	Waves, tides, storm surge, heavy rainfall, sea level rise			
Concerns	Reoccurring minor flooding, property / infrastructure damage, water contamination			
Damaging Components	Depth of water, flood inundation duration, velocity of surge			

Cold Wave

	A rapid fall in temperature within a 24-hour period affecting much larger areas than blizzards, ice storms, and other winter hazards			
Causes	Winter temperatures, polar vortexes, shift in jet stream			
Concerns	Pipes bursting, livestock harm, ice and frost, fuel and electric demands, dangerous roads, agriculture harm			
Damaging Components	Rapid freezing, ice on roads, winter weather			

억, to 1 1	Pellets of frozen rain
Causes	Strong updrafts, cold upper region of thunderstorm
Concerns	Vehicle/ roofing/ window/ gutter damage, agriculture, bodily harm
Damaging Components	Size of hail stone, frequency, amount in a given storm

Heat Wave	
IIII	A period of time where there are abnormally high temperatures compared to the average
Causes	Trapped air circulation, high pressure system, heated, stagnant air
Concerns	Lack of awareness, outdoor work related tasks/jobs, health issues
Damaging Components	High heat, extreme exertion on body, drought conditions

Lightning

4	An electrical discharge caused by imbalances between storm clouds and the ground				
Causes	Electrical imbalances, thunderstorms	Strong Wind			
		Ŷ	Atmospheric pressure variation that causes air to rush to fill low-pressure zones		
Concerns	Fires, utility interruption	Causes	Hurncanes, jet stream activity, large storm fronts, derecho		
Descelar		Concerns	Tree: faling, air infiltration, downed utilities, property damage		
Damaging Components	Fires, direct strikes to humans, electrical ma	Damaging Components	Interse guets, travimb lais, living datas		

Earthquake

A.	A sudden and violent shaking of the ground, due to tectonic movement
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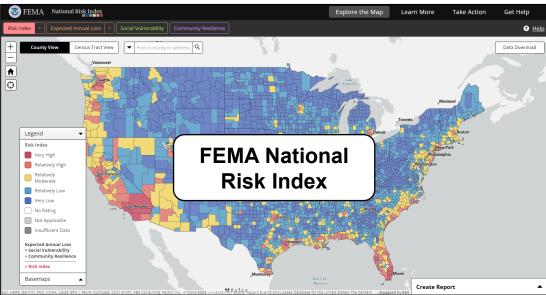






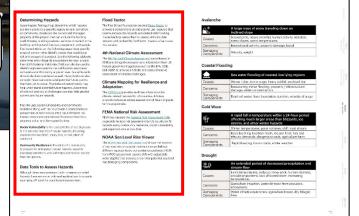
Step 03 – Industry Tools





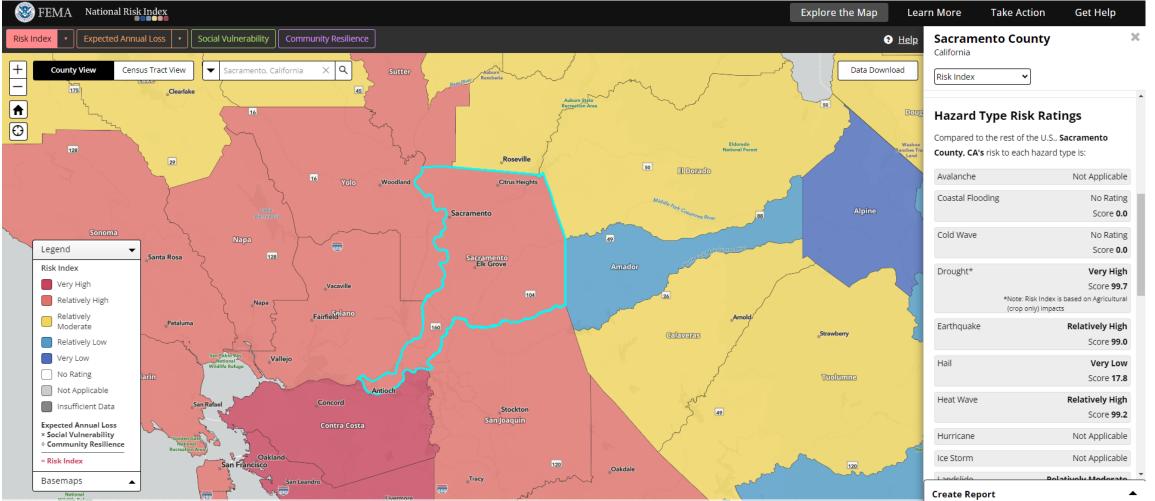








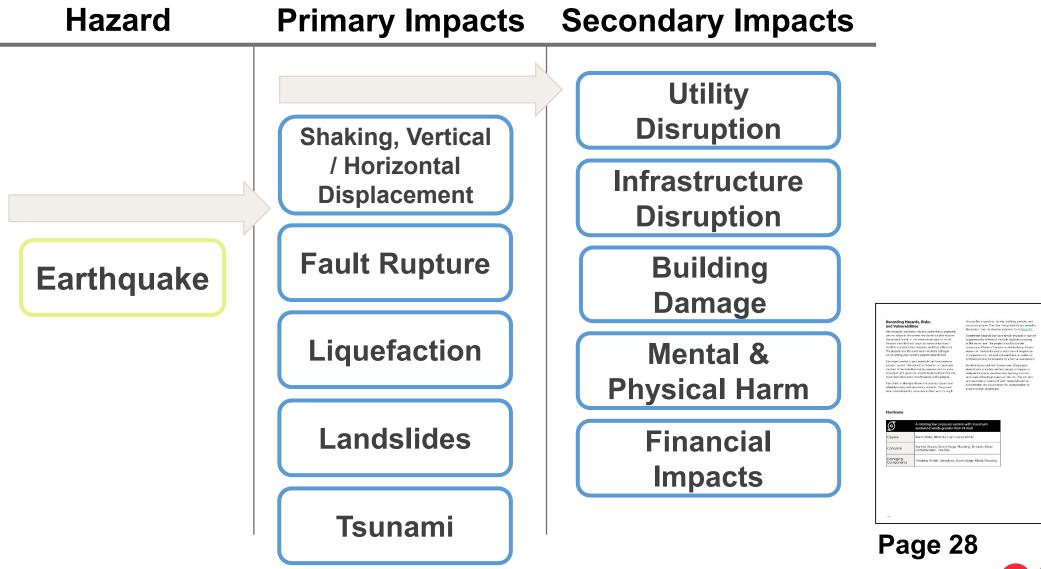
Step 03 – FEMA National Risk Index



County of Sacramento, California State Parks, Esri, TomTom, Garmin, SafeGraph, FAO, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USFWS | FEMA, Compass, CDM, Smith; ABS Consulting, Factor, Inc., Arizona State University (for Spatial Hazard Events and Losses Database for the Unite... Powered by Esri



Step 03 – Determine Critical Impacts

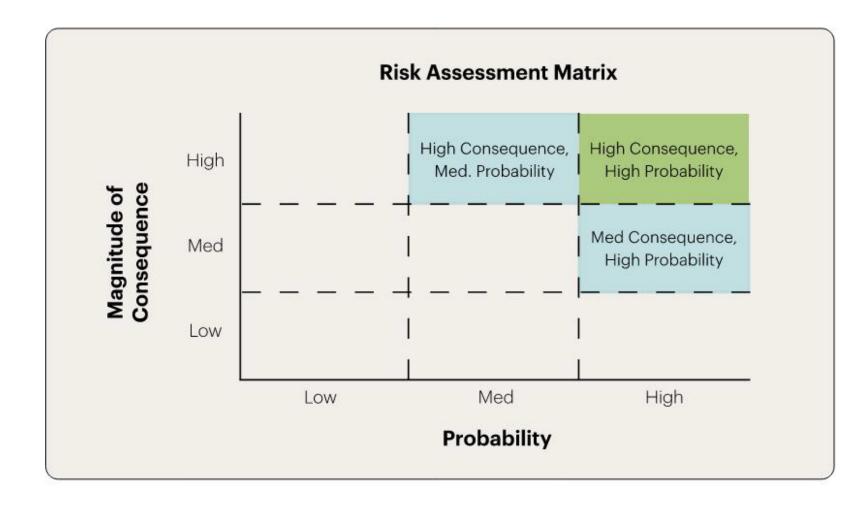




Flooding from Intense Brin Topical makaze centrolicae assess familitoching and riverine Booching

Hurricene The project is on a coastal site in a fact to me begand grow

Step 03 – Magnitude of Consequence



Vulnerability	that sugment primery and secondary repeats. It is important to parallel if was importantly ing the risk	Example - Ase	essing Flood Vulnerability		
Exposure, sensitivity and adaptive capacity are the components of value-obility. Sensitivity refers to	essection of L	Sonsitivity Lev	el Sensitivity	AC Level	Adaptive Capacity
second title for impacts to a project or community, Adaptive capseity addresses the skilling for a project to adjust to and accommodate an emergency.	With MeC and probability coloulated, begin to plot the osset-based parts on the Risk Assessment Varies. The units for the MsC and Probability should reflect the	High	Site of sea level	Low	Low bing snew with minimal area for scormwator or storm surge splection
absorp potential impacts, romain intest and portinue to serve its community following a disaster event. Both components can be subjective and cifficult to	serge of providinities for the project, of sec. In deflets and them. The magacines by further estagacies dimo- low, modularit, or Fight to group more act to fracteds	Madum	Site 10-20" above san level	Medium	Adjocent water systemic otton Bood, stormwater infrastructure in place
country summary, When assessing sensitially and adaptive aspectry, it is importent to review supporting information searches the tested sidentified. It count	tagether. Assos hezard pairs in the High High or High Medium areas of the matrix represent highest potential impacts and should be prioritized in design.	Low	Site 30° atom ses level	High	Stornwater infrastructure in placa, minimal flooding
be useful to have a real encempert provide might or perform a formal vulnorability assossment for the	Assessing Risk	Example - Ase	essing Flood Risk		
project before entering design. The table below shows how high sensitivity and low adaptive capecity cource be problematic for a project and courd be impacted.	 Develop Hazard Asset Pairs. Assets potential hazards to the site and associated impacts on project. 	Level	Probability	M	sgnitude of Consequence
from an elevated level of exposure	essets by understancing project vulnerabilities or the susceptibility to a naced with the adaptive caced by	High	0% Annual chance food of	vent Ma	jor fooding raads un-passable. Idings un occupiable
Risk The probability of the hazard occurring, and the	 Determine Hazard Probability, How Tedy is the hezard to occur at the project location? How frequently 	Medium	15 Annual chance Bood eve	10	vere flooding, some buildings and ads are compromised
In producting or user taket or an explosion of each respective of impact are the components of each Probability can be accessed through instruction data for a size such on board or probability and confidencements. An impacting climate makes calculatering pochod by	has it accurred in the pass, and is that treatancy increasing due to elimate change? FEMA's National Risk Assessment and FAGUS can previde protobility for some hazards	Low	10% Annual chance flood ev	venz dif	say fooding, standing water and fisult travel
of Float, however now productions and weather files are available to help make educated and strent. The magnitude of consequence (McC) retracts to the impacts sets and from a hazard. Historica loss data may help meetide as using an white resperts for a contracter	 Assess Magnitude of Consequences, Woold the Instant cause a major disruption for many people for an exercised period? Woold in require large ancuras of memory and time to resource form an exert 27 As professionals in the full the enformment, and wo can 		Risk A	ssessment	Matrix
Instantion is grown wherce project. For the predictions we require difficult and predictive methology are help associa- pather and impacts.	weren van te moler perciption ware petersisi oper and impacts from dienargens Anveidense somethet over help mele on informed assessment of the project.			h Consequence And Protobility	
Magnitude of Consequence	A cost astimator or the olient may provice actual or predicted value and cost information.	Rude	Afed		Med Consequence, 11th Probability
MrX were to heard up to known the period, and see to affect all tryinover modifies present or bits, it is one of the servers the variant life to be asize to ancientiand potential consecutions on sits. From these, determine their impact on the site and building concentrates above them a variantifier the Theor	4. Plot Hazaeds on the Risk Assessment Matrix, Now we leave data to rease an information and assessment of the bazaedinexets on the project seeds. Hazaeds in the tarong it must areas of the choir to include be provided in disign.	Magnitude of Consequence	~		
give no sensore innered and structure in pacts that could be experienced if the specific heard recents. Recedence who compared impacts through multiplies like power outspectra fining a disaster want			Low	Mad Probability	Hen

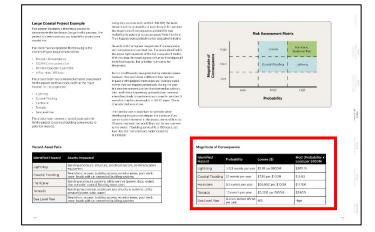


Step 03 – Determine Magnitude of Consequence

Hazard mapping chart helps determine risk from identified hazards.

Critical Hazard	Probability (Annualized Frequency) per year	Exposure Value	Magnitude of Consequence (Expected Annual Loss)
Earthquake	0.654% Chance	\$263B	\$1 per \$3,150
Drought	55.3	\$318B	\$1 per \$10.27
Heat Wave	2.3	\$263B	\$1 per \$1.27B
Wildfire	0.254%	\$166B	\$1 per \$91,200
Landslide	0	\$15B	\$1 per \$1.48M

Probability vs. Frequency. It is impossible to know exactly how many storms or hazardous events will occur in any given year. We use annualized frequency to assess probability of a hazard occurring.





Step 03 – Plotting Magnitude of Consequence

Critical HazardsOpposeEarthquake Drought Heat Wave Wildfire Land SlideOppose Oppos	Earthquake 0.654% AF \$263B AL		Heat Wave 2.3 AF \$263B AL
Others to consider:		Wildfire 0.254% AF \$166B AL	Drought 55.3 AF \$318B
Pandemic / Health Emergency Social Unrest	Landslide >0 AF \$15B AL		

Probability (Annualized Frequency)



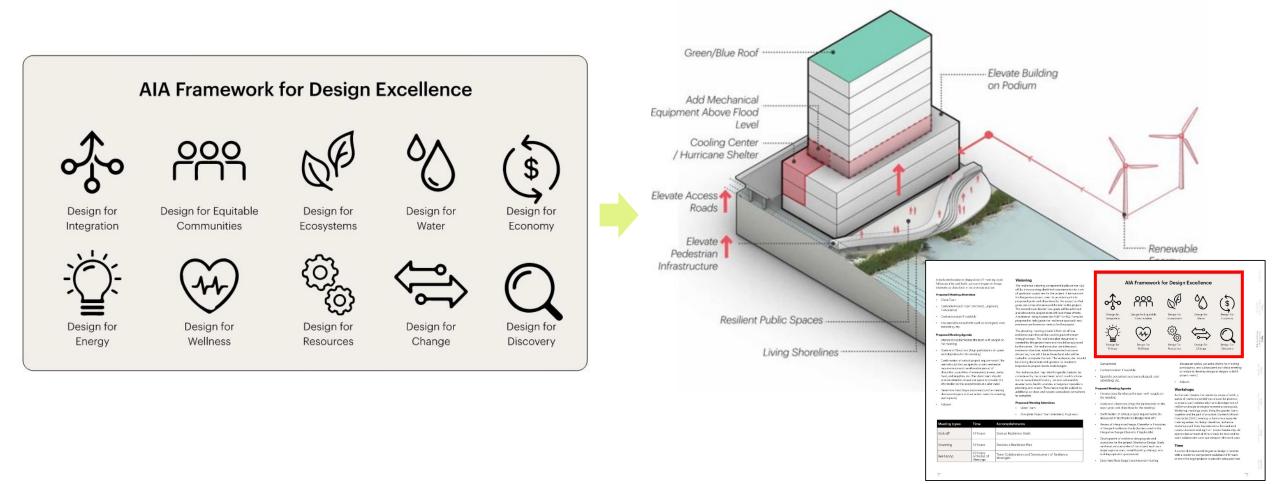


Step 04

Integrate Resilience



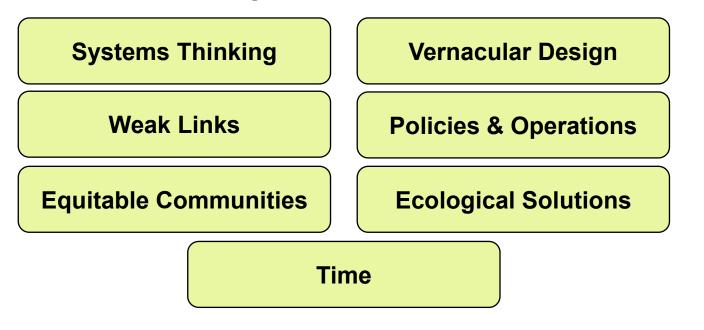
Step 04 – Knowledge of Place in Design





Step 04 – When Developing Solutions....

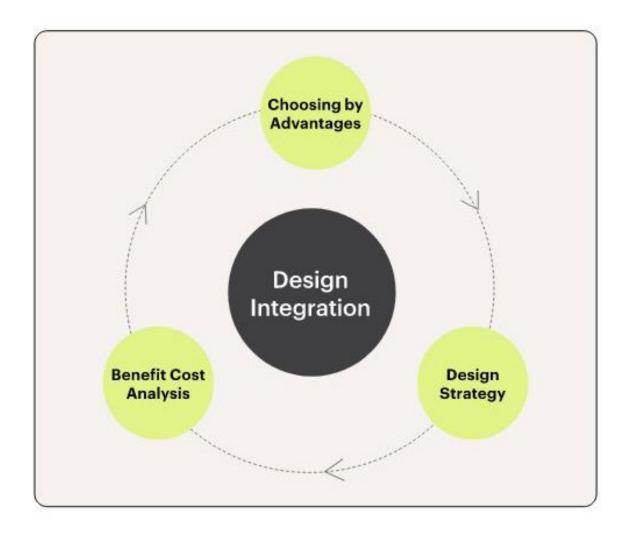
7 Topics to Consider



azards to Solutions	for fire suppression equipment is not available, it is incompanies to design and know traceries that each iden-	Policies & Operations	Time
relacing solutions requires ortical trinking and with of perspectives from the project learn.	each component, determine peter tol weak links, and develop methods to maintain operation.	Test all "accedure quine a designed solar on, fromerines It is more a "factive to initigate a hoter differing th controlling a protocol or process to operate the	C inside charge project two analysis successibly further they project into the tuture, thus, predicting reactly when estatements interacts could affer a
caching holistic and comprehensive ideas for transminence may negated by largeless. The wig concepts.	Equitable Communities	building so that an impact is minimized. For instance, an office building movies ure tenorits and workers	project are hard to calculate. We can identify risk thresholds and work backwards to mitigate those
tems Thinking	New growth and development often increase property waves which one gentify communities and displace respects and bacmasess. Social self-related or unity	to work from home to minimize need for extended periods of emergency power fael and potable varies exppty. The neares could also put impleme	impacts in design. This allows an owner to determine if a specific level of risk is acceptable for a project.
formatics an area with social contraction	we we compose is to throma communities and	connects to deliver fail and power for the bailding	For instance, set level itso experienced on a project
pononts and human behaviors that ears be affected	should also be considered in resiliance stategies.	with utility providers to ensure minimal disruption.	site may be negligible today but sould be significant
vectors. The effects on the system components may	Epictions should also ponsider the culture, beliefs, and	These operational policies can have positive benefits	or debilitiong for a project in 20 years. If the site can
are possible challenges that are not apparent when	history of a place. Projects are often dependent on	for tenants who are interested in a building with	accommodate 2" of sea level rise, but will endure
considering a central component. For instance.	the local community to support their business or use.	this type of policy and provide a better economic	Booking with any further using water, the threadesic as 2 of sea level time When sea level rise ascends 2. If a
sider hulding prove systems. Most includings have	without a reality community, but need on. Id is, fire,	opportunity for local food & beverage relaters to maintain customers if marks of loar are not effected.	2 of see level new VD arrange level rise seconds 2. If a united will have machine ball to ten into unity. The project
ectrical grid commotion, using transmission lines		In a main concernent in manual arms of a traditional direction	non should discuss with the owner to determine it this
randermony as well as a rate of gas correct in-	Epictions should seek to be supportive of community	by any first and data and a first strategies and	is an accopitable level of tisk or if further mitikation or
building uses electricity or nature gas to power fina HVAC systems, forking, ocurament, pipe leads.	gods and pultare. Key topics to ponsider include problem (sport top, strengthening commanity proups,	project team our bin dation.	adaptation is required.
ing HVAC systems, lighting, equipment, plug leads, identifying all the variables allow the project team	blowing in: community community groups.	project taste en e richts git.	addition in regards.
insider points of failure and bottleneoks to bailding	process providing accessibility of main in economic	Ecological Solutions	Since the taptice pant will be difficult to accurately
tion. A powerful relation by readers building	actely while microsing aertification. Developes	Ecological Solutions	predict, the threshold should be adjusted to militate
ment of contrible by contribution bits down	can be sensitive to community graphs and should	Using natural processes from native and acapted	risk. Extra site capee by for water, elevated buildings
ministructure, slop madering bartlery operated	he appropriate discusses with community leaders.	coosystems can provide officiencies in pulicing	and systems, a new project site all tagether could be
many consultants in a second contains.	In some situations, pro existing stresson like food	performance. Natural processes often self-requires and	employed to minimize expected risk for the owner.
	doserts, lask of photdable housine or access to	requiremining interaction to function when pritical	These strategies should be developed and exalipated
mailties are outside imposits on a system and are	community resources can exacerbate inequalities that	ecosystem comparisons are presided and protected.	for effectiveness. To seems long term unbility of a
a out of a project's ability to centrol. It is important made activitiation on that failures our rule	can become compound effects during a disaster event.	For instance, separation can establish yillow and mitigate stormaster without reading account to infordation.	reading to contend to its group prediction to states had result from our a range of accession to understand
project alle can be anticipated and miligated agrichteger. Using the same power infrodrocture	Vernacular Design	Vegetation can also help clean the ait, reduce a box heat Island, and inject bloghills for a project. An ecological solution can support an intervative approach.	adaptability to variations in the future. Strategies that can accommodate a variaty of impacts and are responsive to what could be even knowd provide mare
rplo, damaged above ground transmission lines	Realiston design should also consider the methods, see flatter, and functions for cleaner of the place.	souden ban sabjorr an megrariot approach.	value to clients and the community
so oireum centod with redundant electri caligrid rections or on-sterements detected a Departicipa	section of the sector for design of the place. Carries sizes of an elevation many controls the	A Celementine, evel-box end beaut/ulland-pape	
n owner's tolerance for being generation. Depending	Communities of ten detector are produced in a teo count the resources productio and receipt of a	centilize atteact more efficient populations, pertilibing	
n owner's telerance for being not operational. Indext power systems may be realized.	page. Real ence design strategies should consider	an area and pushing less off up it residents away.	
rear freeze attraction and a serie freeze	locally sourced materials assertioled using typical	Mol adaption, or actions that can increase risk or	
ak Links	means and methods of construction. This is especially	unwanted consequences, should be considered when	
air Links	to trial in stress with a diservole and under service of	developing solutions. Denofits should be sreighed	
ing region or telles on a sector of components	translations who will have its second maintain the	against known impacts to help create more equitable	
notion in unison earther building services are	project components Other, local materials and	COMPARISON.	
tained. As defined by Arcp. sestem imagity is	construction means and methods have evolved from		
ancent on the componence functioning conectly	disaster overta and provide insight into more efficient		
is only as strong as its weakest link. For example,	and sustainable design strategies. Understanding		
ifding that has bable up power, cirinking water,	vernocular clesion of a place is a goal of a AIA Principles		
I, and supplies may still have to close if water	of Dodigh Excellence exercise.		



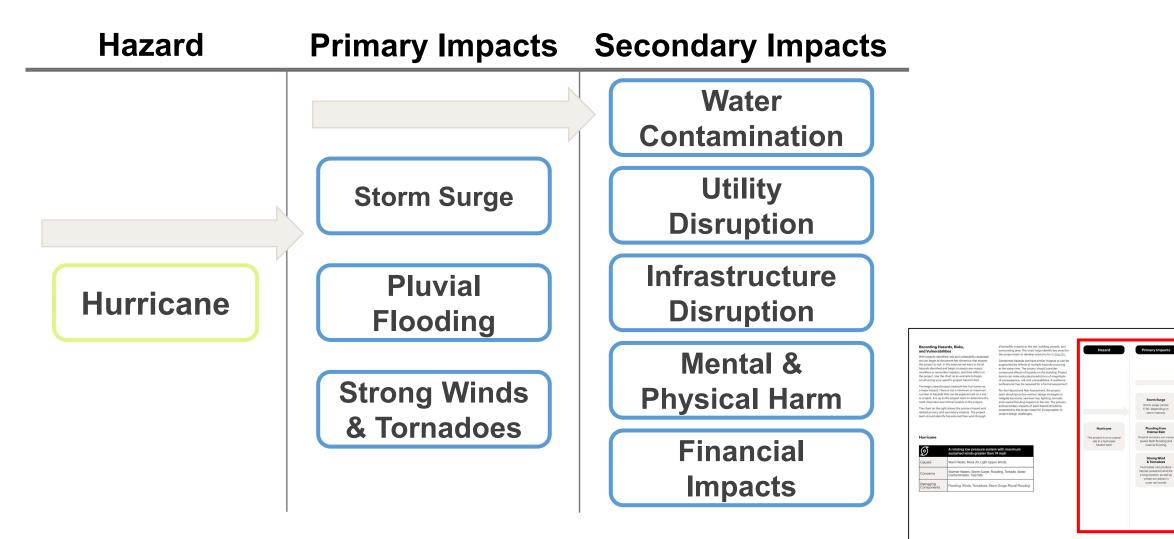
Step 04 – Resilience Design Feedback Loop







From Step 03 – Determine Critical Impacts



From Step 03 – Plotting Magnitude of Consequence

Critical Hazards Hurricane Tornado Coastal Flooding	Hurrica 0.3 A \$19B	F		
Lightning Sea Level Rise	Torna 0.2 A \$597M	\ F		Sea Level Rise 0.5-1" Per Yr. \$N/A
Pandemic / Health Emergency Social Unrest			Coastal Flooding	Lightning 244 AF

Probability (Annualized Frequency)

3.7 AF

\$34M AL



\$32M AL

Key Building Components to Consider

Enclosure	Roofs, opaque wall, glazing, curtain wall, seismic joints
Mechanical / HVAC	Air handlers, cooling towers, chillers, roof top units, fan units, dehumidification systems, exhaust, and intakes
Electrical / Data	Lighting, emergency power, process loads, electrical gear, renewable energy systems, transformers, vertical circulation, low voltage, data, communications
Plumbing	Water supply fixtures, wastewater systems, filtration systems, pool pumps, cisterns, potable water storage systems
Site	Landscape areas, pool deck, building entry, loading dock, waste collection, amenity lawns, building connections

Primary Impact-Asset Pairs for Hurricanes

Primary Impact	Assets Impacted	
Storm Surge	Damage to beach front access, exterior areas and	
Flash Flooding	amenities, impact to building access, inundation of building lower levels, damage to un-protected building systems on lower levels (electrical, mechanical, plumbin communications)	
Strong Wind	Damage to building enclosure systems, disruption of utility service (power, data, water, gas), down trees, inhibited travel to and from site	
Tornado	Severe damage to most building components, space to shelter in place required	

Secondary Impact-Asset Pairs for Hurricanes

Secondary Impact	Assets Impacted
Water Contamination	Storm debris, flooded fuel tanks, chemical spills, sewage overflow, and other pollutants enter local water ways and municipal water systems damaged by a hurricane
Utility Disruption	Damage to electrical, natural gas, data, communications, and water grid infrastructure can disrupt services to the site
Infrastructure Disruption	Flooded and debris strewn roadways impede travel which can prevent resources and emergency services from reaching the site
Mental and Physical Harm	Extreme conditions create risk to physical and mental health through physical objects and experiences. This creates liabilities for the ownership group and increases exposure to risk
Financial Impacts	Substantial losses and damages inhibit business operations which impacts capital debt payments, employee salaries, maintenance, and more



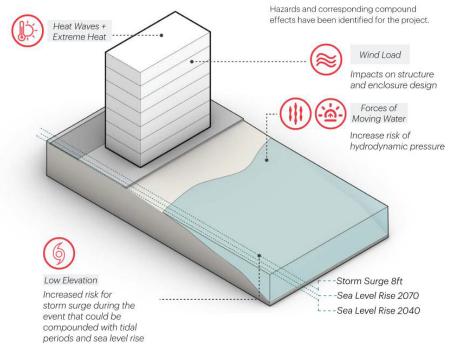
Sanibel Island, FL after Hurricane Ian (Cat. 4) 2022.

Page 31

minuing with the large coast: I hate coample from p 03, in Step 04 we can begin to connect primary	Processes of these components and the types of systems used combines a significant impact on the		Primary Impact-Ass	Primary Impact-Asset Pairs for Hurricanes	
cl secondary heateds with building components, this example we will facus on just humoanes for	realize and performant		Primary impact	Assets Impacted	
splicity. The same process should be conducted with identified based in provide a completensize.	services are disrupted, for	inputs may function over when other building services are disrupted, for example, operable windows		Damage to beach from access, exterior areas and amonthes, import to building access, inundation of	
essences for the project. o project team should also convoire project hezards	rated for humans force a and then can be opened a	dier a storm passes for	Flash Flopcing	building lower levels, demage to un-protected building systems on lower levels (electrical, mechanica), plumbing, communications)	
to the owner's objectives. These should be cercified if is in the pre-planning process. Sometimes, the cerd assessment may be inform or further circle op-	national variation and including utilities and the activat. Renormalized provides an end when when the hashing poolski provide a natural variation on strange to know the hulding involve seases comformable and provem mild and milding variations.		Strong Wind	Damage to building enclosure systems disruption of utile servers (power; data, water, gas), down meas, inhibited travel to and from site	
wher project requirements. Comparing identified exerts to project requirements will reprice ofly which to it is to consider that.			Tornedo	Severe damage to most building components acade to shoter in place required	
explaints project, the project learn alrund consider relativity or another endowing much relative section, and plumbing systems, solve or cogramming, indecode design, sherr water capacity, redundant sectors.	Key Building Comp	Roo's, ocaque well, glazing, namen well, seismin jointa	Secondary Impact	Asset Pairs for Hurricanes	
econe, and infrastructure. No aminet team should use consider 1 there are any		Air handles, cooling towers, shillers, roof top units, fon	Water Contamination	Sharm debris, flooded fuel tentis, chamical splits, sewage overflow, and other poliutants enter local water ways and multiples where soften uter societ for a functione.	
ager design of versicher the owner or design texes dates to pursue that may not be represented in the heres. A holistic restor there ar por each could be	Mechanical / HVAC	units, behavidification systems, exhaust, and intakas	Utility Disruption	Damage to electrical, not religious data, communications, and water gid infrastructure can disrupt services to the electronic services to	
effective mechod to also drive resilient sign concepts.	to domage building	Lighting, emergency power, process loads, electrical gear, processible process posterno.	Infrastructure Disruction	Finate and debris stream rockways impode tread which can proved resources and emogency services from reaching the size.	
Imary and secondary indext studies identify imported the building that are studies to demage on the identified instants. Design of these building importeds should insected in restant theiring to		transformens, varical arounation, low voltage, deta, communications	Mental and Physical Harm	Estroma conditions owers risk to physical and memai health through physical objects and experiences. This creates labilities for the conversity group and increases apposure to risk	
if profiligate patiential inspects by determining key ynwriaer neurochand with the building comparisate of adjaceng the design to bestern with ander an Hando or enemple, official ochicing systems seen as HMAO	Flumbing	Water supply fatures, westwater systems, fittation systems, polable water storage systems	Financial Impacts	Substantial losses and parrages inhibit ousiness operation which impacts capital deot payments, employee estates, maintenance, and more	
released gear that could be damaged from flood ators and storm surge should be lifted above the prim surge prediction level and placed inside the	Ste	Londscape areas, prol deck, building entry, loading dock, watte collection, amority israne, building contextuors			

AIA HKS ARUP

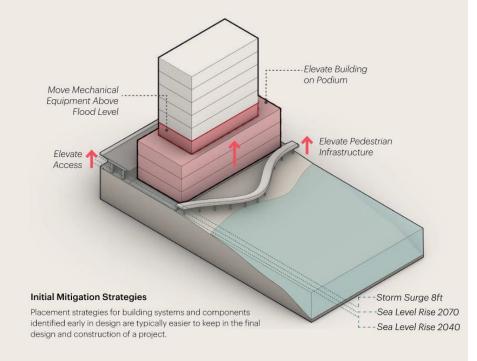
Hazards Identified



Resilience Design

When designing for resilience, sometimes the best way to start is to just jump headfirst with an idea to see where it goes. In the process, considerations and supplementary ideas will help shape design. There is not one correct way to put a building together and this is where it is up to the design and project team to take the information provided and make the process theirs.

It is beneficial to incorporate the AIA Framework for Design Excellence into the design process to help coordinate design concepts with the ten measures. This will help maintain a thorough assessment of the design and help provide documentation needed for AIA award submissions. The hospitality project example uses the AIA Framework for Design Excellence to illustrate how the ten measures could be incorporated into design solutions.



Design for Water

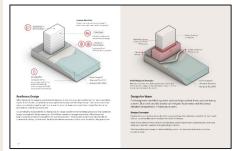
Fortifying sewer and drinking water systems helps protect these systems during a storm. Blue roofs and bio swales can mitigate flood waters and help keep elevated transportation infrastructure open.

Design Concepts

Raise building on a podium above the storm surge level, base flood elevation, and allow for "wet" levels that can accommodate water inundation with minimal damage.

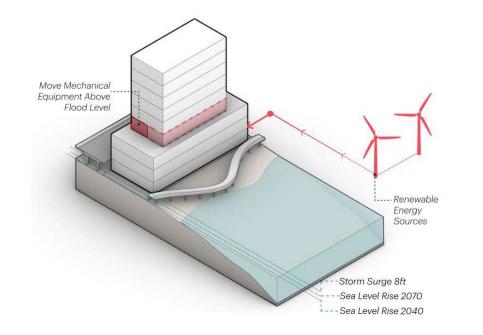
Raise infrastructure connections and critical building systems above storm surge level and base flood elevation to maintain operation during flooding inundation.

Plan for potable water storage on-site for building users in the case municipal water connection is compromised.









Design for Energy

Redundant and elevated power, data and communication systems protect building components and mitigate risks for storm surge. This is especially critical for essential buildings like hospitals and residences.

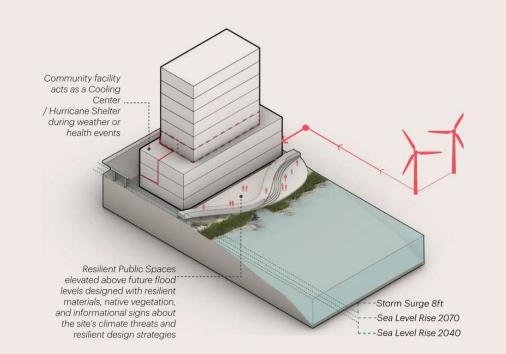
Design Concepts

Redundant and protected energy systems (Raised equipment floors from flood level).

Flexible power systems.

Micro-grid power delivery.

Reducing energy consumption by cool paving/roofs (by reflecting more solar energy and enhancing water evaporation) not only cools the pavement surface and surrounding air but can also reduce stormwater runoff and improve nighttime visibility. Can reduce ambient temperatures by 80 degrees and reflects 85-90% of radiation on site.



Design for Equitable Communities & Wellness

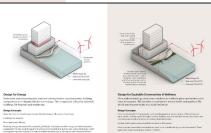
More resilient buildings allow more residents to shelter in place and minimize the need to evacuate. This benefits a community's mental health and quality of life which can improve equity and social resilience.

Design Concepts

Communities benefit from previously mentioned strategies that protect quality of life and maintain water quality, minimize power disruption, protect dwelling units, and maintain security, this allows us to continue to go to work and school and acquire financial security.

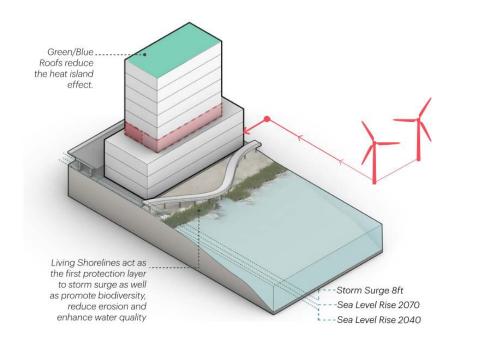
Resilient public spaces ensure equitable access to public spaces.

Cooling centers are resilient spaces that are open to communities during extreme heat events. These spaces can double as hurricane and storm shelters.









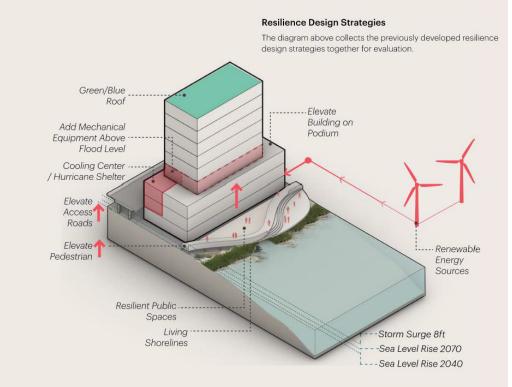
Design for Ecosystems

Natural solutions can often provide more effective solutions to environmental concerns. Vegetative buffers on the coast can mitigate storm surge and flooding while promoting biodiversity that can be an asset to the ecology of a place as well an aesthetic asset for communities.

Design Concepts

Living shorelines and vegetated coastal buffers better resist erosion and promote biodiversity on land and under the water.

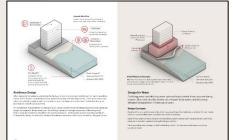
Vegetated landscapes better control storm water, clean pollutants from run-off water, promote biodiversity, reduce urban heat island, and promote biophilia which helps promote healing and control stress.



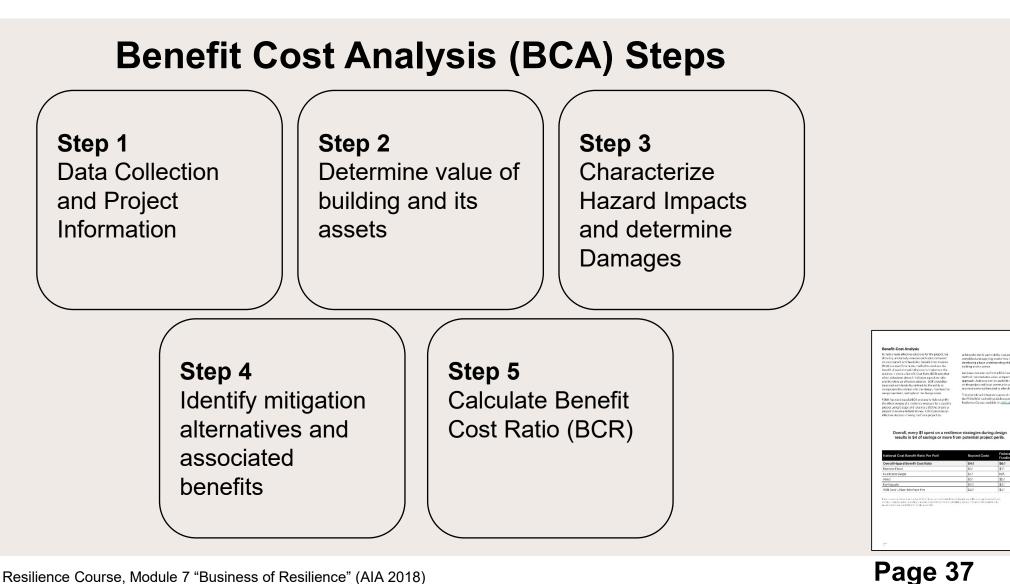
Resilience Design Assessment

The diagram above collects the developed resilience design strategies together for evaluation. In your project you may have multiple ideas to satisfy design objectives or mitigate hazards. A value engineering process may also jeopardize the ability to keep some concepts in the design. Resilience design strategies naturally require a systems approach that help us think about several different types of building systems, concepts, and features to create an integrative and holistic design idea. A building design solution that touches many parts of the building is harder to value engineer or remove from the project. For example, if solar brise soleil reduce visual glare, shrink the size of mechanical equipment, and can be used as hurricane shutters for windows, it may be harder for the project to remove them to save cost. The existence of the brise soleil help reduce cost of other items in the project.

When a more objective analysis is needed to determine if an option is viable to keep in a project or to help decide between multiple different ideas, a BCA can be used. The next section introduces the concept of a BCA and performs one for the hospitality project example.









Damages from Potential Hazards



Cost for Resilience Strategies

Damages Cost of Resilience Strategies

Benefit Cost Ratio (BCR) >1.0



The Resilience Strategy Should be Considered



Step 1: Project Data

- 60 year life expectancy
- \$300M construction cost
- Maintain operations 24/7/365
- 4-Star hotel, 180 Keys
- Major hurricanes incidence expected, 5.4 events in 60 years

Step 2: Determine Value

- Property value with building \$320 Million USD
- Property value of contents \$100 Million USD

Step 3: Characterize Impacts and Determine Damages

- Hurricane potential damage estimates \$5 Million USD per storm
- Major hurricane potential damage estimates \$15 Million USD per storm
- Potential loss of revenue if the facility is closed: \$47,000 per day

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Repair These energy multi-end and discourse the product to black product and the order of the product to black product and the product and the product to black product and the product and the pro- perties it associated only project use and type.		Kitin-Neystein / Cope BMI 1960-Decembra Jone Statieners Tangel BMI 1960-Decembra - Service Statiene BMI 1933-10



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Resilience Design Solutions

Solution	Cost
Living Shoreline	\$3,000,000
Elevated Building above BFE & Storm Surge Line	\$4,000,000
Back-up Power Systems for 7-days	\$15,000,000
Back-up Water Systems for 7-days	\$8,000,000
Resource Storage for 7-days	\$500,000
Green / Blue Roofs	\$1,500,000
Elevated Pedestrian Space	\$2,000,000
Renewable Energy Systems	\$7,000,000
Native & Adaptive Species Landscape Design	\$1,500,000
Total for Resilience Design Solutions	\$58,500,000

Resilience Design Solutions for a Major Hurricane

Solution	Cost
Living Shoreline	\$3,000,000
Elevated Building above BFE & Storm Surge Line	\$4,000,000
Back-up Power Systems for 7-days	\$15,000,000
Back-up Water Systems for 7-days	\$8,000,000
Resource Storage for 7-days	\$500,000
Elevated Pedestrian Space	\$2,000,000
Native & Adaptive Species Landscape Design	\$1,500,000
Total for Resilience Design Solutions	\$34,000,000



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Step 4: Hazard Mitigation Analysis

To the right are the resilience design solutions identified for the project.

Not all of the resilience design solutions are intended to protect the building from a major hurricane. Those solutions could be calculated separately outside of a major hurricane scenario. For demonstration purposes, we will keep the BCA only for a major hurricane event. The same process can be used to evaluate other scenarios and design solutions as well.

The intention of the resilience design solutions is to minimize damage and reduce downtime of the project. In this case we will reduce the impacts for damages as follows in the table.

Damage forecasts are reduced by 1/3 and the property is able to re-open 20 days sooner allowing for revenue to begin flowing more quickly. Impacts to local infrastructure, roadways, airports, etc. should be considered when the facility is able to operate.

Resilience Design Solutions

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Resource Storage for 7-days	\$500,000
Elevated Pedestrian Space	\$2,000,000
Native & Adaptive Species Landscape Design	\$1,500,000
Total for Resilience Design Solutions	\$34,000,000

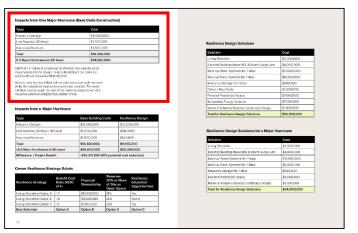


Impacts from One Major Hurricane (Base Code Construction)

Туре	Cost	
Property Damage	\$15,000,000	
Lost Revenue (30 days)	\$1,500,000	
Insurance Premium	\$1,800,000	
Total	\$18,300,000	
5.4 Major Hurricanes in 60 Years	\$98,820,000	

A BCR of 1 or higher is considered an effective ratio and should be implemented into the design. To keep the BCR at 1 the resilience solution should not exceed \$38,421,000.

Since a major hurricane likely will not strike every year and may never strike, this calculation represents a worst-case scenario. The owner will likely need to weigh the cost of the resilience solutions with the insurance premium and potential position of risk.



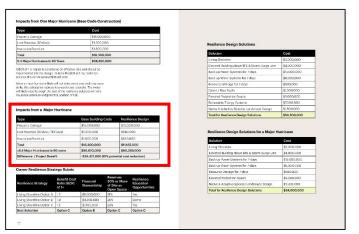


Impacts from a Major Hurricane

Туре	Base Building Code	Resilience Design
Property Damage	\$15,000,000	\$10,000,000
Lost Revenue (30 days / 10 Days)	\$1,500,000	\$540,000
Insurance Premium	\$1,800,000	\$645,000
Total	\$18,300,000	\$11,185,000
x5.4 Major Hurricanes in 60 years	\$98,820,000	\$60,399,000
Difference / Project Benefit -\$38,421,000 (61% potentia		ntial cost reduction)

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Resilience Design Solutions

Solution	Cost
Living Shoreline	\$3,000,000
Elevated Building above BFE & Storm Surge Line	\$4,000,000
Back-up Power Systems for 7-days	\$15,000,000
Back-up Water Systems for 7-days	\$8,000,000
Resource Storage for 7-days	\$500,000
Green / Blue Roofs	\$1,500,000
Elevated Pedestrian Space	\$2,000,000
Renewable Energy Systems	\$7,000,000
Native & Adaptive Species Landscape Design	\$1,500,000
Total for Resilience Design Solutions	\$58,500,000

Resilience Design Solutions for a Major Hurricane

Solution	Cost
Living Shoreline	\$3,000,000
Elevated Building above BFE & Storm Surge Line	\$4,000,000
Back-up Power Systems for 7-days	\$15,000,000
Back-up Water Systems for 7-days	\$8,000,000
Resource Storage for 7-days	\$500,000
Elevated Pedestrian Space	\$2,000,000
Native & Adaptive Species Landscape Design	\$1,500,000
Total for Resilience Design Solutions	\$34,000,000

Owner Resilience Strategy Rubric

Resilience Strategy	Benefit Cost Ratio (BCR) of 1+	Financial Stewardship	Reserves 30% or More of Site as Open Space	Resilience Education Opportunities
Living Shoreline Option A	1.2	\$5,000,000	31%	Yes
Living Shoreline Option B	1.0	\$4,350,000	28%	Some
Living Shoreline Option C	1.5	\$7,100,000	35%	Yes
Best Selection	Option C	Option B	Option C	Option C

Option C Should Be Selected

		Cost				
ety Damage		\$15,000	000			
Reserve (3D doys)		\$1.500.0	0.0		Resilience Design Solutions	
urança Demium		\$1800.0	20		Resilience Design Solutions	
al		\$18,300	000		Solution	Cost
Major Humicenee in 64	D Years	\$98,820	000		Using Shoreline	\$3,000,000
		1			Elevited Building above BFE & Storm Surg	Line \$4,000.000
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ton should not exceed \$3					Back up Water Systems for 7 days	\$8,000,000
amajor humome Heaty					Resource Storage for 7 days	\$500,000
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					Benevable Formy Systems	\$7,000,000
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Impacts from a Major Hurricane

Туре	Base Building Code	Resilience Design
Property Damage	\$15,000,000	\$10,000,000
Lost Revenue (30 days / 10 Days)	\$1,500,000	\$540,000
Insurance Premium	\$1,800,000	\$645,000
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Difference / Project Benefit	-\$38,421,000 (61% potential cost reduction)	

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> Damages Cost of Resilience Strategies

Resilience Design Solutions for a Major Hurricane

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Living Shoreline	\$3,000,000
Elevated Building above BFE & Storm Surge Line	\$4,000,000
Back-up Power Systems for 7-days	\$15,000,000
Back-up Water Systems for 7-days	\$8,000,000
Resource Storage for 7-days	\$500,000
Elevated Pedestrian Space	\$2,000,000
Native & Adaptive Species Landscape Design	\$1,500,000
Total for Resilience Design Solutions	\$34,000,000

Benefit Cost Ratio (BCR) >1.0

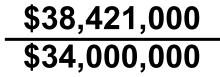


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Benefit Cost Ratio = 1.13 > 1.0

Resilience Strategy Adds Value







5. Evaluate + Nurture

A Resilient Building

Step 05 - Evaluate + Nurture is where the relationship with the client and the performance of the project come together, hopefully in a positive form. We should always seek to know failures and successes of our past projects so that we can learn and perform better on the next project.

Post Construction

Successfully achieving the project's resilience goals presents post occupancy opportunities. After the certificate of occupancy has been earned and the contract requirements have been fulfilled, the project likely is considered complete. This is a perfect time to follow up on Return-on-Investment (ROI) of the project as appropriate with the client and stakeholders. This could be assessed more comprehensively through a Post-Occupancy Evaluation (POE). Lessons learned in the POE may be useful content for a project case study or other publication that describes both failures and successes.

It is incredibly valuable to be able to assess project performance so that we can determine which design strategies functioned as intended or were not worth the investment. The comprehensive yet highly specific design strategies that could be developed for resilience design may be unique to the project and site. Design elements could be used in subsequent projects and a database of successful and not so successful strategies can help provide direction in the future.

Case studies are a great vehicle for documenting project work and the resilience design strategies included in the design. Developing a case study template that is clear and direct helps make project work highly sharable and can also be used for marketing and business development.

Clear and tangible building operations and maintenance manuals are critical for the building to function as designed and maintain its resilience features. Building operations manuals are developed and building operations staff are trained on how to properly operate the building. This is typically performed by commissioning agents and MEP engineers on the project. These training manuals should have sections on building resilience systems.

Through this process, it also provides an opportunity to remain in a trusted position with the client. Maintaining a relationship with a client and their organization may provide opportunities for future work and the ability to follow-up on past projects.

Post Occupancy Evaluation

Within the first year of operation, it is best practice to engage the owner with the opportunity to perform a post occupancy evaluation (POE) for the project.

"Post occupancy evaluation" is a term widely accepted and used across the industry for evaluating design after it has been put into service. The depth of analysis and tools used can vary quite widely in a POE.

POE is an evaluation conducted during the operations phase of a project after completion of design and construction. The scope of POE can differ dramatically by project type, client interest, and the skills and experience of the design team. A POE is executed to answer crucial questions about a building's performance. It can address questions such as:

Does the building perform as it was designed?

Does the building meet the users' needs?

What corrective measures can be implemented to improve performance?

How can building features be designed more effectively in the future?

Quantitative and qualitative measurements taken in a POE study ultimately allow designers and clients to review the effectiveness of design features and building performance.

When

It's important to give the operations team sufficient opportunity to calibrate the building after it is fully occupied, which typically occurs 10-18 months after project completion. Also, work teams, managers and individuals need to adapt to their new spaces, discover what works and doesn't work for them, and run through all processes.

You should start thinking about a POE at the very beginning of the project. A similar evaluation can also be provided prior to the start of a project to document a baseline condition, identify issues or concerns to be addressed with the new design, or help the owner and design team identify project goals and priorities.

Who

Simple tutorials can be provided to help project team members gather quantitative data. When it comes to interviews, surveys, and other qualitative responses, careful consideration in phrasing questions or input prompts will help collect unbiased and more useful responses. In identifying user groups and respondents to the POE, the first consideration is the type of information or feedback desired. Typical stakeholders could include building engineers and facility mangers, residents, team leaders, tenants, specialized work groups, students, faculty, nurses, patients, managers, staff, and executives. There are external tools and resources available to help define a more customized POE to address specific concerns or client needs.

Why

The POE provides validation of design strategies and/or construction implementation, and helps track to meet initial goals. Evidence from previous projects, including examples and impacts, makes it even easier to justify or bolster design solutions on future projects.

For the client, the POE proves the value of design and performance enhancements (daylight, biophilia, acoustic control, lighting, individual control, thermal comfort, etc.). The end user gains better understanding of the physical space they occupy and the design considerations.

A POE could also be used to demonstrate to an owner the impact of higher quality design features, including higher quality materials.

Follow-up After a Disaster

Inevitably when a disaster occurs, we should all lend a helping hand where we can. After the situation has stabilized, a discussion with an owner may be welcomed on how the building or project endured the disaster event and how the project team can help navigate issues with the building. This may help reveal how the owner has perceived resilience design features which may provide both objective and subjective responses. Having a relationship with the owner can help make these conversations more fluid and may reveal feedback on resilience performance. Sometimes the conversation may not be welcomed, it is up to the project team to assess the situation.

Other Ways to be Involved

The AIA Disaster Assistance Committee provides organization and training for architects to help their communities after a disaster event. The Safety Assessment Program (SAP) uses the California Office of Emergency Services training program for structure assessments after earthquakes, flooding, and extreme windstorms. Architects and Engineers can complete the training and be placed on a list of volunteers to help with damage assessments after a disaster event. This program can provide firsthand experience of the potential damage and hazards, relief process, and protocols that can affect communities, which can help with resilient design development.



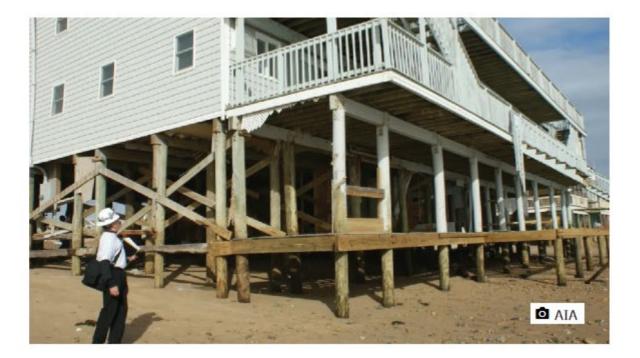
Safety Assessment Program (SAP)

The Safety Assessment Program

NOVEMBER 29, 2023

The AIA Safety Assessment Program (SAP) Training teaches architects, engineers, building officials, and inspectors how to assess homes, buildings, and infrastructure for safety after a disaster.







Safety Assessment Program (SAP) Training

Evaluate buildings after disasters to help people get back into their homes and businesses

- Get certified to do rapid safety assessments
- Based on CalOES's SAP program
- 2 half-day sessions | 6 LU HSW
- Sessions:
 - o September 25-26, 2024
 - o December 10-11, 2024





REDi[™] Design Guidelines

Resilience-based Design Initiative





REDi aims to transform the way resilience is measured and implemented in the built environment, and to **lower the barrier to entry** for owners, developers, architects, and engineers to achieve resilience. Ultimately, REDi defines **best practice for resiliencebased design**.



Resilience-driven Design



REDi™ Design Guides



https://www.redi.arup.com/

REDi[™] is a suite of design guides to enable resilient design in the built environment.

Each REDi[™] guide is a set of prescriptive guidelines for owners, engineers, and architects to implement resiliencebased design to achieve beyondcode resilience objectives.





Current industry approach	Best practice		
Individual Resilience Choices	Align to a Resilience Framework		
 Some disciplines incorporate climate change Some aspects designed for beyond-code requirements 	 Addresses all potential weak links Aligns resilient standards across all disciplines 		



Three Tiers of Resilience Objectives

REDi[™] uses a tiered system of "resilience objectives" based on the desired level of building functionality and performance following a natural hazard event.

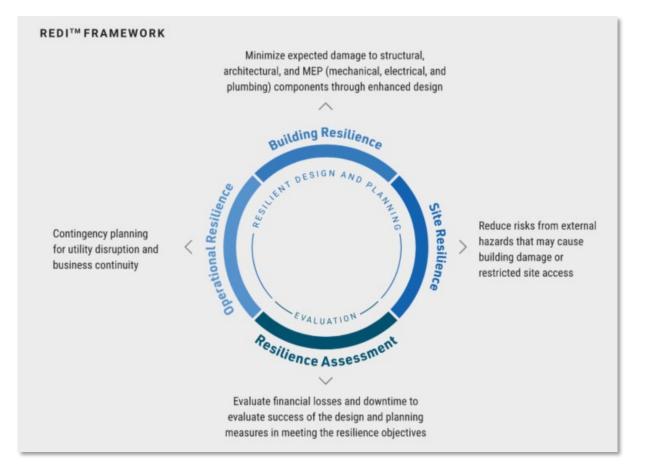
Design teams conduct an initial workshop with the client to establish resilience objectives for a project, which REDi[™] then lays out actions to meet those objectives

Rating	Downtime	Property Damage	Occupant Safety	
● ○ ○ Platinum	Immediate Re-Occupancy Functional recovery in < 72 hours	Probable Loss < 2.5%	Physical injury due to failure of building components unlikely	
O ● ○ Gold	Immediate Re-Occupancy Functional recovery in < 1 month	Probable Loss < 5%	Physical injury due to failure of building components unlikely	
O O ● Silver	Re-Occupancy in < 2 weeks Functional recovery in < 6 months	Probable Loss < 10%	Physical injury due to failure of building components unlikely	





Framework for Holistic Resilience



To achieve holistic resilience, REDi[™] lays out clauses for design teams to follow to across four key areas:

- Operational: contingency plans and processes to support downtime objectives
- Building: enhanced structural and non-structural component design
- Site: consideration of outside-theperimeter factors and access
- Assessment: ensure that the design meets desired objectives







Contingency planning for utility disruption and operational continuity

- Back-up utilities, communications, security, etc.
- Engineer / contractor on retainer
- Protection of critical systems / long-lead time components
- Business continuity plan



Structural systems



Minimize expected damage to structural, architectural and MEP components through enhanced design

- Performance-based design / NLTHA
- Limit building drifts
- Seismic protective devices
- Explicit quantification of collapse

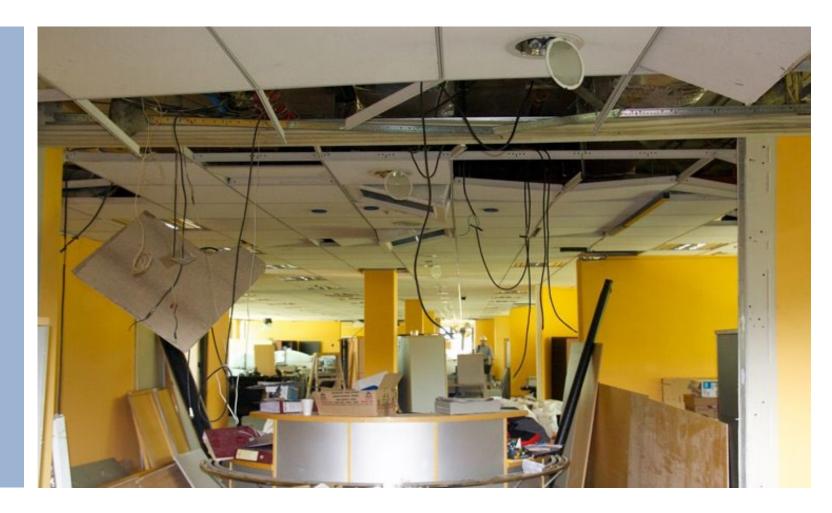


Non-structural systems

BUILDING RESILIENCE

2

Minimize expected damage to structural, architectural and MEP components through enhanced design





SITE RESILIENCE

3

Reduce risks that external earthquake-induced hazards damage building or restrict site access





SITE RESILIENCE

3

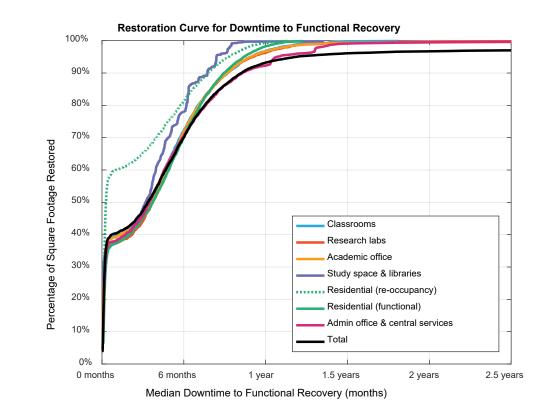
Reduce risks that external earthquake-induced hazards damage building or restrict site access







Evaluate financial losses and downtime to evaluate success of the design and planning measures in meeting the resilience objectives



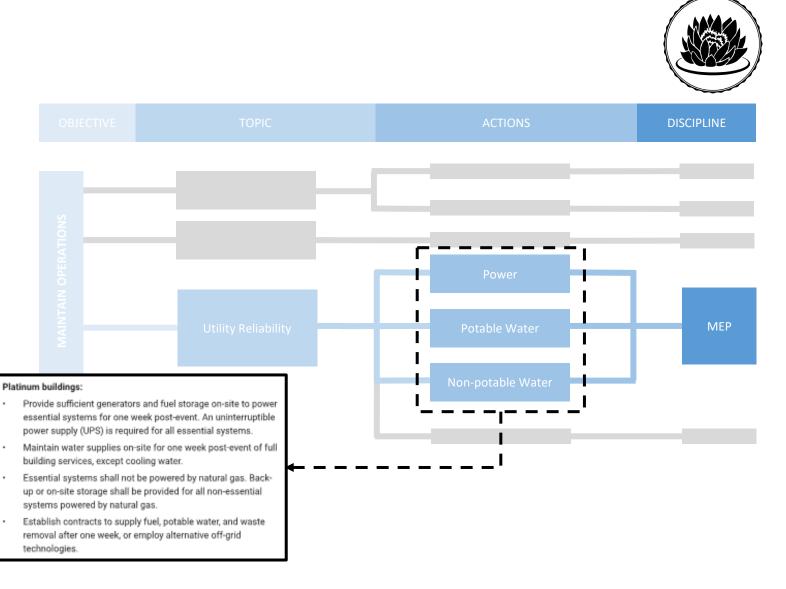
The REDi Risk Models are now publicly available!

https://www.arup.com/news-and-events/redi-seismic-downtime-model-released-as-open-source-software-to-advance-resilient-design



Action-Oriented Guidance

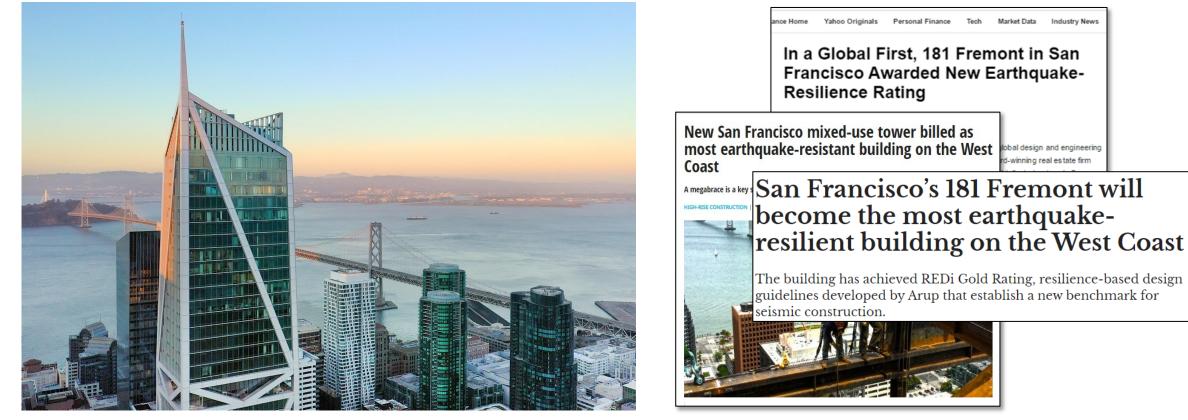
Each clause provides objective-specific guidance on how it can be met in order to lower the barrier to uptake of resilient design actions





REDi™ in Practice





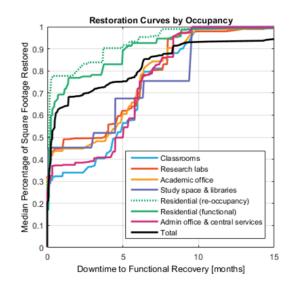
181 Fremont achieved REDi™ Gold Rating



ARUP



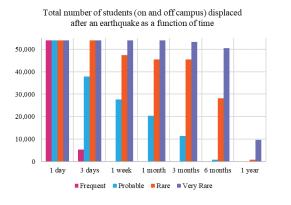
Assess damage to buildings and critical services

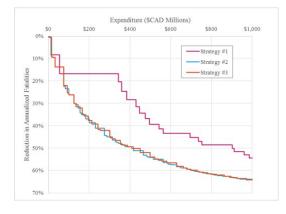


Assess vulnerability of operations

Quantify seismic risk for scenarios

Develop resilience strategies based on C/B









	Operational category	Required performance	
New facilities	Critical	Platinum	
	Important	Gold	
	Normal	Gold	
Aitigation of	Critical	Platinum	
existing buildings	Important	Gold	
	Normal	Silver	



Confirm seismic ri	Sks Confirm Ti IV, III build							
Make new construction resili	ent Construct	Construct new facilities to resilience-based design guidelines						
Protect life safety	Mitigate Ti	er V buildings						
	Mitigate Ti	er IV buildings						
Maintain critical functions		Enhance Tier III buildings that support critical functions						
					Enhance Tier II/I b functions	ouildings that supp	ort critical	
Recover important functions quickly	t	Enhance Tier III buildings that support important functions						
_								
	2020	2025	2030	20	35 20	40 20	45 205	



Example project | Macleod Building, UBC, Vancouver

REDi Rating

None

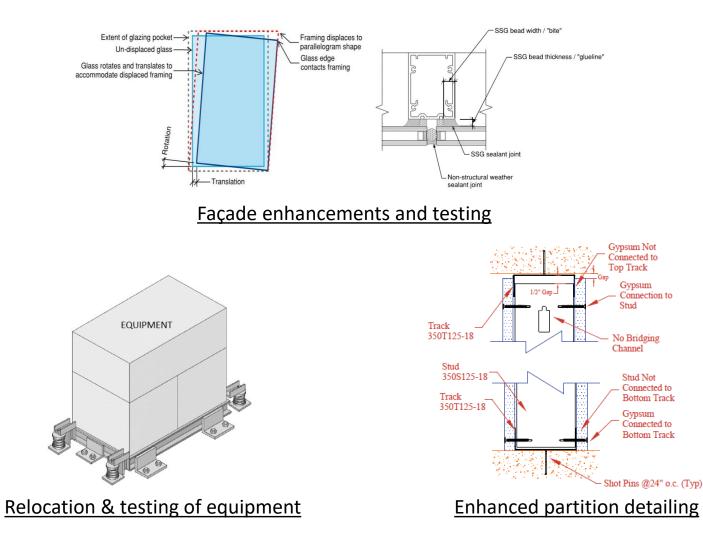
Architect: Provide the Resilience Consultant: A

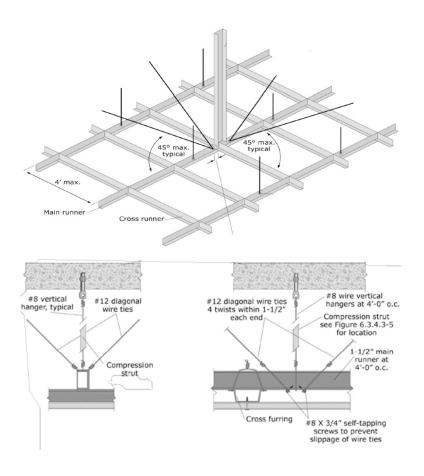
Proscenium Arup



How did REDi affect these projects?

Architectural considerations





Enhanced ceiling detailing



Closing Thoughts

Leveraging Integrative Frameworks for Resilient Design

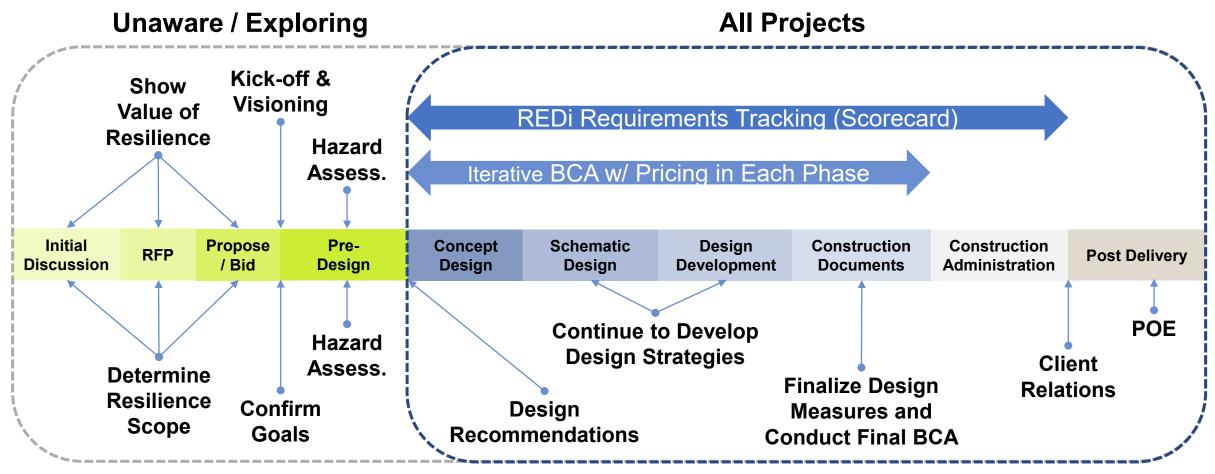


Resilient Design





Resilience Design Coordination Timeline



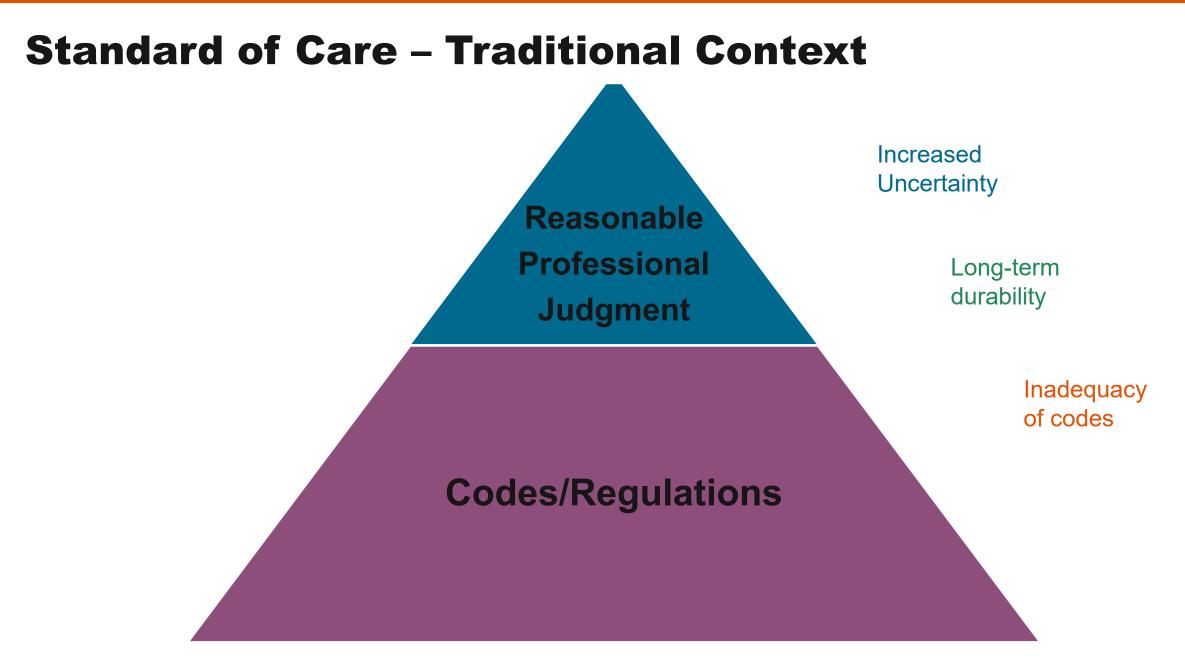
Evaluating / Embedded





Navigating Professional Liability and Climate Change

Yvonne Castillo, Esq. SVP, Director of Risk Advisory Victor Insurance Managers, LLC





Evolving Standard of Care for Climate Change



Codes/Regulations

Resilience-based rating systems/guidelines, climate projection reports/tools, climate modeling



Reaction by Courts Balancing Test



Lawsuits against:

- industry for failing to adapt facilities against severe weather events
- government entities for failing to adapt or adapting improperly
- federal agencies for not considering climate change factors in project development



Q+A

To submit your question, click on the Q&A button located on the black menu bar at the lower or upper portion of your screen, then type in our questions.