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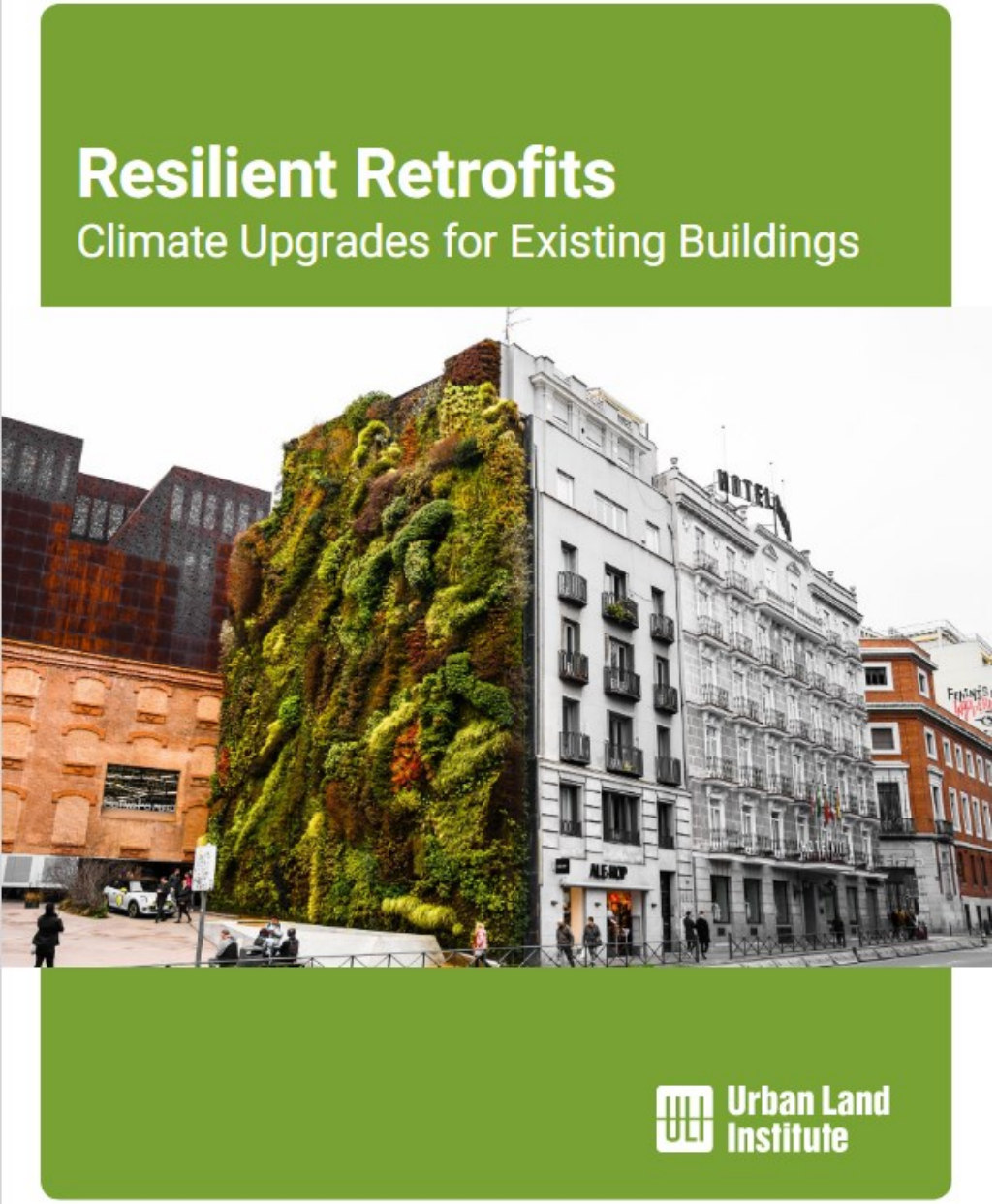
Resilient Retrofits: Existing Buildings and Physical Climate Risk

CLAY HAYNES | DANIELE HORTON | IBBI ALMUFTI | MARY WITUCKI

URBAN RESILIENCE PROGRAM

MAY 13, 2022



Resilient Retrofits Report

From ULI's Urban Resilience Program

How can we prepare existing buildings for accelerating physical climate risks?

What role can real estate actors, designers, policymakers, and finance professionals play in the process?

Report includes:

- The business case for resilient retrofits
- A summary of design strategies for each physical climate risk
- A selection of public-sector policies influencing the retrofit context
- An array of financing solutions applicable to retrofits

Available Now on Knowledge Finder

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A Few Housekeeping Announcements

- Participants will remain muted through the duration of the webinar
- Submit your questions through the Zoom Q&A function
- This webinar is being recorded and will be sent to registrants shortly, and uploaded to ULI's Knowledge Finder platform

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Speaker Introductions

Clay Haynes
Moderator
Founder & Principal

Public Square

Daniele Horton

Founder and CEO

Verdani Partners

Ibbi Almufti

Associate Principal
Risk & Resilience Practice Leader

Arup

Mary Witucki

Community Education and Outreach Program Lead

FEMA Region 9

Why is Resilience Important to CRE Facing Climate?

- Risks from extreme weather are here
- Resilience planning is urgent and a key component of risk management
- Risk information already includes climate related risks
- Climate change is already having an increasing impact on building values
- Resilience has become a competitive advantage
- Building owners that can have been implementing measures to mitigate flood and fire risk
- “Climate risks are investment risk.”

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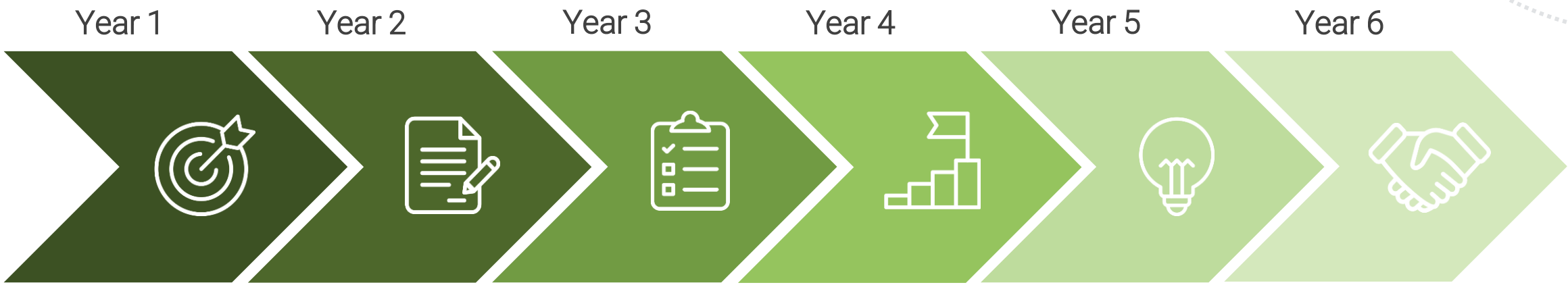
Resilience Program Roadmap



Establish resilience program goals and strategies

Perform portfolio risk assessments to understand portfolio risks.

Perform additional onsite risk assessments for high-risk properties.

Invest in fortification strategies. Ensure optimal operation practices.

Make buildings more resilient and self-reliant. Resilient distributed energy systems.

Public, Private, Partnerships. Seek Solutions that benefit the entire region.

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Resilience Risk Categories for Real Estate

We recommend assessing key portfolio risks through the following categories in alignment with the GRESB Real Estate Assessment and the Task Force for Climate Related Financial Disclosures (TCFD). A resilience risk assessment can help to identify and mitigate key physical, social and transition risks.

Reduce disruption to building operations in the case of extreme weather events or long-term shifts in climate patterns.

Develop and operate buildings that are safe and promote the health and well-being of our building occupants and the livelihoods and prosperity of the local communities.

Reduce the entity's and building's exposure to climate-related transition risks such as changes in energy costs and enhanced energy and emissions reduction and reporting laws.

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Strategic Approach to Resilience

ASSESS RISK & VULNERABILITY

- **PERFORM RISK ASSESSMENTS** physical, social and transition risks. Includes existing assets, new acquisitions, new developments & loan origination
- Budget for and **PERFORM ADDITIONAL ON-SITE RISK ASSESMENTS FOR HIGH-RISK ASSETS**
- Due Diligence for New Acquisitions

MAKE A PLAN

- Develop & implement a **RESILIENCE PLAN** . Establish goals and targets
- Evaluate risk assessment results
- **INCORPORATE PRIORITY RESILIENCE MITIGATION MEASURES INTO ANNUAL BUDGETS**
- **UPDATE PROPERTY LEVEL EMERGENCY PLANS**
- Check **INSURANCE COVERAGE**

IMPLEMENT RESILIENCE STRATEGY

- **IMPLEMENT RESILIENCE MITIGATION MEASURES**
- Educate stakeholders on the **EMERGENCY PREPAREDNESS**
- Track financial impacts of climate risks
- **REPORT RESILIENCE PROGRAM PROGRESS** and updates to GRESB, TCFD & Annual ESG reports

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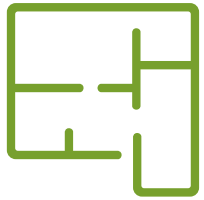
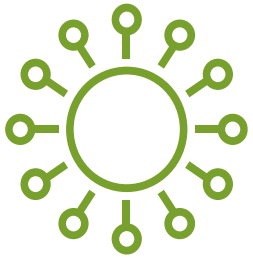
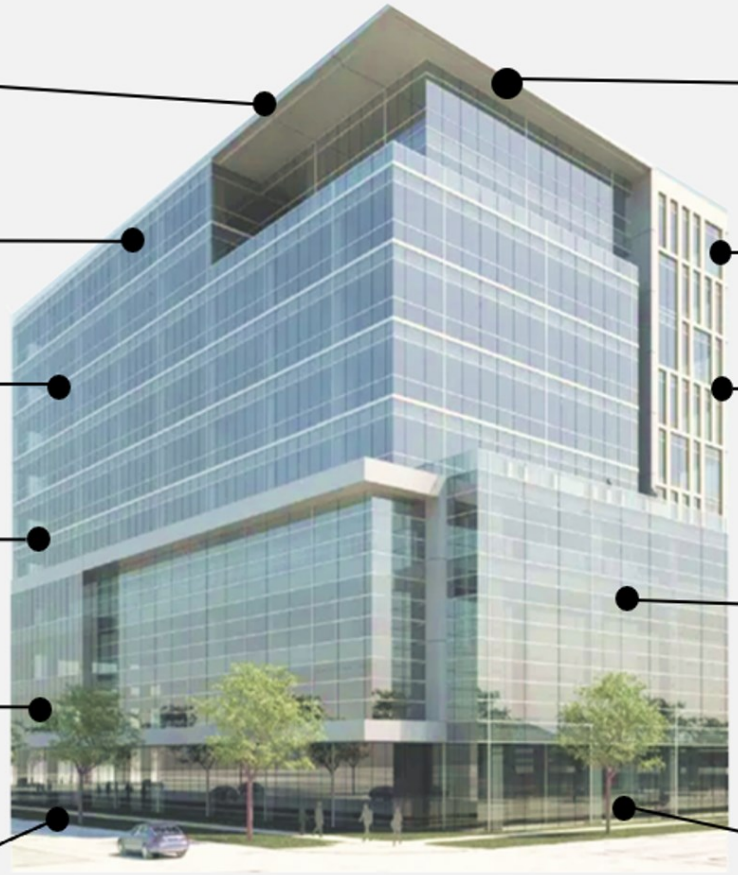
Plan: Resilience & Emergency Planning





SITE	STRUCTURE	SYSTEMS	OPERATIONS	PEOPLE
• Flood-proof Building Site • Create Cool Ground Surfaces • Flood proof Buildings • Use Hazard Resilient Landscape Design • Provide Shade • Stabilize Slopes Susceptible to Erosion, Landslide, Fire • Use Soft/Green Infrastructure to Prevent Flooding	• Enhance Structural Elements for Extreme Loads • Use Cool Roofing • Enhance Building Insulation • Manage Heat Gain • Prevent Wind, Water, Fire Damage • Protect mechanical systems	• Ensure Back-Up Power and Systems • Create Resilient Heating, Cooling, and Ventilation Systems • Identify Resilient Water Systems • Extend Emergency Lighting and Services	• Have Emergency Plans • Protect Records and Inventory • Secure Interior Environment • Train Building Owners for Resilience Upgrades • Protect Chemical Storage • Secure Potable Water	• Locate Vulnerable Populations • Plan for Building Occupant Needs • Identify Mutual Aid Resources

Top Building level Resilience Solutions in CRE



Backup Power – solar, high ground generators, etc.

Building electrification & Renewable Energy

Emergency Management – Property team training on using emergency systems and available backup systems

Record Protection – Protect records and inventory

Backup – Guarantee food & water availability

Flood Proof Protect building from flood including temporary flood barriers, sandbags & dewatering pumps

Resilient Power Availability – Maintain high ground/ protected from flooding

Safety – Ensure compliance with the latest structural/fire codes

Emergency Command – Establish emergency communications and command system

Structure – Enhance structural elements for extreme loads

Transition Risks – Consider future risks to asset value including reduction in capital availability and repricing of "brown" assets

Landscape – Integrate hazard resistant landscape design

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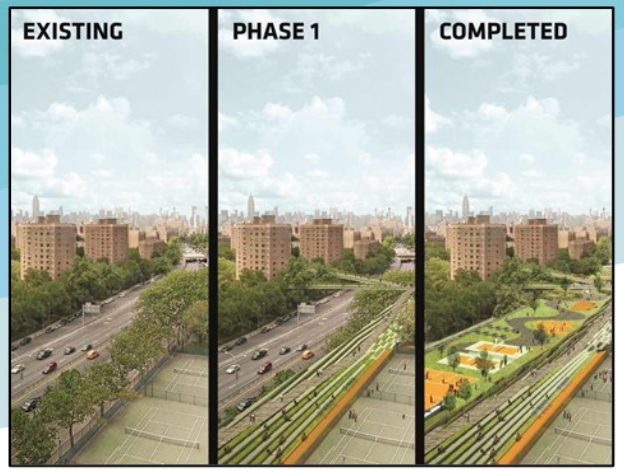
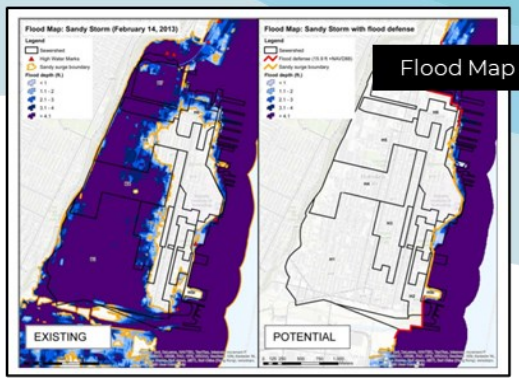
Public Private Partnerships

To Protect Regional Coastal Areas

New York dry line project



Boston's | Resilient Boston Harbor: Downtown

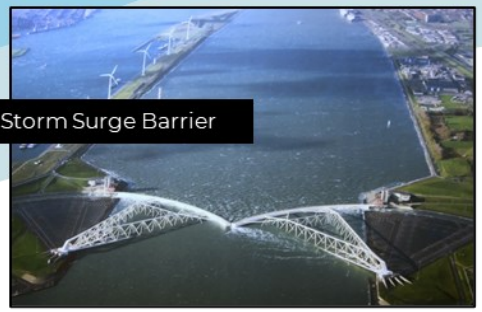


Flood Map – Existing & potential

Oma's Proposed Hoboken Waterfront

The Netherland's Sea Wall

Rotterdam Storm Surge Barrier



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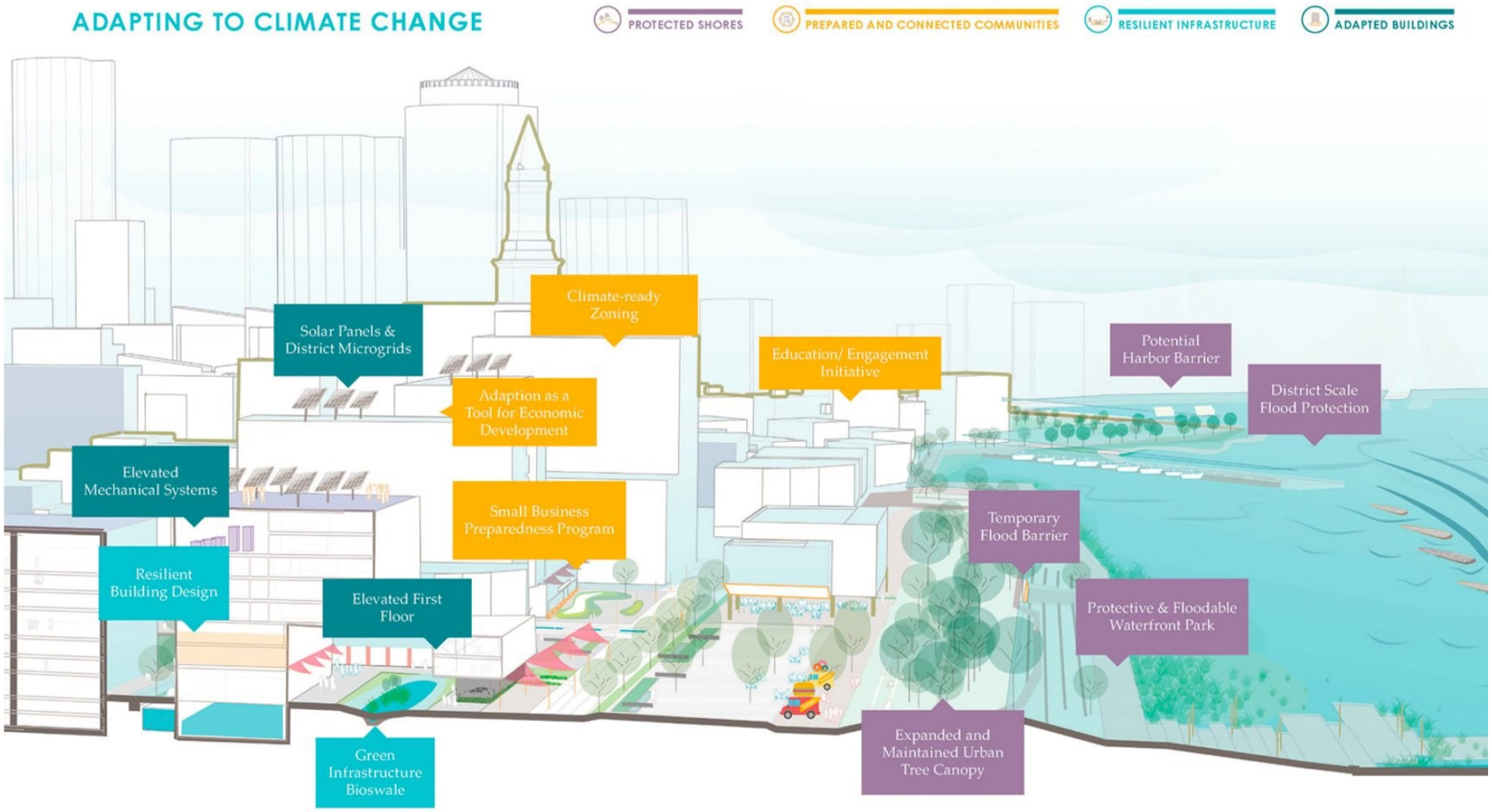
Public Private Partnerships



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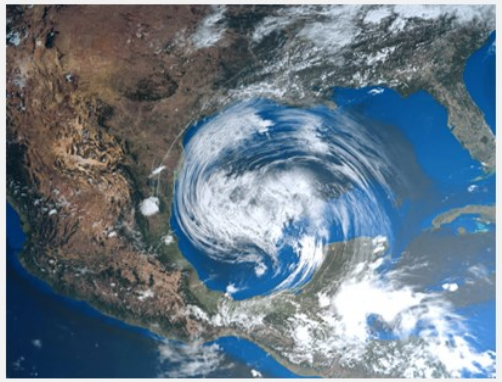
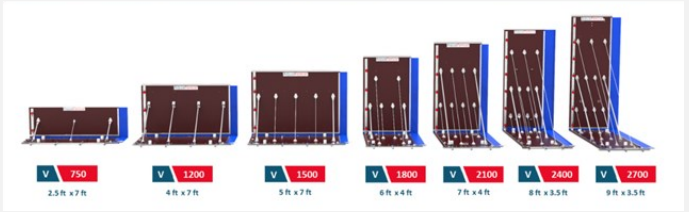
SOURCE: CLIMATE READY BOSTON

Implemented Resilience Measures | Parkway & Hurricane Harvey

Ranked 1st Globally – GRESB Resilience Module (2018 & 2019)

Cat 4 Hurricane Harvey	On Site Teams	Dewatering Pumps	Flood Gates
			
			
$125 billion in damage No insurance claims for PKY	On site team prevented further damages during storm	Previously installed pumps ran full time as needed	Installed to protect underground spaces

Implemented Resilience Measures | Flood Mitigation

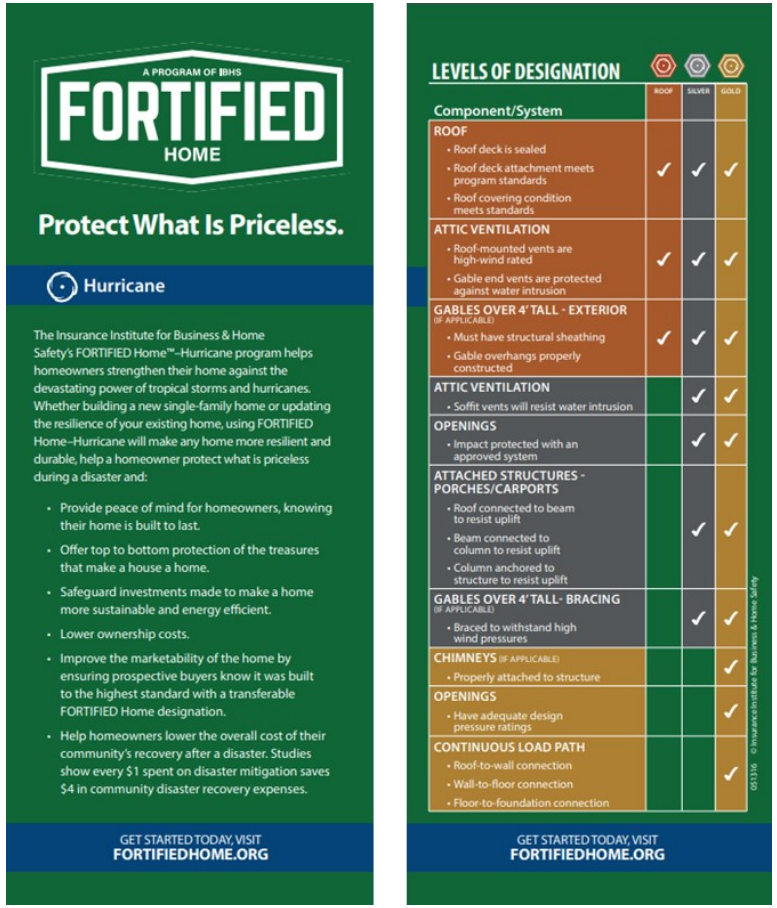


SEA-LEVEL RISE & FLOODING MITIGATION

- Developed in 2018, Pier 4 is a 13 story, LEED Gold, trophy asset in Boston's dynamic Seaport District.
- The building is surrounded by three sides of waterfront exposure, located in Special Flood Hazard Zone AE.
- Mitigation measures were studied and implemented. Critical building services are located on the roof or mezzanine level.
- The property deployable flood mitigation protection barrier called FloodWall by AquaFence®.
- The four-foot-tall wall is designed for rapid deployment around the builging within eight hours of a pending flood event and can be packed and stored in a minimal amount of space.
- The FloodWall has a protective shield designed to withstand impact from moving debris. Through annual emergency training, this wall is assembled to ensure all building staff can install the wall entirely around the premises of the property.

FORTIFIED Homes

Nationally recognized resilience building method



- Insurance Institute for Business and Home Safety (IBHS) FORTIFIEDTM is a national standard for resilient construction.
- The standard indicates cost-effective measures that make homes more resilient.
- For instance, "Continuous Load Path" standards reinforce attachment of roof to walls and walls to floors to reduce wind damage.
- FORTIFIEDTM Gold-rated houses are expected to withstand EF-0, EF-1, and many EF-2 tornadoes.
- The cost of new home compliance with FORTIFIED standards ranges from zero to 3 percent of hard costs. Retrofits generally cost 18 to 24 cents per square foot.
  - In Mississippi, it costs $3,000-5,000 more per 1,800 square foot home to build to FORTIFIED Gold.
  - In Florida, where building codes require more resilient features, the additional effort to reach Gold costs $1,000 more per 1,800 square foot.
- FORTIFIED homes have an average 7% increase in resale value.
- Due to regulations in some states, insurance premiums are reduced for FORTIFIED homes.
- Alabama up to 55%; Oklahoma up to 42%; North Carolina up to 19%.

SOURCE: HTTPS://FORTIFIEDHOME.ORG/

“For Every Dollar Invested in Climate-Resilient Infrastructure Six Dollars Are Saved”,

Secretary-General Says in Message for Disaster Risk Reduction Day

“The estimated cost of meeting the toughest 1.5C climate target is about $0.5tn over the next 30 years but will save the world $30tn in damages,”

Marshall Burke, assistant professor at Stanford University

Organizations ask us…

1. Which hazards should I be concerned with and how do we measure their impacts on my assets, people, and business?

2. Which physical and operational interventions should my organization prioritize?

3. How do I make a business case for investing in resilience?

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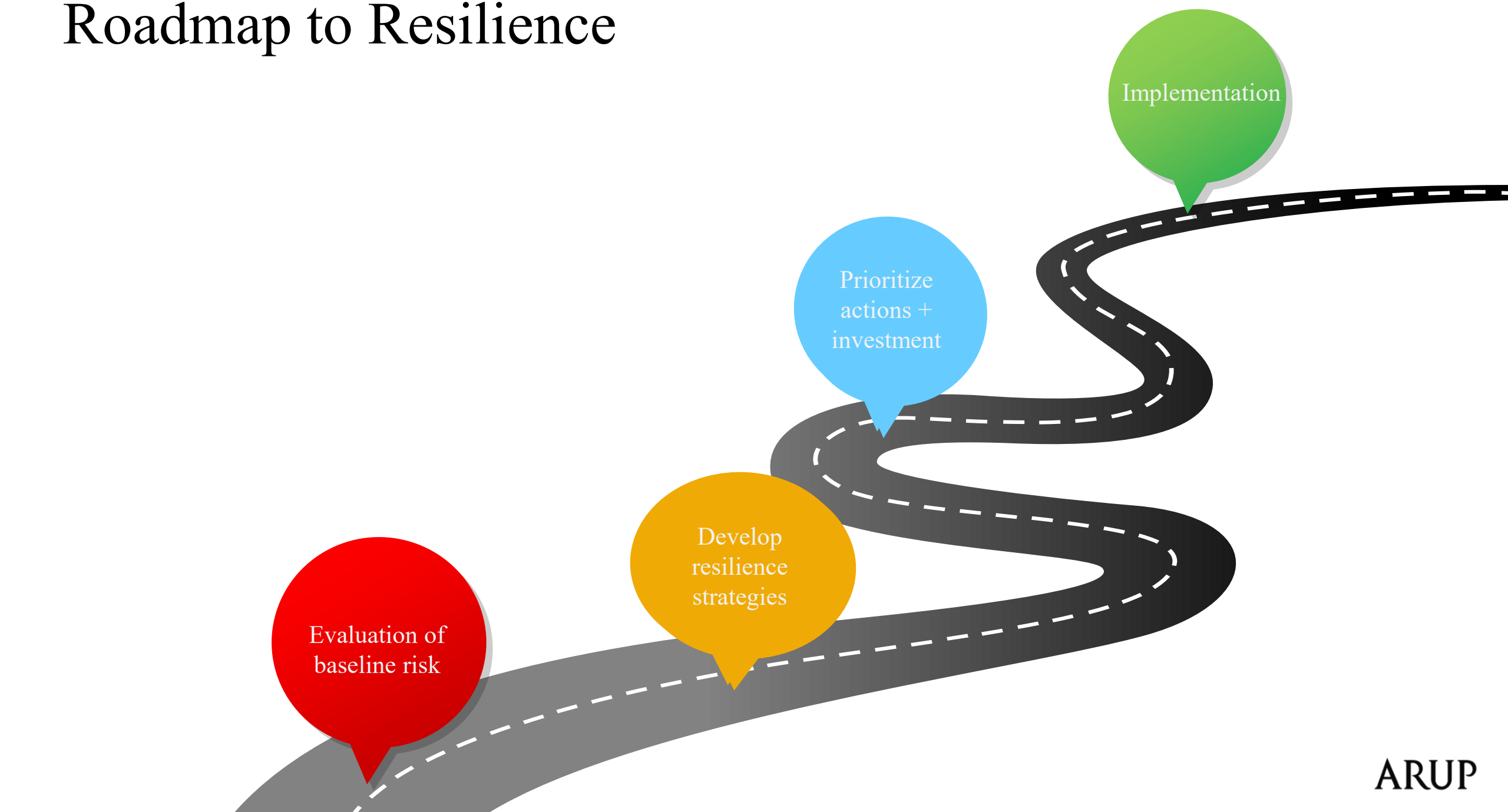
Roadmap to Resilience



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climate migration

injuries and **fatalities**

damage and repair costs

What is risk?

inventory loss

utility disruption

downtime and lost revenues

health and wellness

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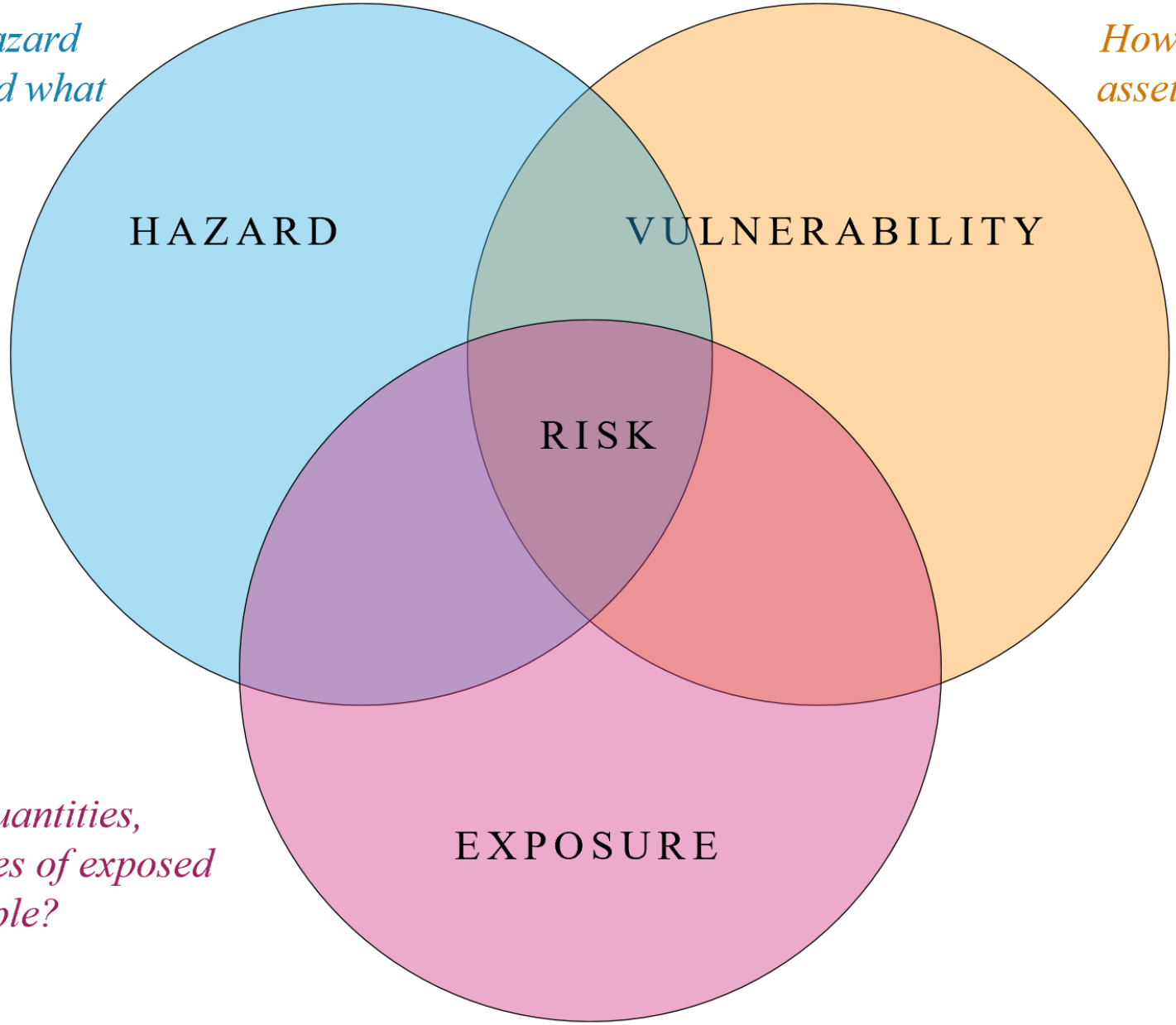
How do you calculate risk?

How likely is a hazard event to occur and what is the intensity?

How damageable are the exposed assets and how vulnerable are the people?



What are the quantities, locations, values of exposed assets and people?

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What are the different types of risk analysis?

Risk Assessment Classes				
	1	2	3	4
General Description	High level risk screening assessment	Baseline risk analysis	Risk modeling	Advanced risk modeling
Application	Screening for Class 2 risk analysis Site selection / Due diligence Awareness	Screening for Class 3 or 4 risk modeling Site selection / Due diligence Risk-informed decision-making	Identification of components driving risk Component-specific risk mitigation Cost-benefit analysis and insurance optimization	Identification of components driving risk Component-specific risk mitigation Cost-benefit analysis and insurance optimization Resilience-based design of new buildings
Recommended scale	100's to 1,000's of buildings	10's to 100's of buildings		10's of buildings
Accuracy / Confidence	Low	Medium	High	Very High

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Cost-benefit analysis workflow
(the quantifiable part of the business case)

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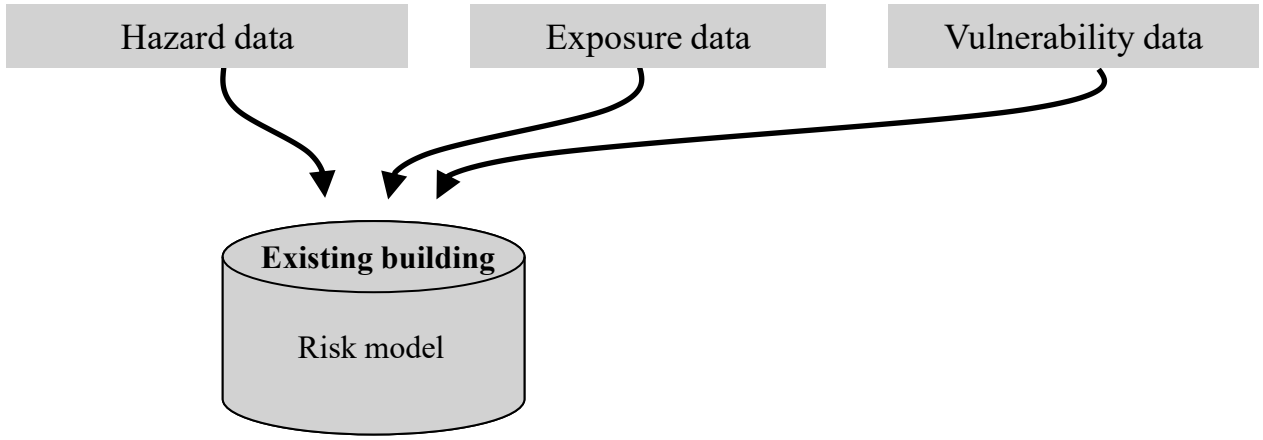
Hazard data
Exposure data
Vulnerability data
Existing building
Risk model

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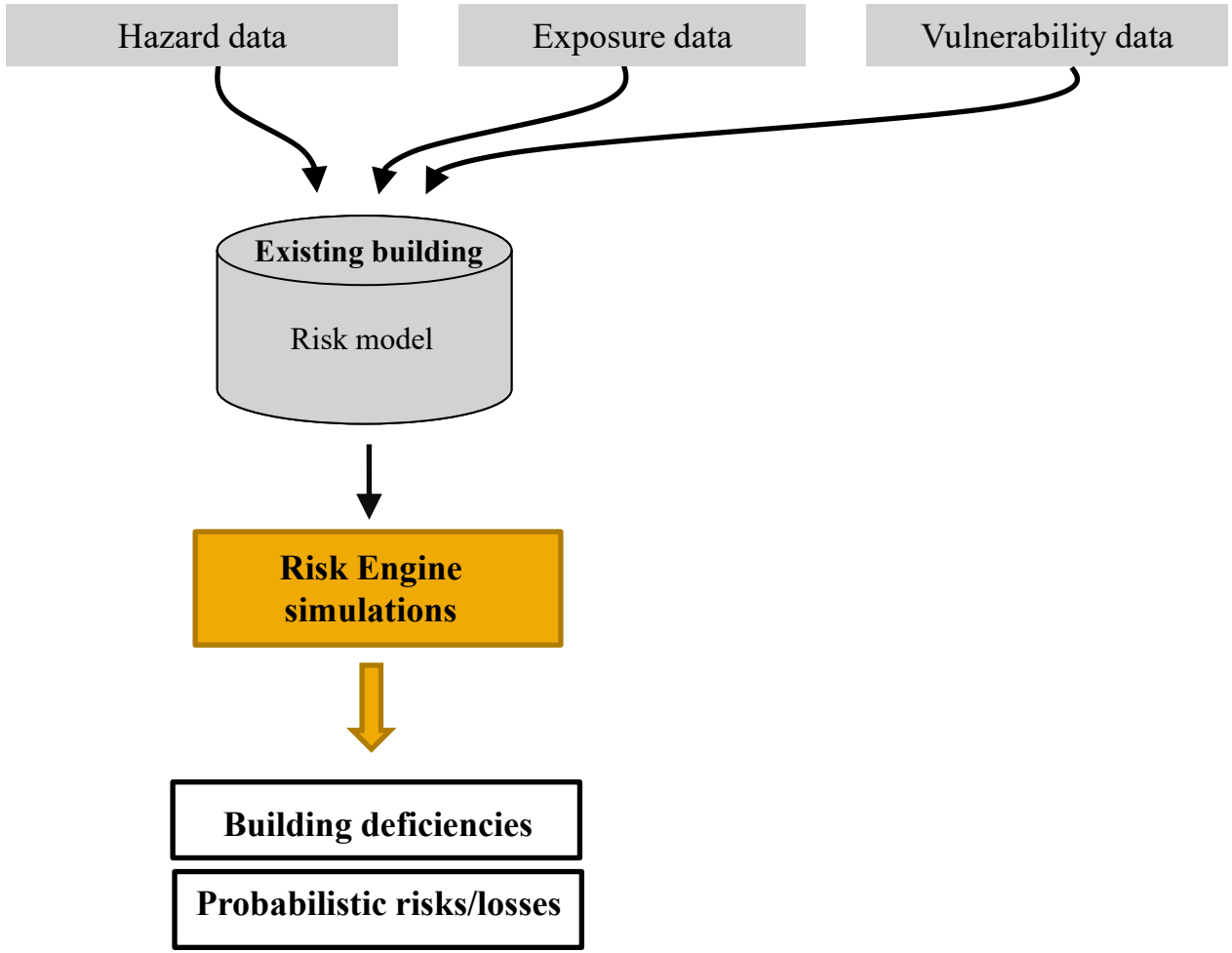
Hazard data
Exposure data
Vulnerability data
Existing building
Risk model
Risk Engine simulations
Building deficiencies
Probabilistic risks/losses

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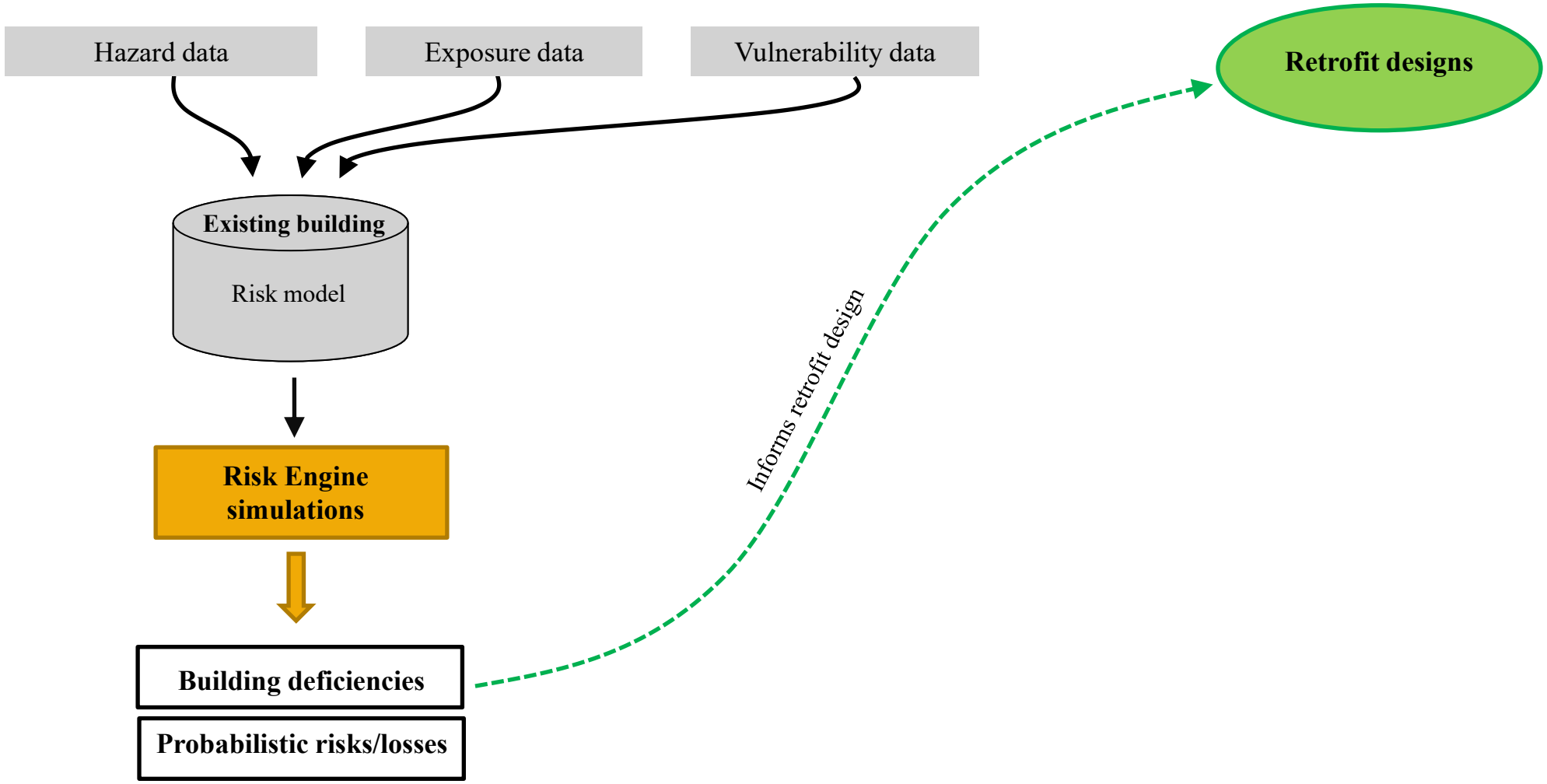
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Risk model
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Building deficiencies
Probabilistic risks/losses
Informs retrofit design
Retrofit designs

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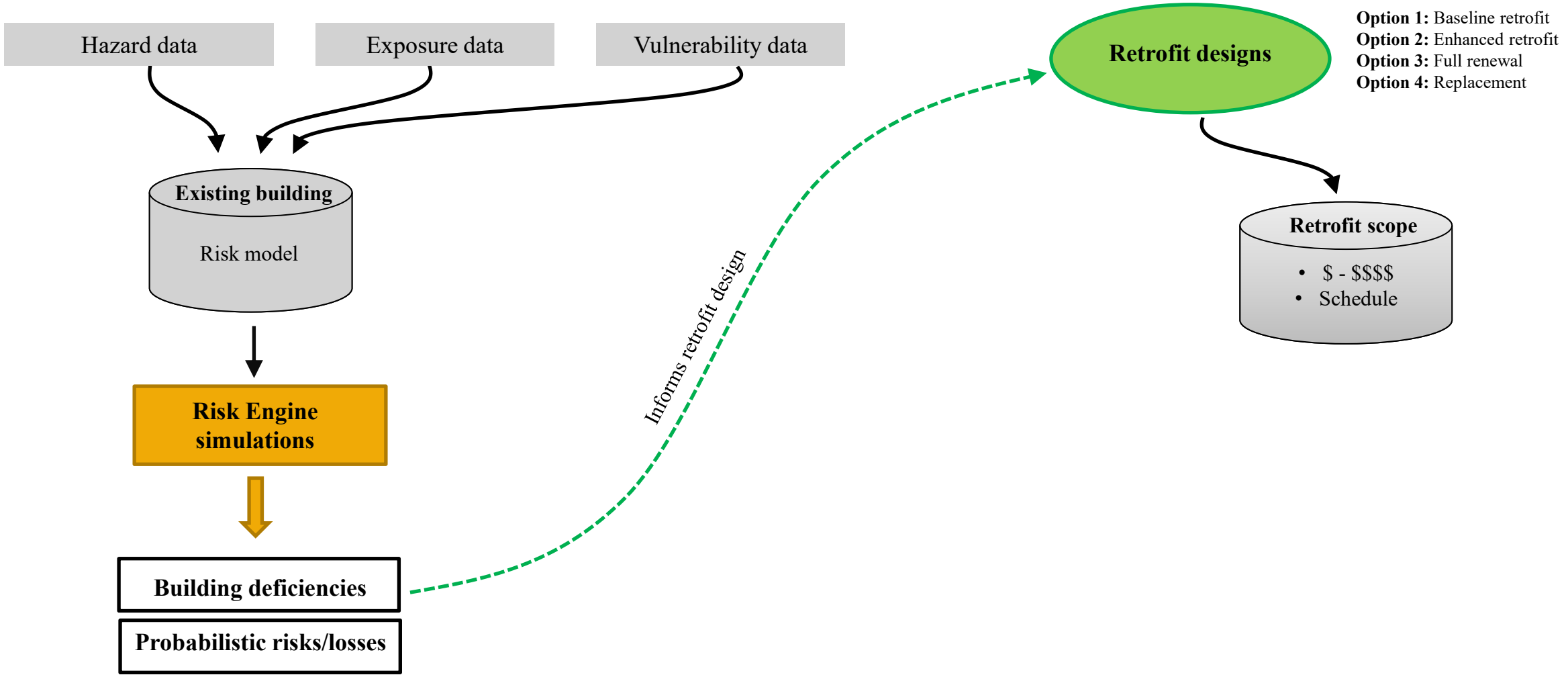
Hazard data
Exposure data
Vulnerability data
Existing building
Risk model
Risk Engine simulations
Building deficiencies
Probabilistic risks/losses
Informs retrofit design
Retrofit designs
Option 1: Baseline retrofit
Option 2: Enhanced retrofit
Option 3: Full renewal
Option 4: Replacement
Retrofit scope
• $ - $$$$
• Schedule

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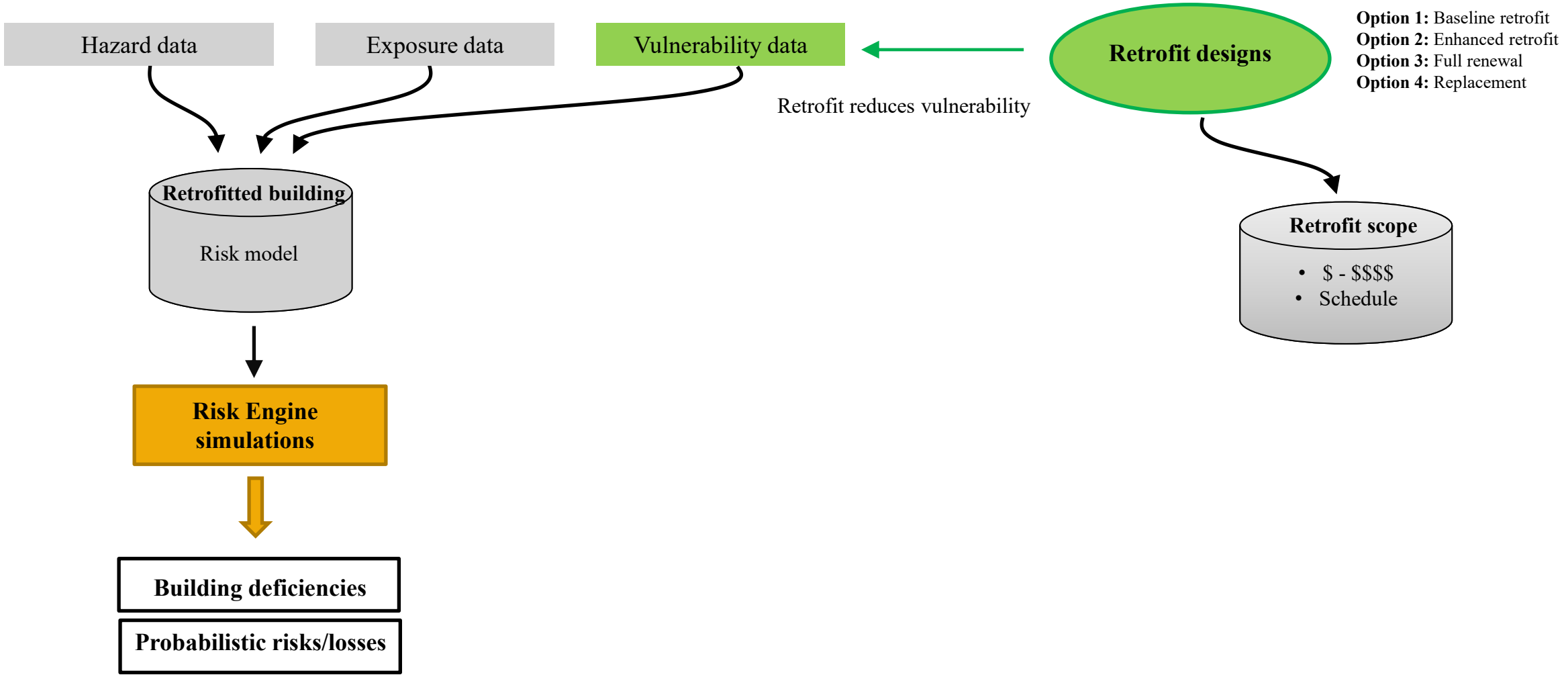
Hazard data
Exposure data
Vulnerability data
Retrofit designs
Option 1: Baseline retrofit
Option 2: Enhanced retrofit
Option 3: Full renewal
Option 4: Replacement
Retrofit reduces vulnerability
Retrofitted building
Risk model
Retrofit scope
• $ - $$$$
• Schedule
Risk Engine simulations
Building deficiencies
Probabilistic risks/losses

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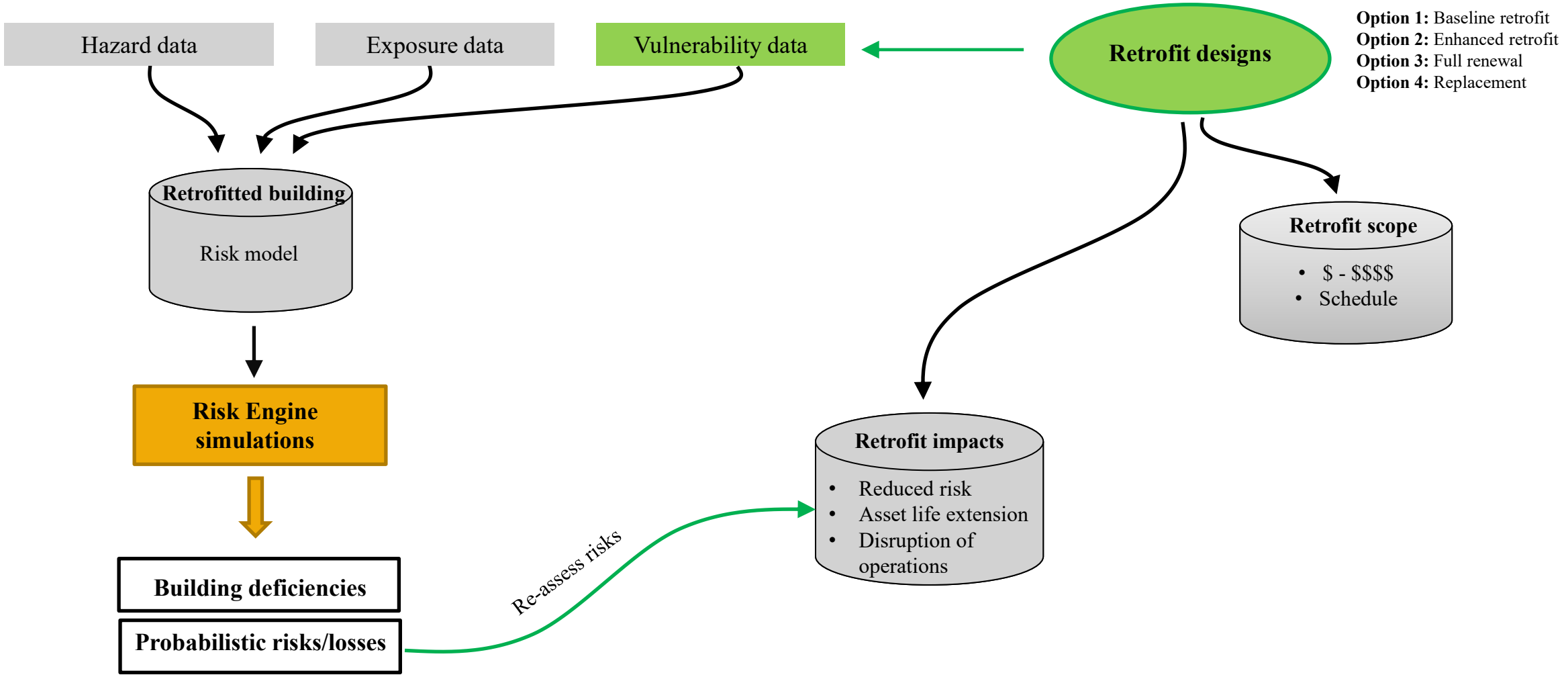
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Vulnerability data
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Option 2: Enhanced retrofit
Option 3: Full renewal
Option 4: Replacement
Retrofitted building
Risk model
Retrofit scope
• $ - $$$$
• Schedule
Risk Engine simulations
Retrofit impacts
• Reduced risk
• Asset life extension
• Disruption of operations
Building deficiencies
Probabilistic risks/losses
Re-assess risks

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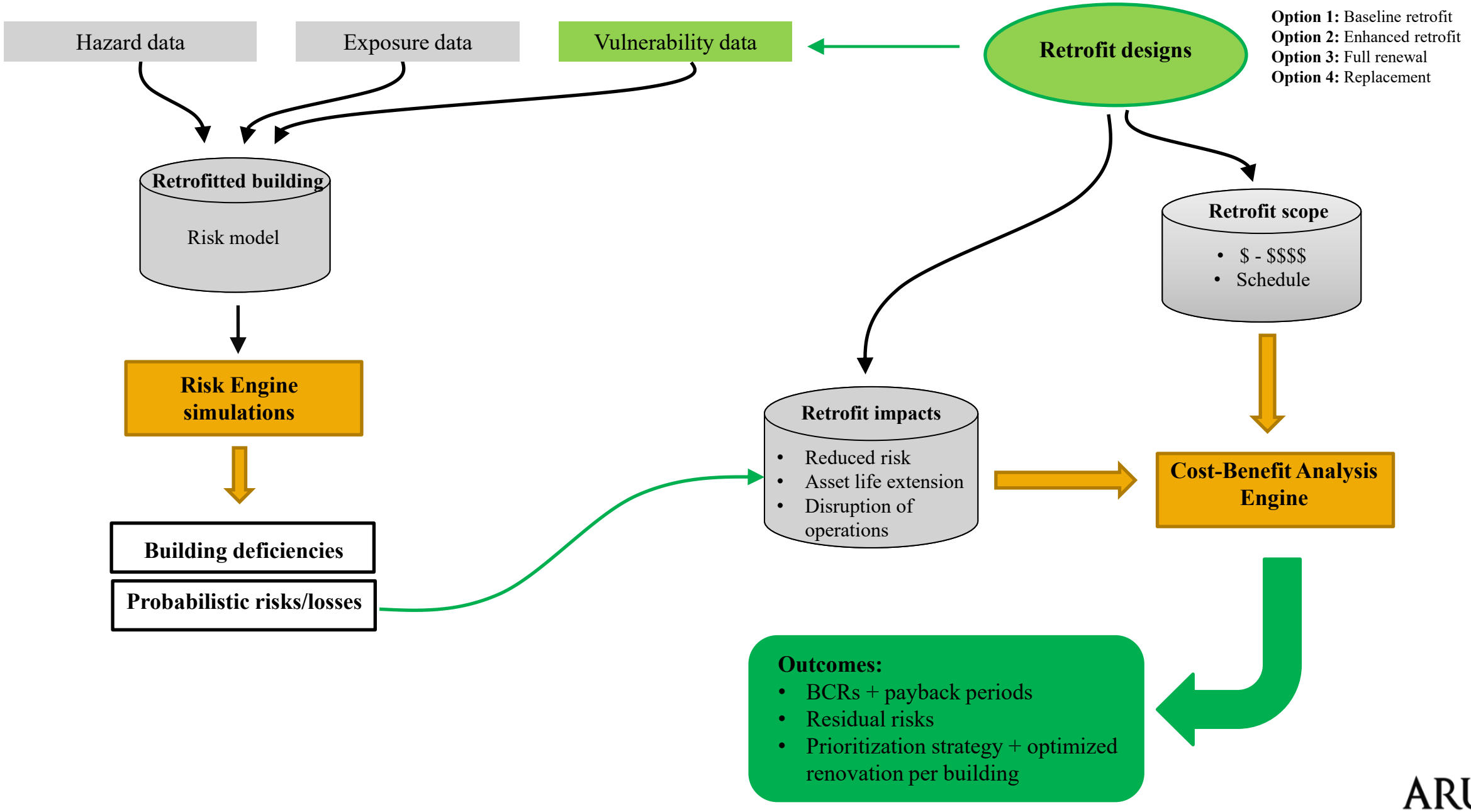
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• Schedule
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Retrofit impacts
• Reduced risk
• Asset life extension
• Disruption of operations
Cost-Benefit Analysis Engine
Building deficiencies
Probabilistic risks/losses
Outcomes:
• BCRs + payback periods
• Residual risks
• Prioritization strategy + optimized renovation per building
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Retrofit Payback Calculator

Resilience Payback Calculator

Welcome to the Arup Resilience Payback Calculator, a tool that enables building owners and developers to explore the benefits of investing in resilience. Please answer the following questions to discover whether extra investment in resilience can yield positive returns. Use of this tool should not take the place of detailed structural analyses and financial calculations.

1. Where is the building located?

Earthquake hazard varies depending on location. Please select a location from the list below so we can more accurately determine the expected earthquake losses and downtime for the building.

Vancouver

2. What is the building occupancy?

Please select the building's primary occupancy from the list below. We will use this information to determine the value of the building and the cost of downtime. If desired, these values can be adjusted later.

Academic

3. How large is the building?

Please provide the approximate gross area of the building in square feet.

200000 sq ft — 800000 sq ft

The extra investment in resilience will pay for itself within

23 years

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Real estate resilience framework | University of British Columbia resilience study

- Outlines tolerable risk targets and translates to building performance
- Specifies building performance objectives for new and existing buildings
- Specifies triggers for building retrofit and renewal

Real Estate Framework

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- Specifies design criteria to achieve policy objectives
- Specifies risk analysis criteria

Resilience-based Design Guidelines for New Construction

THE UNIVERSITY OF BRITISH COLUMBIA

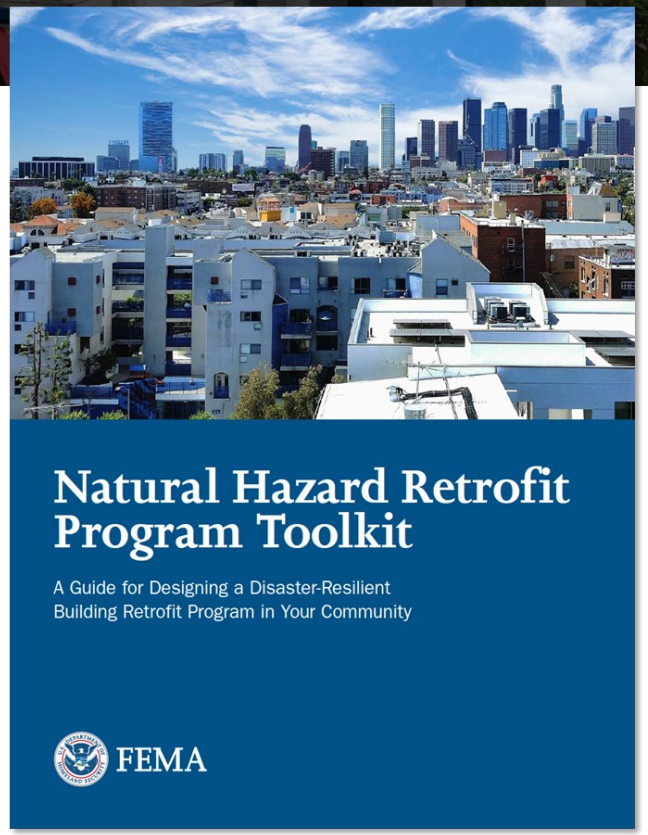
Resilience-based Design Guidelines for Retrofits and Renewals

THE UNIVERSITY OF BRITISH COLUMBIA

Implications for Program & Policy Development

Mary Witucki | Community Education and Outreach Program Lead
FEMA Region 9 | Mitigation Division

- FEMA listened to local practitioners across the United States.
  - Approximately 30 practitioners from various communities.
  - Best practices and strategies they use to design and implement building retrofit programs.



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Common Challenges:

- Managing funding
- Understanding community perspectives
- Designing a program
- Supporting partnerships
- Communicating program goals

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Managing Funding

"What funding is available? What is required?"

- Project Requirements
  - Cost of each retrofit
  - Time required for each retrofit
- Funding Requirements
  - Processes
  - Timelines
  - Commitments

ADVICE FROM A PRACTITIONER:

Learn from everyone around you. Talk to other communities and find out how they found and managed funding. Use all of your options for help.

– Laura Nelson, *Senior Emergency Management Planner, Office of Emergency Management, Flagler County, Florida*

- Scope accordingly based on requirements and team capacity.

"Build relationships with funding source contacts and communicate often. Work together to streamline program processes."

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Understanding Community Perspectives

"Who are the participants? What is important to them?"

- Identify potential barriers
  - Capability
  - Motivation
  - Opportunity

- EAST Framework
  - Easy, Attractive, Social, Timely

"We must work to understand the variety of factors and recognize how they overlap and intersect to affect an individual's position, access, and resources."

Program/Policy Design

"Where to start? How to right-size?"

- Goals
  - Few & focused
- Tips for effective policy
  - Keep it simple
  - Communicate
  - Be flexible
  - Ensure stability and reliability
  - Elevate equity

- Establish clear design/construction standards that can be evaluated when each retrofit is complete.

"Programs centered on ensuring equity will help avoid unintentionally creating additional barriers that exclude or marginalize those who already have fewer resources and assistance available to them."

ADVICE FROM A PRACTITIONER:

Reach out to other communities to see how they did their programs, and base new programs on those by tailoring it to your community needs. There is no need to reinvent the wheel and make more work for yourself than necessary.

— Tanya Davis-Hernandez, *AICP, Director of Development Services, City of Lauderdale Lakes, Florida*

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Supporting Partnerships

"What partners are available to support the program?"

- Market Profile
  - Contractors/Inspectors
  - Materials suppliers
  - Insurance agents
- Community Partners
  - Associations/groups
  - Leaders
- Implementation Team
  - Planning/building departments
  - Communications/outreach
  - Training

ADVICE FROM A PRACTITIONER:

Don't sit on payments. Get them out to your partners as soon as you can. If jurisdictions do not pay contractors in a timely manner, they may have had to front thousands of dollars to do the retrofit work for the homeowner. Contractors, especially small contractors, are not able to sustain this. This is one way that communities could lose good contractors. If they don't get paid on time, the program might not be sustainable for them and they will drop out.

– Vicki White, *Housing and Community Development Manager, City of Bradenton, Florida*

"Retrofit programs are often administered by small teams in low-capacity departments. They survive by building strong partnerships with other city departments, agencies, and private sector businesses."

Communicating Program Goals

"How to gather support, buy-in, and participation?"

- Program Engagement Lessons Learned
  - Start small
  - Be creative
  - Build trust
  - Rely on success
- Keep a service-oriented mindset
  - Providing high-quality service is integral for a sustainable and successful program.

"Take advantage of diverse expertise and create a cross-departmental agreement, where one department hosts the program and serves as a 'one-stop shop' and others provide services and assistance."

Keys to Successful Programs:

- Meet people where they are
- Set clear expectations
- Build strong, diverse partnerships

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