Climate Risk Analysis For Buildings And Infrastructure

Written by: Kit Wong, Ph.D., Principal Architect and Senior Vice President, GFT

A Step-by-Step Reality Check

Environmental conditions are no longer a future concern; it is already reshaping how people experience buildings, infrastructure, and public spaces. Across the country, people are feeling the effects of hotter summers, heavier storms, flooding, and service disruptions that affect safety, reliability, and continuity.

In my work, the human side of climate resiliency always comes first. Before talking about models or projections, I ask one question: Who depends on this place, and how will their daily life be affected as climate conditions continue to change?

Over more than three decades of climate resiliency work, including more than 80 planning, assessment, and design projects across a range of facility types and market sectors, I have seen this question drive the most effective decisions.

According to the National Oceanic and Atmospheric Administration (NOAA), the U.S. now experiences an average of roughly $150 billion in losses each year from billion-dollar weather and climate disasters, a figure that continues to rise and reinforces the urgency of preparing infrastructure for future conditions.

This is where climate-focused risk analysis becomes essential. When I work with clients across federal, civic, energy, and transit markets, they all want the same thing: clarity. They need to understand which assets are vulnerable, what climate

events are most likely to disrupt their operations, and how those disruptions will affect the people who rely on their facilities every day.

This step-by-step approach mirrors the framework I use in practice, beginning with shared awareness and risk fundamentals, then moving into quantitative analysis and practical tools that support early, informed decision making.

To make those decisions confidently, we need a structured way to look ahead that looks beyond historical conditions to what the climate is becoming. That's the foundation of any effective climate resiliency strategy. Below is the step-by-step framework I use to help organizations see risk clearly and act with purpose.

STEP 1: MAP THE FUTURE CONDITIONS, NOT THE PAST

The first step is to understand the climate in which your project must perform. The growing frequency and cost of climate-related disasters show that historical weather data alone can no longer guide responsible decisions.

I begin every analysis by looking at future climate projections. These projections illustrate how rainfall, flooding, extreme heat, and sea level rise will shift in the coming decades. They give us the magnitude of each hazard, the likelihood it will occur, and the locations where people and operations will be most affected.

Today, climate hazard and extreme condition projections extending 30 years into the future are widely available, allowing teams to plan with far greater confidence than even a decade ago.

This forward-looking baseline anchors the entire risk assessment process. It helps us understand the environment in which buildings, systems, and communities will need to perform, and it sets the stage for decisions that strengthen safety, reliability, and long-term resilience.

STEP 2: IDENTIFY AND UNDERSTAND VULNERABILITIES

Once I understand the future extreme conditions, the next step is to identify which parts of a facility are most sensitive to those hazards. I look at how the building was designed, when it was built, and where it is located. These factors often reveal gaps between current conditions and future climate demands.

I also focus on how different elements respond to specific hazards. Facilities exposed to extreme heat face challenges that differ from those in flood- or hurricane-prone regions. Each hazard requires its own method for assessing vulnerability, and each system needs to be evaluated based on how it protects people and supports essential functions.

Vulnerability is not only about the structure itself. What happens inside the building matters just as much. We call that Exposure and Importance. A warehouse may tolerate smoke from a wildfire, while a healthcare or childcare facility may not be safe under the same conditions.

This step provides a clear picture of where weaknesses exist. It shows which assets are at risk, what events are most likely to cause disruption, and how those disruptions could affect occupants, operations, and surrounding communities.

STEP 3: QUANTIFY THE IMPACT

After identifying the vulnerabilities, I move to quantifying the impact of each hazard. This step transforms the analysis from a general concern to an actionable insight. I look at the consequences that a specific hazard would have on people, buildings, equipment, utilities, and operations.

In risk analysis, risk is defined as the intersection of hazard, vulnerability, and exposure. Consistently evaluating these three elements allows teams to compare very different threats and prioritize action.

The goal is to understand what failure would actually mean. This includes the potential for physical damage, the amount of time a building or facility may be unavailable or offline, the cost of recovery, and the cascading effects that follow. For instance, a power outage during a heatwave can shut down cooling systems and create unsafe conditions for residents in an apartment building or patients in a healthcare facility.

By quantifying these impacts, risks can be objectively compared to identify which risks are most urgent and which ones carry the greatest consequences for safety, continuity, and mission performance.

STEP 4: PRIORITIZE WHAT MATTERS

Once the impacts are quantified, I begin working with teams to prioritize the risks. The highest risks are those with both a high likelihood of occurring and a high consequence of failure. These are the events that can interrupt essential services, threaten safety, or cause significant financial losses.

Establishing priorities brings clarity to decision-making. It helps us determine which vulnerabilities must be addressed immediately, which ones can wait, and which ones can be scheduled for long-term improvements.

In large organizations, these priorities are often defined at the enterprise level to reflect mission-criticality, not just individual project preferences.

This approach helps direct investments to where they matter most, focusing attention on the actions that create the strongest protection for people and the systems they rely on.

STEP 5: DEVELOP A PRACTICAL, RESILIENT PATH FORWARD

With priorities identified, the final step is to create a clear plan for strengthening resilience. I work with teams to consider design strategies, operational changes, maintenance approaches, and future upgrades that reduce risk and improve performance under evolving climate conditions.

The plan may include relocating equipment, improving building envelopes, increasing cooling capacity, expanding stormwater management, etc. Each solution is tailored to the facility, the hazard, and the needs of the people who depend on the space.

For example, following hurricane damage at a Coast Guard facility, resiliency goals were defined before design began, including maintaining operational capability during future storms and operating independently for two weeks without grid power or water. That clarity guided every planning and design decision that followed.

A strong resilience plan is realistic and actionable. It provides a path for organizations to follow over time, beginning with the highest-priority risks and moving toward long-term improvements that support health, safety, and continuity. Every step helps create buildings and infrastructure that can perform reliably in a changing climate.

Moving From Insight to Action

Extreme weather and shifting environmental patterns are already influencing how infrastructure performs and how people experience the built environment. A clear, structured risk analysis helps organizations respond with confidence. By mapping future climate conditions, identifying what is vulnerable, quantifying impacts, setting priorities, and developing a practical plan, we can design and operate facilities that protect people and sustain essential services under evolving conditions.

Across dozens of projects, one lesson remains consistent: resiliency is most effective when addressed early. Rapid assessments completed at the start of planning can identify major risks in days rather than months, shaping decisions before costs escalate and options narrow.

This process supports better decisions today and more reliable performance in the years ahead. It helps create environments where communities can continue to work, learn, travel, and heal, even as the climate continues to change.

About the Author

Dr. Kit Wong is the principal architect and senior vice president at GFT. He is a nationally recognized climate resiliency expert with 35+ years supporting federal agencies. A licensed architect in 12 states, Kit has led award-winning projects and advances resilient infrastructure nationwide.

About the Article

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