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A Discussion on Post-Catastrophe Issues

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A. Introduction: Disaster Recovery: What Is It?

Merriam-Webster defines “disaster” as “a sudden calamitous event bringing great damage, loss, or destruction.” Disaster recovery is a response to such a calamitous event, which could be a natural disaster, such as hurricane, tornado, flood, earthquake or fire – the focus of this discussion – but could also be an operational disaster like the BP oil-drill platform explosion in the Gulf of Mexico or the Kleen Energy Systems power station in Middletown, Connecticut.

Although natural disasters affect humanity in general, this paper will focus on the interests of the stakeholders in construction immediately after such an event. These stakeholders include owners, contractors, subcontractors, design professionals, insurance brokers, banks and lenders, nongovernmental organizations (NGOs), the legal community, and the vast array of consulting professionals servicing the construction industry. The interests of these stakeholders can vary, but they all share a common goal: to restore the facility or, in the case of construction, the project to its pre-disaster condition as soon as possible.

B. Disaster Recovery Lifecycle

Disaster recovery is best viewed in stages or as a lifecycle. Considerations in each stage may differ for an ongoing construction project versus an existing structure.

The first stage is an awareness to appreciate the potential severity of the impact on human health and property. The second stage is the initial response by emergency personnel and first responders. The third stage involves the process of repairing and rebuilding structures or facilities affected by the disaster. The second and third stages both focus on the activities undertaken to handle the disaster’s impact and return the facility or project to the pre-disaster condition. The timeline for these stages will differ, since the initial response will be focused on immediate needs – life safety and stabilization, versus the design, procurement and construction related to
repair/rebuild efforts in the third stage. The fourth and last stage involves actions and measures to prevent or reduce the degree of impact caused by future natural disasters.

1. Awareness of Potential for a Disaster

The key to reducing loss of life, injuries and damage from natural disasters is awareness, or education. Stakeholders in construction must be made aware of what natural hazards they are likely to face in their project locations. They should know in advance what specific preparations to make for a hurricane, earthquake, flood, fire, or other likely event, what to do during it, and what actions to take afterward. The pre-disaster phase consists of detection, estimation and preparation, including safety planning against known hazards and risks. There are many actions that can be taken to stabilize a structure before an event and minimize potential damage.

Pre-disaster actions are critical and should focus on protection of the building and the valuable machinery, equipment and materials inside. Damage may be prevented or mitigated by inspecting the following building features, systems and equipment, and strengthening them if necessary:

- Windows, shutters and doors
- Roof flashing, covering and drainage
- Exterior signs
- Mechanical equipment, antennas and satellite dishes on rooftops
- Outside storage, tanks and equipment
• Air intakes
• High-value machinery
• Sensitive electronic equipment, including information technology and process controllers

Equally important, public officials and the media — television, radio, and newspapers — must be fully prepared to respond effectively, responsibly and quickly to large-scale natural emergencies. They need to be aware of what procedures to follow in a crisis that may paralyze the entire community they serve, and they need to know how to communicate accurate information to the public during such a disaster.

This stage of the disaster recovery lifecycle is important; however, stages two, three and four are the main focus of this paper.

2. Initial Response to Event

Every year, natural disasters put millions of people worldwide in danger and cost billions of dollars in property damage. When an emergency occurs, the immediate and primary concern always is – and should be – life safety. The initial response efforts include assessing the integrity of the structure or project, as well as what immediate actions need to be taken to stabilize conditions and prevent further damage or collapse. From a legal point of view, the initial response to a disaster can be challenging, as it may involve obtaining access to affected properties to perform a condition assessment, or determining what financial resources there are to fund the immediate response and rebuilding efforts.

3. Rebuild

As soon as conditions on the ground allow, the process of rebuilding can begin. Initially this involves assessment of current conditions, followed by design and remedial measures, then
their implementation. The process is not simple and involves many variables and unknowns which must be addressed.

4. **Mitigation Measures**

Design professionals agree that the most successful way to mitigate loss of life, property and function is to design buildings that are disaster-resistant. This approach should be incorporated into the project planning, design and development as early as possible so design and material decisions can be based on an integrated “whole building” approach.

A variety of techniques are available to mitigate hazards to the built environment. A structure can be designed to resist the effects of natural disasters, such as induced loads and flooding, depending on the hazards identified, the location and construction type of a proposed building or facility, and the specific performance requirements for the building. Later in a building’s lifecycle, additional opportunities to reduce the risks presented by natural hazards may occur when renovations or repairs of the existing structure are undertaken.

C. **INITIAL RESPONSE**

Experts – engineers, architects, or other building consultants – typically arrive on site soon after the first wave of emergency responders in a catastrophic event. These experts may be engaged by the building owner, an insurance carrier, an insurance adjuster, a lawyer, a general contractor or the local or federal government. As would be expected, the expert’s scope of work varies depending on who hires the expert. The type of policy coverage, such as property policy or builder’s risk policy, does not drastically change the expert’s role. Regardless of the party engaging the expert or the type of policy coverage, the expert’s role is to determine the cause and origin of the loss and the extent of damage to the property.

For lawyers, the initial challenges can include:
When and how to request a property assessment and who will pay for the assessment;
Finding applicable insurance policies and complying with notice requirements;
Whether a property can be accessed;
Whether people perished inside of a building (which can cause delays in accessing a property); and
Whether there are investigations into casualties and their causation.

If the expert is engaged by the insurance adjuster or carrier, the typical scope of the work includes:

1. **Determine the cause of the damage** – The determination of the cause of damage is important, as it is the basis for most of what follows in the investigation. The cause must be determined as specifically as possible, including how and when the damage occurred. While the damage may be obvious, the cause may not be. For instance, was hurricane damage due to rain, flood, wind or was it pre-existing? Observations and evidence must be obtained to allow for such a determination.

2. **Determine the extent of the damage related to the event** – The damage may be only cosmetic and may be excluded from coverage. Does the damage exist only in the “obvious” places or is it also located in less observable members or foundations?

3. **Determine the repair scope of the damage** – The repair will typically involve a larger area than the direct damage due to the event. The investigator should strive to determine the extent of damage, whether invasive de-assembly is needed to perform a repair, and if other exacerbating factors could impact cost or extend scope of work.

4. **Allocate damage if multiple events are involved** – In cases where an earthquake has
occurred and is followed by a separate event or earthquake (not including an aftershock), the scope includes determining which event caused what damage. In New Zealand, this was particularly important as multiple significant earthquakes occurred within a few years. Documenting damage between events proved to be very beneficial, as this was used to clearly delineate damage and the corresponding responsibility for repair costs for each event. Otherwise, determination of damage for each event may be left to untested methods and speculation.

5. **Determine the minimum code upgrades required to reinstate the building** – Building codes are not static; time is the true test of codes and may illuminate deficiencies requiring change. Changes to building codes are generally viewed on a looking forward basis after disasters. Although some exceptions may occur, most existing buildings are not required to comply with newly implemented code changes unless upgrades are triggered. Depending on the extent of damage, however, to reinstate the building may require an evaluation of the building to determine if retrofit is required to comply with the current code. The evaluation of current conditions, in concert with the current building code, will dictate the extent of required retrofit to the structure, egresses, fire safety systems or other systems.

6. **Peer review of other engineers; reports** – It is not uncommon to have multiple parties engaged from different perspectives for different clients. Since the insurance claim is made by the insured, the expert for the insurer must often assist in evaluating those claims. Thorough investigation will be necessary to critically assess and comment on other experts’ views.

For example, after Hurricane Harvey, Thornton Tomasetti (“TT”) was retained by an insurance carrier to identify and document damages sustained by various properties owned by an insured. The resulting report presented the findings of TT’s initial investigation, which was limited to the condition of the roof assembly, the interiors, and the curtain wall system of the buildings.
The overall goal under the scope of work was to identify and distinguish damages covered under the policy and to isolate conditions that were unrelated to the storm or which were preexisting conditions. This is a typical scope of work which is necessary for investigations to recommend repairs and retrofits. The scope of work can vary significantly from project to project, but the work product typically includes a report summarizing the conditions of the elements listed above and, if necessary, to testify in support of the stated opinion in later litigation.

An expert engaged by a general contractor, owner, or government agency will have similar scopes. However, these scopes of work may also include an emergency response, such as inspection and temporary stabilization of a damaged structure. An inspection may also be required to evaluate the structural integrity of the building and to determine if the building can be reoccupied. In some cases, temporary stabilization – bracing concrete walls or cladding systems, for example – may be required before re-occupancy can occur or, in some cases, before access to the building may be given.

A different scenario occurred after the 2011 earthquakes in Christchurch, New Zealand. There, TT was retained by an insurer to provide a damage assessment and conceptual scopes of repair for particular major seismic events in the Canterbury earthquake sequence for a property in Christchurch, New Zealand. The objectives of this assessment included:

- Assessing the extent and types of damage sustained by the property due to the earthquakes that have occurred on and since September 4, 2010.
- Reviewing pertinent documents
- Determining the percentage New Building Standard (NBS) of the building and identify any structural components that require strengthening so the building would not be considered earthquake-prone.1
For cost estimating, identify two separate conceptual scopes of work appropriate to repair the observed earthquake-related damage to a condition substantially the same as when new:

- Option 1: Without enhancing the strength and/or ductility of the damaged components (i.e., equivalent to a like-for-like replacement). In this case, the building may still be considered earthquake-prone after the repair.
- Option 2: Enhancing the strength and/or ductility of the damaged components so that the building will not be considered earthquake-prone.

- Review and comment on the reports provided to the insurer by the owner making the insurance claim.
- Provide guidance on allocation of earthquake-related repairs to particular events of the Canterbury Earthquake Sequence.
- Develop a pragmatic repair strategy to address all identified structural damage caused by the earthquakes.

Buildings and bridges are designed to sustain some damage from the earthquakes. They are designed to withstand damage, but to be unlikely to collapse. That is why damage to structures is more likely after an earthquake unlike many other natural events; therefore, inspection of the buildings is critical prior to re-occupancy. Inspections after an earthquake are performed in two stages. Initial inspection is to determine if the structure is safe to enter, unsafe or safe with exceptions. The structure is tagged red green or yellow. Color tagging is performed by licensed or certified individuals who have Safety Assessment Program training. Each state may have its own system. In California, the Department of Emergency Services maintains an assessment program and trains inspectors who follow the ATC-20 guide for Rapid Assessment of Structures due to earthquake. Once the safety of the building has been determined, a more thorough follow-up
inspection is performed to look for damage to the structural elements and if necessary, specify repairs.

Another case study was provided by the 2017 Mexico City earthquake. In that disaster, while the general public played a large role in the initial response, multiple legal questions were raised which are not dissimilar to those issues encountered in the United States:

- Because only public authorized experts are able to make a technical assessment of the damage to buildings, who was responsible for initiating that process: the government or the property owners?
- Who would coordinate the response among the federal government, local government, the civil engineers’ association, NGOs, and other entities?
- Would the Mexican government at any level bear any responsibility for building failures based on their acceptance of buildings as they stood without any seismic retrofitting?
- What responsibility would building owners and building designers have for failures?
- What changes, if any, should be made to the existing building codes in light of the widespread building failures?

D. SITE ACCESS

1. Logistics

The logistics of assessing a site can be challenging at times, especially after a catastrophic event. For an isolated fire or explosion, the logistics of getting to and assessing the site are relatively simple, since airports are functioning, rental cars are available, and the city/town infrastructure is functioning normally. However, for an event like Hurricane Harvey or Hurricane
Michael, where large areas of Texas, Florida and neighboring states were affected, the logistics of assessing the site may be much more complicated. A state of emergency might have been declared for counties in the path of the storm. Major roads and highways may be closed due to flooding, debris or downed power lines, and in some cases the nearby airports may be shut down or limiting operations. There is often a shortage of rental cars, and accommodation close to the site is not available.

After Hurricane Harvey, for example, a project site was located in Corpus Christi, Texas. Due to local conditions, lodging could not be obtained any closer than 2.5 hours from the site in San Antonio, Texas. The commute time every day allowed only about six hours of site time. After Hurricane Irma, access to Puerto Rico was available only through flights in and out the same day, since lodging with electricity and water was very limited.

Similarly, in 2017 in Mexico City, the open questions regarding whether certain buildings were unstable led government officials to deny access to property owners to their own buildings until such time as the property could be evaluated by engineers. Some people even made claims that their human rights were violated by being refused access to their own properties.

All of these factors slow down response time. In particular, if the infrastructure of the city has been affected by the event, increasingly difficult logistical issues can be expected.

2. **Coordination**

Coordination with key personnel to provide site access and to unlock buildings should be in place prior to the visit. In some scenarios, there may as many as five consultants on site trying to gain access to the building. For example, in one project, the contractor, a building consultant, and an outside forensic engineering and architecture team were evaluating apartment buildings in a community after Hurricane Michael. Some of the units were still occupied. After a disaster, the
people remaining behind may be mentally and emotionally distressed, meaning that entering their property without proper introduction or escort could be dangerous. In this case, the property manager required that building maintenance staff provide an escort to all outside consultants. Consequently, a group of seven people were shared for building access between two different teams to gain access to the interiors of units. This required extra coordination between building consultants and forensic engineers, and it limited the number of engineers who could be on site.

The coordination process and site visit preparation process also involved using satellite imagery to understand the footprint and size of the building. Aerial imagery technology companies such as Nearmap and Geomni provide satellite imagery and aircraft-based images of disaster-stricken areas soon after the event. These images provide valuable information about the site and are essential to review. Understanding the history of the building through all available means, including internet research, can be vital to the repair and rebuilding processes.

In some situations, coordination may also be required for property owners. For instance, a limited number of engineers may be immediately available to assess building safety, as was the case in 2017 in Mexico City. In those cases, coordination involving the engineers and the government was necessary.

3. Safety

Other considerations are the safety of the experts in a potentially dangerous environment. They should always work in teams of two or more, regardless of the complexity of the building, never alone. Phone lines may be down, and internet data connections may not be available on site. Other means of communication like walkie-talkies may be required on site.

After the February 2011 Christchurch earthquake, the central business district was cordoned off on the same day, and this area became known as the Central City Red Zone or CBD
Red Zone. Soldiers secured the red zone cordon and restricted access to selected contractors and experts who had access cards. Inspection of a building that was red-tagged (deemed structurally unsafe) in the cordon zone required a team of three individuals: two accessed the interior and the third remained on watch outside the building. Aftershocks were common after the main earthquake, and the third individual’s task was to assist in recovery of the other engineers should another major earthquake occur. The restricted area gradually shrank in size and was eventually removed in June 2013, over two years after the initial earthquake.

After arriving at the site and before entering any building, the possibility of various dangerous conditions should be considered, including:

- The building could be structurally unstable and unsafe to enter.
- Landslides or mudslides in a hilly area with rainy weather.
- If the event was an earthquake, aftershocks can occur. Even if the building appears safe to enter, depending on the magnitude of the aftershock (or another earthquake event), the building can quickly become unsafe or unstable.
- There could be a variety of toxins in the building, depending on the type of event. Mold is quite common after a hurricane or flood. At a minimum, a fitted respirator is recommended before entering mold-infested property. Toxins from smoke and ash after a fire can be present in the air, making breathing difficult and possibly causing respiratory issues if there is prolonged exposure. Again, an appropriate mask would be required before accessing the site.
- Squatters and looters may have unlawfully occupied the property after the owner has evacuated.
- Animals displaced from the event can be unexpected and aggressive. Insect control may no longer be effective, possibly increasing the risk of exposure to disease.
4. Government Oversight

Each state has similar but unique licensing requirements and rules of professional conduct for the practicing expert. In general, all states require that the plans, specifications and reports are prepared by a licensed engineer or prepared under the licensee’s “direct supervision”. However, direct supervision is defined differently in each state.

For example, in South Carolina, the term direct supervision is defined by statute. Specifically, for professional engineers, direct supervision is defined meaning “that there is a clear-cut personal connection to the project or employee supervised, marked by firsthand knowledge and direct control and assumption of professional responsibility for the work.”

In North Carolina, the term is defined by regulation and includes the idea that “direct supervisory control may be accomplished face to face or by other means of communication.”

Looking to Georgia, the issue of direct supervisory control is dealt with as a rule of an engineer’s professional conduct, and the rule is far more detailed in what is expected of a licensed engineer overseeing one who is not licensed in Georgia:

“Direct supervisory control” shall require the registrant to have daily interaction with and provide guidance and direction to any non-registrant employee or non-registrant contract employee in the preparation of engineering or land surveying plans, documents or plats, in each phase of the preparation of the calculations, drawings, specifications, reports, surveys and all other documents completed by the non-registrant. Direct supervisory control may be typically established at a location (address) where both the registrant and the non-registrant employee (whether full time or part time or contract) are employed and there is a direct connection between the registrant and the non-registrant employee. If the registrant and the non-registrant employee are not located at the same location, then the registrant shall be able to demonstrate how direct supervisory control is maintained over the non-registrant and how the registrant and the employee maintain a direct connection for the direct supervisory control of the engineering or surveying work as indicated above, upon an inquiry from the Board.

Other countries’ laws are much different. For instance, in Mexico, while professionals licensed elsewhere were welcome to give independent assessments, only certain registered
professionals were authorized by the government to give a valid certification of the conditions of the affected buildings.

E. SITE INVESTIGATION

Safety is of utmost concern when assessing the site. First, any dangerous conditions such as gas leakage or severed electrical conduit should be mitigated as soon as possible by shutting off the building power, gas lines, etc. The evaluation of the physical structure begins with a walkthrough of the perimeter of the building to evaluate plumbness of the walls, façade and cladding, and is followed by a walkthrough of the roof. Once no apparent life-safety issues are detected, the interior of the building is accessed for evaluation. The building is then methodically inspected for damage.

A building is comprised of a foundation, superstructure, building envelope, mechanical, electrical and plumbing (MEP) systems, and architectural finishes. Depending on the nature of the event, the evaluation procedure and observations will vary. While making the following observations, experts assess whether or not the damage is indicative of issues in life-safety or serviceability.

a. Site – Site is the land on which a building sits and consists of hardscape, landscape, trees and parking lots. For a hurricane event, fallen or leaning trees are observed to indicate direction of the wind and rain. After an earthquake event, settlement, angulations and ejected material of the hardscape or landscape are noted. This indicates the severity of ground movement.

b. Foundation – The foundation system can be deep or shallow and is likely unknown at the time of the inspection. Levelness of the building which may indicate foundation settlement is evaluated, particularly for an earthquake event. Foundation issues in a hurricane event typically come from uprooted trees and localized settlement issues.
c. **Superstructure** – Superstructure consists of beams, columns, walls and floors. Typical observations include cracks and separations, indicating building movement or loss of strength in an element. Certain areas of the building may be more vulnerable, depending on the building type, layout and height. These hotspots can be a concrete elevator core (the main lateral system of the building), a large opening in the slab adjacent to the elevator core walls or a discontinuous shear wall. These hotspots are carefully observed and damage, such as cracks and separations, is noted. The levelness of walls and floors is also checked, which can indicate out-of-plumbness (tilt). The observed distress can be related to serviceability, building age or previous damage. During the evaluation, it is crucial to look for non-distressed areas to understand the full picture.

d. **Building Envelope** – The exterior wall can be a curtain wall, cavity system or window glazing system. In most cases, drawings are not available prior to the site visit and sensory observations are used to identify the cladding system. For instance, EIFS (exterior insulation and finish system) is hollow-sounding when compared to stucco, and brick veneer typically has weep holes while a structural brick wall does not. Typical observations of cladding include impact damage, cracks, separations and water intrusion through the curtain wall. For windows and doors, assessment of sealant tightness and cohesion is noted. Similarly, roof evaluations involve a walkthrough of the roof if it’s relatively flat or the use of ladders for closer inspection if it’s a pitched roof. For a membrane roof such as a TPO or PVC roof, uplift of the membrane, particularly around roof penetrations from drains, vents and scuppers, and around parapet roofing termination bars, indicates damage likely caused by upward pressure from a wind event.

e. **Mechanical, Electrical, and Plumbing (MEP)** – MEP systems consist of various equipment, piping, cabling, ductwork and panels. Typical observations that indicate movement
consist of out-of-plane distortion of materials, cracks and separations at connections of equipment components. Corrosion can occur quickly from soot deposits and discoloration may indicate equipment exposure to contaminants. It’s crucial to document model numbers and condition of the equipment at the time of the site visit. If the equipment is not protected and is further exposed to weather, its condition can significantly deteriorate. After a fire event, by observing the severity of melting, heat zones can be established, which assists in determining the direction and the cause and origin of the fire.

f. Architectural finishes – Nonstructural damage, *i.e.*, cracks, separation and movement in the finishes, are signs of building movement. Structural elements are often covered with architectural finishes, and damage to the finishes can be indicative of structural damage. Damage to other non-structural items such as ceilings, chimneys and rooftop equipment, which could have shifted during a hurricane or an earthquake event, is indicative of the severity of building movement during the event. It is crucial to note the location of firewalls, which architecturally subdivide the building into separate areas or buildings. One large residential building can be architecturally subdivided into several smaller buildings, which has building code implication when reinstating the building.

It is critical to be methodical on site, as the quality of the site visit can shape the remainder of the project. Critical evidence must be gathered and documented efficiently and effectively. Photographs are often the most important piece of evidence during the site visit, since additional access to a site may not be available; the site may be demolished, or another event may occur soon after the site visit. Site plans, notes, diagrams and figures can be created from a properly photographed site visit; however, detailed site plans and notes cannot be used to recreate photographic evidence.
The photographs should tell a story. The photograph documentation process involves taking an overall photograph and then a close-up photograph of the damage, and ensuring that the photographs are in focus, have adequate lighting and are high resolution. In some cases, a zoom lens can show more damage than is visible to the naked eye. Part of site documentation involves taking measurements using a crack gauge, tape measure, ruler, micrometer, etc. Drones can assist during the site visit as well, since they can be used to access areas normally inaccessible. For instance, after a roof collapse, drones can provide an overall view of the site, depicting the building condition and the stability prior to attempting entry.

Typically, the initial site visit is limited to a walkthrough of the site. Other resources such as a boom lift, ground penetration radar or thermographic camera may not be available or accessible for the initial site visit. However, basic site gear such as a digital camera, flashlight, measuring tape, safety vest, hard-toed boots, hard hat and a ladder should be brought to site. It is likely that home improvement stores like Home Depot and Lowe’s will be closed due to the catastrophe. Therefore, all necessary equipment should be brought to the site from the home office.

F. **REBUILD**

1. *Develop scope of repair/remediation work*

   After damage evaluation of a building, the question becomes *can the building be repaired?* This is often a complicated question involving multiple disciplines. From an engineering perspective, the majority of buildings can be repaired but this may not be cost effective. The engineering, architecture and building consultant team works together to develop a repair scope and estimate the cost of repair. Then the owner makes the decision if the building will be repaired. Regardless of the extent of damage and the cost to return the building to its original condition, the
owner may take this opportunity to change the location of the business or repurpose the building.

In some cases, the forensic engineer and engineer of record (designer) are the same. Often though, they are not. The forensic engineer typically is engaged by the insurance carrier or lawyer to document damage and determine the cause of the failure. The designer is involved with the building repair and perhaps retrofit if the code requires upgrades. Conflict may occur when the owner’s needs are not congruent with the insurance coverage.

If the engineer of record is not the same as the forensic engineer, the forensic engineer acts as a peer reviewer representing the insurance carrier. The scope of the forensic engineer is to reinstate the building to its original condition with minimum code requirements. The mindset of the engineer of record, who typically designs new buildings, is to bring the damaged building into compliance with the current building code. The different approaches can often lead to a conflicting repair scope for the two parties. The majority of the time, as a forensic engineer, the assignment involves developing a repair scope and/or peer reviewing the repair scope prepared by the owner’s engineer.

In the United States, the International Code Council (ICC) develops model codes and standards used in design. All states have adopted the ICC codes and make amendments as necessary. The International Existing Building Code (IEBC) is the governing building code for repair, alteration, change of occupancy, relocation and/or additions to existing buildings. These codes are the minimum set of requirements for compliance to safeguard the public health, safety and welfare. States such as Florida and California have utilized the model code language and added amendments to the IEBC and established governing codes such as the California Existing Building Code (CEBC) or Florida Existing Building Code (FEBC). Local authorities may add further requirements.
For instance, according to the 2017 version of the FEBC, “not more than 25 percent of the total roof area or roof section of any existing building or structure shall be repaired, replaced or recovered in any 12-month period unless the entire existing roofing system or roof section is replaced to conform to requirements of this code.” As stated above, the FEBC has a unique roofing requirement where if more than 25% of the existing roofing system is being repaired, replaced or recovered, then the entire existing system requires replacement to conform to the current code.

In the FEBC, substantial damage is deemed to have occurred if, “the cost of restoring the structure to its before-damaged condition would equal or exceed 50 percent of the market value of the structure.” Furthermore, if the substantially damaged building is in a flood hazard zone, then “all new construction of buildings, structures, portions of buildings and structures, including substantial improvement and restoration of substantial damage to buildings and structures, shall be designed and constructed to resist the effects of floor hazards and flood loads.” In sum, damaged buildings in a flood hazard zone will be required to have the building’s lowest floor elevation above the base floor elevation as defined in the current building code.

Furthermore, the Florida Building Code (FBC) – which governs new construction – states that, “in new construction the minimum deck slope shall be not less than 1/4:12.” FEBC Section 706.1 has the following exception: “reroofing shall not be required to meet the minimum design slope requirement of one-quarter unit vertical in 12 units horizontal (2-percent slope) in Section 1507 of the Florida Building Code, Building for roofs that provide positive roof drainage (High-Velocity Hurricane Zones shall comply with Sections 1515.2.2.1 and 1516.2.4 of the Florida Building Code, Building).” The High-Velocity Hurricane Zones in Florida include Broward (which is the county in which the seminar is taking place) and Miami-Dade counties. According to this code requirement, reroofing repairs in Broward and Miami-Dade counties can be more
extensive if the existing roof does not have a 2% slope. It is crucial to understand the unique code requirements for each state to ensure that appropriate data is collected on site. In this case, measuring the existing building roof slope would be essential to collect and determine the repair scope.

For comparison, the California Building Code (CBC) states that when alterations, additions or structural repairs are made to the existing building, “an accessible path of travel to the specific area of alteration or addition shall be provided.”\(^{10}\) For instance, if there is a localized roof failure of a large warehouse, the repair scope would include the direct damage and the code upgrade would include an accessible path of travel to the primary area, an accessible toilet and an accessible drinking fountain serving the area of repair. This provision can increase the repair scope dramatically. However, identifying firewalls within a building can limit the accessibility code upgrade work. Architecturally, a firewall divides a building into separate buildings. Thus, if the damage is limited to one area of the building divided by a firewall, the upgrades would be required only for the damaged half of the building, i.e., the other half of the building separated by the firewall would not require accessibility code upgrade work.

Similarly, according to the 2016 CEBC Section 202, substantial structural damage is a condition where, “in any story, the vertical elements of the lateral force-resisting system have suffered damage such that the lateral load-carrying capacity of the structure in any horizontal direction has been reduced by more than 33 percent from its pre-damage condition.”\(^{11}\) Additionally, “the capacity of any vertical gravity load-carrying component, or any group of such components, that supports more than 30 percent of the total area of the structure’s floor(s) and roof(s) has been reduced more than 20 percent from its pre-damage condition and the remaining capacity of such affected elements, with respect to all dead and live loads, is less than 75 percent
of that required by this code for new buildings of similar structure, purpose and location.”¹² This means that substantial structural damage occurs when the vertical elements of the lateral system or vertical gravity load-carrying components have reduced capacity. If the building has sustained substantial structural damage, then a seismic evaluation of the damaged structure may be required. If the existing building does not meet the seismic evaluation criteria, then the building is required to be retrofitted to 75% of the current building code forces. This may result in upgrade of the main lateral system of the building by adding concrete shear walls, steel braces, steel moment frames or other lateral systems.

However, although the building code requirements are in effect already, governments are very likely to change codes in response to disasters specifically for rebuilding. During the 1994 Northridge earthquake, bridge failure and structural damage of several hospitals and multistory wood frame buildings occurred. In addition, welded steel moment frame buildings experienced unexpected premature fractures initiating from welds at the steel beam to column connections during the earthquake. This led to the initiation of several studies funded by FEMA and engaged in by many universities across the country. It also led to multiple new ordinances.

For example, after the 1994 Northridge earthquake in Southern California, the City of Los Angeles passed Ordinance No. 170406 in 1995, which mandated inspections of welded steel moment frames and repairs of all damaged welded connections. The ordinance states that, “the Building Code does not allow a welded steel moment frame building to be maintained with damaged connections and it is necessary to ensure that repairs to these welded steel moment frame buildings be performed in an expeditious manner.”

Senate Bill 1953 was enacted in 1994 after the Northridge earthquake expanded the scope of the 1973 Hospital Act and stated the following: “All existing hospitals must be seismically evaluated, and retrofitted, if needed, by 2030, so that they are in substantial compliance with the Act (which requires that the hospital buildings be reasonably capable of providing services to the public after disasters).”

A later enactment took place in 2015 in the City of Los Angeles, which passed a mandatory retrofit ordinance in 2015 for wood frame buildings and non-ductile reinforced concrete buildings. “In the Northridge Earthquake, many multi-story wood-frame buildings with tuck-under parking performed poorly and collapsed, causing the loss of human life, personal injury and property damage. It has been determined that the structural vulnerability of this building type is typically due to soft, weak or open front walls. This division creates minimum standards to mitigate hazards from these deficiencies. Adherence to these minimum standards will improve the performance of these buildings during earthquakes and reduce, but not necessarily prevent, the loss of life, injury or earthquake-related damage.” Similarly, in 2017, the City of Santa Monica passed a mandatory retrofit program for seismic strengthening provisions for soft, weak or open front walls in light, wood-framed buildings (Santa Monica Municipal Code {SMMC} 8.72), non-ductile concrete buildings (SMMC 8.80), concrete tilt-up buildings (SMMC 8.64), unreinforced masonry building (SMMC 8.60), and steel moment frame buildings (SMMC 8.76). The purpose of the retrofit program as noted in SMMC 8.76 is that – “the welded connections and non-ductility of the steel connecting elements introduce poor performance of these buildings in seismic events. The deficiencies in the lateral force resisting system beam-column connections could experience damage and possible connection failures. This program created minimum standards intended to improve the performance of these buildings during earthquakes and reduce, but not necessarily
prevent, loss of life, injury or earthquake-related damage.”

Finally, the California Department of Transportation (“CalTrans”) looked at its own infrastructure’s earthquake readiness. CalTrans identified 1,155 state-owned bridges for their Seismic Retrofit Program after the Northridge earthquake. The Seismic Safety Retrofit Program was established after the 1989 Loma Prieta earthquake with “[t]he purpose [being] . . . to evaluate all publicly owned bridges in California and to take actions necessary to prevent their collapse due to earthquakes.”

In short, it is common for buildings to require upgrade when weaknesses in design methods are uncovered by extreme events. Even as this paper is being written, the City of San Francisco is looking to develop guidance, whether mandatory or voluntary, related to seismic upgrade of the taller pre-Northridge moment-frame buildings within the city. At this point, given the unknowns, is it better for an owner to initiate a current voluntary upgrade and assume, once the city determines what shall be required, that this will allow an exemption, or to wait until the specifics, if any, are finalized? Rising sea levels, climate change, and the potential for strong earthquakes are all risks that property owners and insurers must consider, and such events will require teams of experts to respond.

2. Schedule considerations

The time required to complete a construction project is always a key component in the planning and design process, and undertaking a rebuild project is no exception. Disaster response plans require resources and staff to execute them. However, the available resources and the available workforce are limited in a rebuild scenario, even though other variables may be similar to renovation projects. In fact, these variables pervade all aspects of facility construction, including foundation, superstructure, enclosure, MEP and interior finishes but in rebuilds, i.e. shortages of
material, labor and equipment add further variables and constraints planning and scheduling. The number and extent of these variables can have a significant impact on the time required for construction. Therefore, the importance of planning and scheduling in rebuild projects is even greater than that for new construction of similar complexity.

Displaced business operations experience curtailed productivity and other impacts, and will be anxious to return its operations to normal. Returning buildings damaged by a disaster to a useful condition is a time sensitive-endeavor. Similarly, the impact of a disaster on an active construction project will also raise schedule concerns, as the event will most likely delay completion date of project. In most rebuild scenarios after a disaster, time is of the essence.

a. Planning for repair/remediation activities

The planning and scheduling of construction endeavors require a clear understanding of the scope of work, the availability of skilled labor, access to construction materials, equipment availability, target completion date and project budget. The planning and scheduling of rebuilds following a natural disaster is not different, as these are all essential components in the effective execution of work. Although disaster recovery activities are usually performed in an “all-hands-on-deck” environment, proper planning and scheduling assist in the expeditious restoration of pre-disaster conditions. The funding sources for recovery efforts will be understandably anxious to know the time and cost of implementation of the remedial construction. In order to arrive at a reasonable estimate of time and cost, the condition assessment or triage portion of the process must be comprehensive.

i. Scope of Work – A clear understanding of the tasks required to design, procure and construct remedial measures is crucial to its successful completion. The design of the repair/remediation, in particular requires a clear understanding of the damage sustained. As with a
renovation project, understanding of the existing conditions is necessary before the design process can start. However, unlike in a renovation project, the survey of existing conditions is performed under crisis conditions. While a standard renovation design can be planned in advance, design activities in a disaster recovery scenario begin only after the disaster is over. The initial phase is condition assessment, which indicates what work is necessary. The time required for damage assessment must be factored into the project schedule as a comprehensive sequence of required activities.

ii. **Target Completion** – Timely completion is a principal goal in all construction projects. The completion of disaster recovery measures, whether for an existing facility or project under construction, is of critical concern to the owner and funding entity. In order to provide a reasonable forecast, a CPM schedule should be developed that provides a detailed work breakdown structure, activity descriptions, dependency relationships and the expected duration of each activity.

iii. **Project Budget** – Cost is another principal factor in a construction project. However, in a rebuild scenario the cost of the work cannot be estimated until the scope of the remedial measures is determined and the overall construction cost can be estimated.

b. **Impacts to project completion**

The large number of variables in disaster rebuilds adds uncertainty to the schedule of work, which includes known activities with detailed scopes of work, known activities without detailed scopes of work, and unanticipated activities. When dealing with disaster recovery, the likelihood of unanticipated issues and problems cannot be overstated. Such issues may affect the entire project from design through completion, and include delays in the procurement of materials, shortages in labor, lower-than-expected skill levels of workers (resulting in work taking longer),
and the scope of work increasing due to unanticipated problems or defects. The CPM schedule must include complete details of all relevant activities, allowance for the anticipated unknowns and a contingency for unanticipated unknowns. Taking all these issues into account will result in a realistic forecast of the time required to achieve pre-disaster conditions.

c. **Was the project on-schedule before the event?**

When dealing with an ongoing construction project that has suffered a disaster event, care must be taken to prepare a comprehensive status update of the work prior to the occurrence. This pre-disaster status will allow determination of whether the project was on, behind or ahead of schedule.

* A *force majeure* delay triggers different clauses in the general conditions that will have a significant impact on the compensation for delays experienced on the ongoing project. After a properly updated status report is prepared for the pre-disaster time period, any additional work can be inserted into the CPM schedule.

3. **Contracting for construction**

Contracting considerations for disaster recovery work will differ depending on whether the project is in the public or private domain, as there are differences in the contracting requirements. That said, in a disaster recovery, both public and private work will need to address the chaotic environment. Federal, state and local agencies overseeing construction activities will all be overtaxed, so wait times for permits and other submissions will be larger. Additionally, labor and material shortages will present atypical challenges in the already complex construction environment.

a. **Labor shortages**

In the weeks and months following a disaster event, the demand for labor in construction
activities is high and labor shortages usually occur. For example, a trio of monster hurricanes and a ferocious wildfire season in 2017 led to the costliest year for natural disasters on record in the U.S., with nearly a third of a trillion dollars in damage. The surge in demand for labor resulted in skilled labor shortages throughout the construction labor force. These limitations must be considered when determining how long work will take, as shortages in the workforce will extend delay completion of both design and construction.

b. Material shortages/challenges

The ability of supply chains to provide materials and support to areas hit by disaster can be significantly affected. For example, 30,000 homes in Houston were destroyed by Hurricane Harvey, more than the city was expected to build in all of 2017. The sourcing and procurement of construction materials will impact the duration and cost of work.

Materials may need to be sourced from distant locations, adding time and cost. Anticipation of such challenges can help predict potential impacts to time and cost, and can assist in taking steps to mitigate the impact of post-disaster conditions.

c. Coordination

As noted above, rebuild projects are usually performed on a time-is-of-the-essence basis. Contracting will likely be fast tracked and include a greater than normal overlap between predecessor and successor trades. Therefore, attention to detail in planning and scheduling the work is even more critical.

i. Integration of repair/remediation work with ongoing construction

The need to implement repair/remediation work in an ongoing construction project will likely cause disruption to the anticipated flow of the base contract work. Decisions on how to integrate this added work will depend on numerous considerations, including the timeliness and
quality of the work of the current workforce, the type of repair/remediation work to be performed and its effect on the scope of uncompleted work.

When deciding whether to use the existing workforce or engage a new contractor for the repair/remediation work, using the current workforce is recommended if the performance of the current contractor and subs has been satisfactory or better. Using the existing workforce simplifies the coordination of work and use of the site. However, if the performance of the current general contractor and subcontractors has been substandard, adding scope is not recommended. All interested parties should actively coordinate any added work to assure timely performance and guard against potential claims of disruption to the base contract work.

ii. Considerations when dealing with existing structures

The severity of damage to existing structures will determine whether the facility is habitable or not. Unoccupied structures involve a less complicated repair/remediation effort. The driving consideration in this situation is to complete the work expeditiously to allow a quick return to normal operations. When repairs are required in partially or fully occupied structures, phasing of repair work will be necessary to minimize the impact on everyday operations. The phasing will extend the completion timeline but result in a lower overall impact to operations.

iii. Pricing Issues: Prohibitions against Price Gouging

When pricing the project for rebuilding, contractors must also be careful not to run afoul of state laws aimed at price gougers. Thirty-four states and the District of Colombia have enacted local statutes to protect consumers from some form of price gouging. For example, in California, a contractor cannot sell or offer to sell any repair or reconstruction services, or any services used in emergency cleanup, at a price more than 10 percent above the price charged for the same services prior to the proclamation of a disaster or emergency for a period of at least 180 days
following that proclamation.\textsuperscript{15} Violations of this provision are punishable as a misdemeanor, meaning the contractor can serve up to one year in jail and/or be fined up to $10,000 per violation.\textsuperscript{16}

A full list of the various state statutes relating to price gouging issues is set forth as Appendix A.

G. MITIGATION MEASURES

Disasters often reveal vulnerabilities in the original design and construction and test the limits of the planning, design and construction abilities of engineers. Disasters of all sizes, especially large-scale ones, can cause considerable damage to the built environment and disruption to power and communication systems, making normal and emergency management activities difficult. The impact of large-scale disasters on the built environment may reveal weaknesses that planners, code officials, architects, engineers and owners must evaluate in order to be better prepared for future disasters. While disasters cannot be precisely predicted, their impacts are well understood and can be managed effectively through comprehensive hazard mitigation planning.

Mitigation measures are just as important as post-construction efforts in dealing with the negative economic and social impacts associated with natural disasters. In addition to lessons learned, for instance, private and government research initiatives are attempting to duplicate the effects of severe weather on construction materials and methods. Loads and pressure applied to test builds mimic wind, snow loads or earthquake conditions.

1. Incorporating Mitigation Measures into Ongoing Construction Projects

There are many challenges in addressing the weaknesses in the built environment revealed by disasters. Whether the weaknesses are related to an existing or planned structure or system, addressing these weaknesses adds to the scope, coordination and cost of whatever mitigation action is taken. Experience has demonstrated that maintaining and adding to the built environment can
be a complex process with many moving parts. When disaster mitigation is added to the mix, the process becomes even more complex – thus the need for ever-more proactive efforts to assure comprehensive and cost-effective implementation.

2. **The Importance of Mitigation Measures in the Local Building Codes**

Buildings codes prevent health and safety hazards in the built environment, starting with the original Boston building code that outlawed thatched roofs and wooden chimneys in 1631. Fire safety also inspired new building codes after the disastrous fires in London in 1666 and Chicago in 1871.

Over the years, new codes were created to protect neighbors from unsafe structures and to address the relationships between different buildings. By 1940, three regional code organizations had emerged in the United States. In 2000, the three organizations merged and consolidated into the International Code Council, which is still active today. In order to assure that known weaknesses revealed through the disaster recovery process are addressed in existing and planned built environments, the lessons learned in responding to disasters need to be adopted and incorporated into national and local building codes as appropriate.

According to a report in *Engineering News Record*, a National Institute of Building Sciences (NIBS) study on benefit-to-cost ratios (BCR) of hazard-mitigation investments has determined an 11:1 BCR over time for jurisdictions that have adopted model building code updates versus those that still use codes from the 1990s. The study also found a 4:1 BCR for investments to improve hazard resistance in utility and transportation infrastructure. NIBS and the International Code Council are trying to make a case for states and local jurisdictions to adopt the latest model codes, developed by ICC.

3. **Responsibilities for not following up**
In cases where a code has not been adopted in a jurisdiction, it may nonetheless have assumed an authoritative status for building designers. Engineers and architects are licensed by the state to practice their profession and have a duty to be aware of the building features and elements that are potentially a threat to the public and to the building user. The codes, then, are utilized by design professionals in their designs in such geographical areas, even though the codes may not be universally adopted as law there.

In such instances where special codes relating to natural disasters have not been adopted, there may still be a question as to whether a designer should take such issues into account on a particular project. The general rule on standard of care for designers is that the designer is to provide its professional services in a manner that is consistent with the skill and care provided by designers practicing in the same or a similar locality under the same or similar circumstances. If the project is in a location that is susceptible to hurricane damage – say, for example, a hotel located in the Outer Banks of North Carolina – and a designer does not design the project in a manner to minimize hurricane damage and to ensure the project can withstand hurricane force winds even if the local building code does not require it, that may be a failure to meet the standard of care.

4. Disruption and Delay

The time required to integrate mitigation measures in planned projects or those under construction can affect the base contract scope of work. If the mitigation measures are considered prior to the start of design or early in the design phase, there will likely be a more seamless integration of the code changes incorporated into the overall project design. However, the later these measures are incorporated into the project, the greater the potential that he project schedule will be affected.
During the design phase, the ability to implement mitigation measures should be considered, whether it be through evolving building codes or through Federal grants for flood control. Although these measures will ultimately have a positive effect in protecting a structure from harm during a disaster event, the possible impact on the project completion must be considered. The later a mitigation measure is implemented, the higher the probability of delay.

5. **Considerations of incorporating mitigation measures into existing structures**

Identifying enhancements to the built environment, based on lessons learned and research into building materials and systems, is only the first step in achieving potential benefits. The actual implementation of mitigation measures in new projects and existing structures is the only way to realize benefits. New construction projects are subject to building code requirements which are currently being updated to include mitigation measures. However, their inclusion in existing structures typically occurs during major renovation projects or when an owner decides the benefits of implementation outweigh the design and construction costs. This is primarily a choice of the owner and is not yet mandated.

In making the decision to implement mitigation measures, an owner needs to weigh both financial and health safety components of a prevention initiative. The practical aspects of implementation clearly include the costs to design and construct the initiative. Other considerations include the disruption to normal operations and use of the built structure.
## APPENDIX A
### Price Gouging Laws

<table>
<thead>
<tr>
<th>State</th>
<th>Summary of the Law: What is Prohibited &amp; Penalties</th>
<th>Statute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alabama</td>
<td>Charging &quot;unconscionable&quot; prices for commodities or rental facilities during a declared state of emergency.</td>
<td>§ 8-31-1, et seq.</td>
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<td></td>
<td>Civil penalty of $1,000 per incident.</td>
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<tr>
<td>Alaska</td>
<td>n/a</td>
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<tr>
<td>Arizona</td>
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<tr>
<td>Arkansas</td>
<td>Selling commodities, household essentials, fuel, etc. after a declared state of emergency for more than 10% over the cost of these items immediately preceding the declaration.</td>
<td>§ 4-88-301, et seq.</td>
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<td>Class A misdemeanor (up to $2,500 fine and up to one year in jail per violation).</td>
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</tr>
<tr>
<td>California</td>
<td>Selling commodities, household essentials, fuel, etc. after a declared state of emergency for more than 10% over the cost of these items immediately preceding the declaration.</td>
<td>PEN § 396</td>
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<tr>
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<td>Misdemeanor, punishable by up to 1 yr. in jail and/or up to a $10,000 fine; civil penalties of up to $2,500 per violation (plus injunction and restitution).</td>
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<tr>
<td>Colorado</td>
<td>n/a</td>
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<tr>
<td>Connecticut</td>
<td>Selling commodities, household essentials, fuel, etc. after a declared state of emergency for more than acceptable market prices (as determined by the state).</td>
<td>§ 42-230, et seq.</td>
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<tr>
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<td>Penalties range from $99 - $1,000 and/or up to one year in jail per offense.</td>
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<tr>
<td>Delaware</td>
<td>n/a</td>
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<tr>
<td>District of</td>
<td>Selling commodities, household essentials, fuel, etc. after a declared state of emergency for more than 10% over the price at which similar services/products were sold during the 90-day period preceding the emergency.</td>
<td>§ 28-4101 - 4103</td>
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<tr>
<td>Columbia</td>
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<tr>
<td>State</td>
<td>Description</td>
<td>Penalty/Action</td>
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<tr>
<td>Florida</td>
<td>Civil infraction, punishable by up to $1,000 in fines and license/permit revocation/suspension (where applicable). Selling commodities, household essentials, rentals, fuel, etc. after a declared state of emergency at &quot;unconscionable&quot; prices (&quot;grossly exceeding&quot; average prices in the 30-day period preceding the emergency). 2nd-degree misdemeanor, punishable by a fine of up to $1000 and/or up to 60 days in jail for first offense; $25,000 for multiple violations within a 24-hour period.</td>
<td>§ 501.160</td>
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<tr>
<td>Georgia</td>
<td>Selling items or services determined by the Governor during a declared state of emergency to be necessary for public safety at a higher cost than they were immediately prior to the declaration. Charged as a deceptive or unfair trade practice (and investigated by the AG as such); additional civil penalty of up to $10,000 for each violation if &quot;disaster related.&quot;</td>
<td>§ 10-1-393.4, et seq.; § 10-1-438</td>
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<tr>
<td>Hawaii</td>
<td>&quot;Any increase in the selling price of any commodity&quot; after the Governor declares a state of emergency; also, landlords may not terminate tenancy for residential dwellings in an area subject to severe weather warning or emergency declaration Charged as an unfair or deceptive trade act, subject to fines between $500 and $10,000 per violation</td>
<td>§ 127A-30; § 480-2</td>
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<tr>
<td>Idaho</td>
<td>Selling &quot;fuel or food, pharmaceuticals, or water for human consumption at an exorbitant or excessive price&quot; (based on a comparison of prices immediately before and after the declaration) during a declared state of emergency Charged as an unfair trade practice; subject to civil penalties of up to $5,000 per violation, recovery of actual damages suffered by the consumer(s), and/or an order for specific performance</td>
<td>§ 48-603</td>
</tr>
<tr>
<td>Illinois</td>
<td>&quot;During any market emergency, for any petroleum-related business to sell or offer to sell any petroleum product for an amount that represents an unconscionably high price&quot; (defined as a &quot;gross disparity&quot; between the prices immediately before and after the emergency)</td>
<td>815 ILCS 505/2; Illinois Administrative Code: 465.10, et seq.</td>
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<tr>
<td>State</td>
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<tr>
<td>Indiana</td>
<td>Charged as an unfair business practice; subject to injunctive relief, restitution, and civil penalties of up to $50,000 per violation. Price-gouging on fuel sales during (and 24 hours before) a declared state of emergency; defined as charging a price that &quot;grossly exceeds&quot; the average price of fuel in the immediate area during the 7 days immediately preceding the declaration. Attorney General may investigate complaints, seek appropriate injunctive relief, seek restitution for victims, and collect a civil penalty of up to $1,000 per violation.</td>
<td>§ 4-6-9.1-1, et seq.</td>
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<tr>
<td>Iowa</td>
<td>Charging &quot;an excessive price for merchandise to be provided to persons within an area declared to be a disaster area during the period of any declaration of emergency and for the subsequent recovery period.&quot; Charged as an unfair business practice; up to $40,000 per violation (an additional $5,000 if victims were elderly), injunctive relief, and restitution.</td>
<td>§ 714.16; Iowa Administrative Code (IAC): 61-31.1 (714)</td>
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<tr>
<td>Kansas</td>
<td>For any supplier of a &quot;necessary property or service&quot; to &quot;profiteer from a disaster&quot; by charging 25% or more than the pre-disaster price for such goods/services. Charged as an unconscionable business act or practice; punishable by up to $10,000 per violation (an additional $10,000 if victims were elderly), injunctive relief, and restitution.</td>
<td>§ 50-6,106</td>
</tr>
<tr>
<td>Kentucky</td>
<td>Selling or renting goods or services (food, emergency supplies, medical supplies, heating oil, housing, gasoline, etc.) &quot;for a price which is grossly in excess of the price prior to the declaration and unrelated to any increased cost to the seller.&quot; Punishable by a civil penalty of up to $5,000 for the first violation and up to $10,000 for each additional violation.</td>
<td>§ 367.372, et seq.</td>
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<tr>
<td>Louisiana</td>
<td>Selling goods/services during a declared state of emergency (within the designated emergency area) in excess of the ordinary price range immediately before the declaration. Attorney General may bring action to enjoin (cease) the offending act; subject to civil action (including payment of</td>
<td>Tit. 29, § 732, et seq.</td>
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<td>State</td>
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<td>Maine</td>
<td>Selling or offering for sale &quot;necessities at an unconscionable price&quot; when there is an abnormal market disruption (typically a declaration by the Governor). Charged as an unfair act (civil violation); civil fine of up to $10,000; criminal penalties of up to $1,000 and/or up to 3 yrs. in prison.</td>
<td>Title 10, § 1105; § 207</td>
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<td>Maryland</td>
<td>n/a</td>
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<tr>
<td>Massachusetts</td>
<td>Selling &quot;any petroleum product&quot; at an unconscionably high price &quot;during any market emergency&quot; (as declared by the Governor). Civil penalty of $5,000 per violation.</td>
<td>Code of Massachusetts Regulations (CMR): 940 CMR 3.18</td>
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<tr>
<td>Michigan</td>
<td>&quot;Charging the consumer a price that is grossly in excess of the price at which similar property or services are sold&quot; -- regardless of whether there is a declared emergency. Civil penalty of up to $25,000 per violation.</td>
<td>§ 445.903</td>
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<td>Minnesota</td>
<td>n/a</td>
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<tr>
<td>Mississippi</td>
<td>Selling goods and services at above the prices normally charged during a declared state of emergency (or what was charged immediately preceding the declaration). Civil penalty of up $10,000 per violation, plus legal costs; criminal penalties ranging from a misdemeanor (up to $1,000 and 6 months in jail) to a felony (1 to 5 yrs. in prison and/or fine of up to $5,000).</td>
<td>§75-24-25</td>
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<tr>
<td>Missouri</td>
<td>Charging within a disaster area an excessive price for any necessity (or that which the seller has reason to believe will likely be provided to consumers within a disaster area). $1,000 civil penalty per violation, injunctive relief, restitution; may be charged as a Class D felony (1-7 yrs. in prison and up to $10,000 fine).</td>
<td>§ 407.020; Missouri Code of State Regulations (CSR): 15 CSR 60-8.030</td>
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<td>State</td>
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<tr>
<td>Montana</td>
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<td>Nebraska</td>
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<td>Nevada</td>
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<td>New Hampshire</td>
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<td>New Jersey</td>
<td>During a declared emergency, selling goods and services at a price that is at least 10% higher than it was immediately preceding the declaration. Civil penalty of up to $10,000 for first violation, up to $20,000 for each subsequent violation, 56 § 8-107, et seq.</td>
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<tr>
<td>New Mexico</td>
<td>n/a</td>
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<tr>
<td>New York</td>
<td>Selling &quot;goods and services vital and necessary for the health, safety and welfare of consumers&quot; at an &quot;unconscionably excessive price&quot; (as determined by the court) during a declared state of emergency. Up to $25,000 civil penalty per violation, restitution. GBS § 396-r</td>
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<tr>
<td>North Carolina</td>
<td>Selling or renting goods and services &quot;used to preserve, protect, or sustain life, health, safety...&quot; at unreasonably excessive prices after an emergency declaration or abnormal market disruption. Civil penalty of up to $5,000 per violation. § 75-38</td>
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<td>North Dakota</td>
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<td>Ohio</td>
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<tr>
<td>Oklahoma</td>
<td>Selling, renting, or leasing goods, services, dwelling units, or storage space after the declaration of an emergency at a price of more than 10% above the rate charged before the declaration. Charged as a violation of the Oklahoma Consumer Protection Act, punishable by up to $10,000 per claim; may also be 15 OK St. §§ 777.1, et seq.</td>
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<tr>
<td>State</td>
<td>Law</td>
<td>Penalty and Enforcement</td>
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<tr>
<td>Oregon</td>
<td>Selling essential consumer goods or services after the declaration of an emergency at a price of more than 15% above the rate charged before the declaration.</td>
<td>Considered an unlawful trade practice, subject to injunctive relief and private civil action by individuals for damages. § 401.960, et seq.</td>
</tr>
<tr>
<td>Pennsylvania</td>
<td>Selling consumer goods or services in a geographic region subject to a declared emergency at an &quot;unconscionably excessive price&quot; (at least 20% higher than the normal price range immediately prior to the declaration).</td>
<td>Violations subject to a civil penalty of up to $10,000 for each act, in addition to injunctive relief and restitution. Title 73 § 232.1, et seq.</td>
</tr>
<tr>
<td>Puerto Rico (U.S. territory)</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>Rhode Island</td>
<td>Selling &quot;essential commodities&quot; (i.e. heating fuel, motor fuels, food, water, ice, lumber, etc.) after the declaration of an emergency at an &quot;unconscionably high price.&quot;</td>
<td>Violations subject to civil penalties of up to $1,000 per violation (and up to $25,000 in total penalties for violations within any 24-hour period). § 6-13-21</td>
</tr>
<tr>
<td>South Carolina</td>
<td>After an emergency is declared, renting or selling a commodity at an unconscionable price or imposing unconscionable prices for the rental or lease of a dwelling unit, including a motel or hotel unit, or other temporary lodging, or self-storage facility.</td>
<td>Subject to civil penalties of up to $5,000 per violation (up to $15,000 per violation if an injunction has been issued); may be charged as a misdemeanor (fine of up to $1,000 and/or 30 days in jail). § 39-5-145</td>
</tr>
<tr>
<td>South Dakota</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>State</td>
<td>Description</td>
<td>Penalty</td>
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<tr>
<td>Tennessee</td>
<td>Upon the declaration of a state emergency, charging &quot;grossly excessive&quot; prices for food, construction services, emergency supplies, or other vital goods or services.</td>
<td>Subject to civil penalty of between $1,000 and $3,000 per violation.</td>
</tr>
<tr>
<td>Texas</td>
<td>After a declared emergency, &quot;selling or leasing fuel, food, medicine, or another necessity at an exorbitant or excessive price.&quot;</td>
<td>Subject to civil penalty of up to $20,000 per violation (up to $250,000 if the victim was over 65 yrs. old) and injunctive relief.</td>
</tr>
<tr>
<td>Utah</td>
<td>After a declared emergency, charging an &quot;excessive price&quot; for consumer goods and services (10% higher than normal, or 30% higher for goods and services that were not provided immediately before the declaration).</td>
<td>Punishable by the issuance of a cease and desist order and civil penalties of up to $10,000 per day.</td>
</tr>
<tr>
<td>Vermont</td>
<td>After a declared &quot;market emergency,&quot; charging &quot;unconscionably high&quot; prices for petroleum or heating fuel-related products or services.</td>
<td>Aggrieved parties have the private right of action under the Consumer Protection Act to sue the offending party.</td>
</tr>
<tr>
<td>Virginia</td>
<td>During a time of disaster, selling, leasing, or licensing &quot;any necessary goods and services at an unconscionable price.&quot;</td>
<td>Punishable by a civil penalty of up to $2,500 per violation (up to $5,000 if in violation of an injunction).</td>
</tr>
<tr>
<td>Washington</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>West Virginia</td>
<td>After a declared state of emergency, selling consumer food items, medical supplies, heating oil, building supplies, etc. at more than 10% of the average cost of those items prior to the declaration.</td>
<td>Charged as a misdemeanor (up to $1,000 fine and/or up to 1 yr. in jail).</td>
</tr>
</tbody>
</table>
| Wisconsin | Selling, or offering to sell, in this state at wholesale or at retail, consumer goods or services at unreasonably excessive prices after an emergency declaration (15% higher than the average price immediately prior to the declaration)  
Civil penalty of up to $10,000 and/or permanent injunction against the seller's actions. | § 100.305; Wisc. Administrative Code: ATCP 106.01, et seq. |
<table>
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<tbody>
<tr>
<td>Wyoming</td>
<td>n/a</td>
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</tr>
</tbody>
</table>

1 New Building Standard is a standard that a new building would be required to meet; in other words, “percentage NBS” describes the seismic capacity of the building relative to the current building code.


4 21 N.C. Admin. Code 56.0701.

5 Ga. Comp. R. & Regs. 180-6-.03(6).

6 2017 FEBC, Section 706.1.1.

7 2017 FEBC § 202.


12 Id.

13 Los Angeles City Ordinance No. 183893.

14 CalTrans Local Assistance Program Guidelines, Chapter 7.

15 Cal. Penal Code § 396(c)

16 Cal. Penal Code § 396(f).

17 Building Officials Code Administrators International (BOCA); Southern Building Code Congress International (SBCCI) and the International Conference of Building Officials (ICBO).
