



Wasatch Front URM Risk Reduction Strategy Best Practices and Replicability

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FEMA

NOTICE

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Cover image – Starting top left, in clockwise order: (1) Salt Lake Temple base isolation retrofit; (2) commercial building damaged during 2020 magnitude 5.7 Magna, Utah, earthquake; (3) close-up of parapet bracing; and (4) earthquake warning placard.

Photo credits – (1) [Salt Lake Temple](#); (2) [building damage](#); (3) [parapet bracing](#); and (4) [warning placard](#).

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Executive Summary

The [Wasatch Front Unreinforced Masonry Risk Reduction Strategy](#) (the Strategy) provides Utah with a strategy to significantly reduce the risks posed by unreinforced masonry (URM) buildings across the Wasatch Front. This Strategy leverages resources and case studies from seismically vulnerable areas across the country. It was developed to be actionable, recommending best practices in identifying URM buildings, designing retrofits, and developing and implementing programs to significantly reduce URMs. While this Strategy was developed for communities across the Wasatch Front, being replicable across jurisdictions and hazards was a goal throughout the process.

FEMA, [Mitigation Framework Leadership Group \(MitFLG\)](#) partners, and the state of Utah recognize the importance of mitigation in reducing exposure to future losses from disasters. The interagency [National Mitigation Investment Strategy](#) (Investment Strategy) – published in July 2019 – was developed to help the nation be more intentional about setting resilience and mitigation investment priorities to benefit the whole community. Due to Utah’s URM issues and its dedication to creating a solution, the Wasatch Front URM Risk Reduction Strategy was selected as a pilot project through the Investment Strategy. This project brings together local, state, and national experts to develop a mitigation strategy that highlights key concepts that drive risk reduction outcomes. By learning from Salt Lake City’s successful previous investment in mitigation through [Fix the Bricks](#), FEMA and Utah are collaborating to expand the investment in seismic mitigation, both across the Wasatch Front and nationally in other seismically active cities.

Purpose

This document is intended to support and guide the development of URM risk reduction programs across the United States by outlining best practices and transferability from the Wasatch Front. The best practices and transferability guidance can be used by state agencies and local governments to develop URM strategies, and by the MitFLG in the selection of future Investment Strategy pilot projects. Below are the highest-level best practices and recommendations; detailed descriptions of each can be found throughout the document.

Summary of Findings

The development of the Strategy identified several best practices that should be used when developing similar URM strategies or selecting future Investment Strategy projects. These identified best practices fall into one of several categories: 1) State and Local Support and Involvement; 2) Resources; 3) Willing Partners; and 4) Achievable Goals and Recommendations.

Summary of Best Practices

- **State and Local Support and Involvement** - The Wasatch Front Risk Reduction Strategy was developed at the request of the State of Utah Division of Emergency Management Director. Regional, State, and Local subject matter experts were empowered to drive the Strategy's development. *Best Practice – Empower, entrust, and support Regional, State, and Local experts in multiple sectors to influence strategy development.*
- **Resources** - The Strategy was funded by Federal Insurance and Mitigation Administration (FIMA) Leadership, FEMA Regional Mitigation Division Director, and Risk Analysis Branch Chief who included the work in their performance plans to help drive development. *Best Practice – Leadership engagement and accountability ensures prioritization.*
- **Willing Partners** - Strong pre-existing program-level working relationship between Federal, State, and Local partners including the Utah Seismic Safety Commission, Envision Utah, faith-based organizations, and private industry allowed for federal partners to meaningfully contribute. *Best Practice – Alignment of Federal, State, Local governments and faith-based, non-profit, and private industries establish synergies to advance and implement strategic efforts.*
- **Achievable Goals and Recommendations** - Presents five achievable strategic goals broken down thematically around existing local goals and presented in the context of stakeholder drivers and barriers to action. *Best Practice – Generate achievable objectives that are measurable and implementable.*

The design and implementation of the Strategy is replicable across mitigation-related projects, and transferability has been considered to aid individuals and government entities by providing a set of considerations for assessing transferability.

Summary of Replicability Considerations

- **Evaluate the administrative transferability for the Strategy to other State, Local, Tribal and Territorial locations.** This effort is directly transferrable to other strategic risk reduction efforts. Many State, Local, and private sector partners participated in this effort which should be considered as a factor in achieving successful replicability.
- **Evaluate the administrative transferability to partnering federal agencies.** This effort directly aligns to other efforts related to building codes and earthquake resilience.
- **Evaluate the transferability of the project to other mitigation types.** The Strategy contains best practices related to promoting retrofits, considering equity, leveraging available natural hazard risk assessment tools, and utilizing data to inform decision making.

Through the development of the Strategy, the team identified several recommendations that should be considered when applying the Strategy to other areas across the United States and for future projects that demonstrate the Investment Strategy. Recommendations fall into one of several categories: 1) Local Champion, 2) Federal Alignment, 3) Diverse Perspectives, 4) Cross-Jurisdictional Support, and 5) Appropriate Resource Support.

Summary of Recommendations

- **Local Champion** - Empower individuals from State, Local, Tribal, and Territorial agencies, and organizations to lend their expertise to drive the development of risk reduction strategies.
- **Federal Alignment** - Utilize strong federal leads to keep the project moving forward in the event of multiple disasters which can reduce State/Local capacity, particularly in the early stages of the project. (In Utah, work was continued by FEMA staff during the COVID-19 pandemic, allowing the project to remain on track.)
- **Diverse Perspectives** - Elevate diverse perspectives and skillsets and encourage individual team members to meaningfully contribute throughout the project. Ask “Who is not at the table?”
- **Cross-Jurisdictional Support** - Develop strong local buy-in to ensure project implementation. Local groups played a key role in the Strategy’s development and will continue to be influential in its long-term success.
- **Appropriate Resource Support** - Ensure that either internal or contract resources are prepared to support the project scope. This includes ancillary needs like 508 compliance and incorporation of edits from FEMA External Affairs concurrence.

Wasatch Front URM Risk Reduction Strategy Overview

The Wasatch fault poses one of the most catastrophic natural threat scenarios in the United States. The Wasatch Front has a 43% chance of a magnitude 6.75 or greater earthquake in the next 50 years, and experts project that such an event would be among the deadliest and costliest disasters in U.S. history. In a magnitude 7.0 earthquake on the Salt Lake City segment of the Wasatch fault, FEMA's economic loss model, Hazus, estimates 2,000-2,750 fatalities, 8,000-10,000 injuries potentially requiring hospitalization, and roughly 78,000 displaced households.

The devastating potential of the Wasatch fault is due, in part, to the high likelihood of a large earthquake near Utah's most densely populated urban areas. This danger is heightened by the number of people who live, learn, work, worship, or shop in unreinforced masonry (URM) buildings and may be unaware of the potential danger. Additionally, those who live in URM buildings often include a disproportionate number of disadvantaged and marginalized populations. A typical URM building has brick walls with few, or no steel reinforcing bars. During an earthquake, URM buildings often collapse, both inward and outward.



Figure 1. City bus crushed by URM debris falling from nearby buildings during the 2011 Christchurch earthquake in New Zealand. Twelve of the 13 people on board were killed. Photo credit: Simon Baker6.

FEMA, Mitigation Framework Leadership Group (MitFLG) partners, and the state of Utah recognize the importance of mitigation in reducing exposure to future losses from disasters. The interagency National Mitigation Investment Strategy (Investment Strategy) – published in August 2019 – was developed to help the nation be more intentional about setting resilience and mitigation investment priorities to benefit the whole community. Due to Utah's URM issues and its dedication to creating a solution, the Wasatch Front URM Risk Reduction Strategy was selected as a pilot project through the Investment Strategy. This project brings together local and national experts to develop a mitigation strategy that highlights key concepts that drive risk reduction outcomes. By learning from Salt Lake City's successful previous investment in mitigation through [Fix the Bricks](#), FEMA and Utah are

collaborating to expand the investment in seismic mitigation, both across the Wasatch Front and nationally, in other seismically active cities. Five recommendations were provided from the Strategy.

Wasatch Front URM Risk Reduction Strategy Recommendations

1. Unreinforced Masonry School Risk Reduction Program
2. Retrofit Program Focused on Government Owned Unreinforced Masonry Structures
3. Statewide Unreinforced Masonry Risk Reduction Program
4. Utah State Construction Code Enhancement
5. Utah State Construction Code – Local Amendments

The purpose of the [Wasatch Front URM Risk Reduction Strategy](#) was to provide Utah with a strategy for significantly reducing the risks posed by URM buildings across the Wasatch Front. This Strategy leverages resources and case studies from Utah and other seismically vulnerable areas. It was developed to be actionable, by recommending best practices in identifying URM buildings, designing retrofits, and developing and implementing programs. While this Strategy was developed for communities across the Wasatch Front, it is also replicable. This document is intended to support and guide the development of URM risk reduction programs across the United States. The Strategy follows guidance from several documents and is intended for two audiences – (1) groups looking to implement similar strategies and (2) the MitFLG as they identify criteria for future projects to demonstrate the National Mitigation Investment Strategy.

The approach of the Strategy is intended to support and guide the development of URM risk reduction programs across the United States. The Strategy follows guidance from several documents and is predominantly grounded in the following publications:

- FEMA P-774: Unreinforced Masonry Buildings and Earthquakes, Developing Successful Risk Reduction Programs.
- Mitigation Framework Leadership Group (MitFLG) National Mitigation Investment Strategy.
- FEMA 275: Planning for Seismic Rehabilitation: Societal Issues.
- Utah Guide for the Seismic Improvement of Unreinforced Masonry Dwellings.
- Utah Students at Risk: The Earthquake Hazards of School Buildings.

Best Practices

Through the development of the URM Risk Reduction Strategy, several best practices emerged that supported a successful project and should be considered as criteria for identifying, selecting and/or implementing new mitigation projects and/or when developing a URM Strategy in other states and localities. These identified best practices fall into one of several categories: 1) State and Local Support and Involvement; 2) Resources; 3) Willing Partners; and 4) Achievable Goals and Recommendations.

The project team also found that it was important to have and leverage leadership support, including FIMA Assistant Administrators, FEMA Regional Administrator and Mitigation Leadership, State Directors, and multiple Directors and Chiefs of various organizations to ensure that the Strategy development was prioritized and implemented.

State and Local Support and Involvement

The URM Strategy was developed at the direct request from the Utah State Emergency Management Director. Local emergency management, building code, and engineering officials who partnered with the FEMA-led National team were: 1) excited to support the project; 2) knowledgeable about the problems with URM; 3) capable of driving project direction to ensure it met state needs, 4) able to ensure achievable outcomes; 5) knowledgeable about the local context – what would work and what wouldn't; and 6) familiar with the community stakeholders that needed to be involved in moving the identified mitigation measures forward. More importantly, the State team had strong pre-existing, program-level working relationships with their FEMA counterparts. This was key in developing the trust needed to move the project forward. Without official state and local support, the project would have likely failed. Using locally identified projects ensures strong participation, buy-in, and long-term success.

Resources

Another important driver of success was the ability of the project team to leverage support and secure resources from FEMA and federal partners, including appropriate Subject Matter Experts (SMEs). FIMA Senior Leadership, FEMA Region 8 Administrator, Mitigation Division Director, and Risk Analysis Branch Chief included the Strategy in their performance plans. This allowed for the dedication of federal support and resources to help drive the development of the Strategy. FEMA staff were able to set aside significant time to work on this project, even during the height of the COVID-19 pandemic and several other major disasters in the Region (including the Magna, UT Earthquake), when FEMA resources were in high demand. Additionally, because of FEMA support at Headquarters and FEMA Regions 8, funding was made available so that the project team could garner the contractor support needed to finalize the Strategy development and documentation. In cases where contractor support is not available, internal resources must be available to provide the same level of project work and scope that would be taken on by contract staff. Contractor support was able to keep the project on track by scheduling meetings with the team and stakeholders and

taking and distributing notes and documents when FEMA and State staff were overwhelmed with disaster response and recovery.

Throughout the Strategy development, the project team leveraged National Earthquake Hazard Reduction Program resources for SME support. This included structural engineers and building code experts who were able to fill gaps that existed in the contractor support. FEMA also leveraged internal SME support from FEMA Region 10 and Headquarters to cover gaps in Mitigation Planning, Building Codes, and additional earthquake risk-reduction input.

Willing Partners Beyond Emergency Management

While States, Local, Tribal, and Territorial partners support mitigation projects, executing a project often requires the support of the entire community for project success. In working with the State of Utah, the project team found that the State's strong pre-existing, program-level working relationship with local and federal partners, statewide non-profit planning groups, private industry, and faith-based organizations, contributed to project success from goal setting to project implementation.

FEMA staff had the support of FEMA leadership to see the project through to completion. Their support included helping to connect funding for a contractor to assist facilitate meetings, provide technical support, and ensure that the Strategy was published.

The partners also allowed the project team to ensure that the Strategy Review Committee had the appropriate technical and local expertise, including individuals representing emergency management, academia, private sector, community planning, nonprofit, and faith-based organizations. In addition to Wasatch Front organizations, many groups from other areas with a high URM risk were involved in the Strategy's development.

Achievable Goals and Measurable Outcomes

The project team was able to engage local partners early and often throughout the Strategy development due to clearly defined, actionable goals. While developing the Risk Reduction Strategy, and after seeking valuable feedback from a diverse team of reviewers, the project team collaboratively coalesced around 5 recommendations to put forward. These recommendations were generated with direct input from individuals involved in strategy implementation and soundly rooted in proven risk-reduction methodology. All recommendations were actionable, implementable, and achievable over time. Large scale risk-reduction is possible; however, it requires time and resources.

Finally, the Strategy provides case studies of successful URM mitigation efforts in other states. Setting agreed upon recommendations, like retrofitting schools and expanding successful programs, allowed for easy opportunities to gain local buy-in and effectively share findings.

Replicability

Selecting a mitigation project requires an understanding of the feasibility of the project and the identification of potential barriers to implementation. Project owners should determine if there is appropriate institutional capacity to take on the project, and if there is agency, community, regional and/or state leadership buy-in required to move the project forward. In developing the Wasatch Front URM Risk Reduction Strategy, the project team was able to garner support from the Utah Seismic Safety Commission (a Governor appointed group) and other willing partners, including those from other states and localities, who supported the Strategy development with case studies and lessons learned from their communities.

The team considered replicability throughout the development of the URM Strategy and worked hard to ensure the Strategy’s recommendations were useful for those outside of Utah. To demonstrate replicability, the team attempted to demonstrate how to make the pilot location-specific; somewhat paradoxically, this ensures that the process is replicable, despite the fact that the risk being mitigated may be different. The five recommendations from the Strategy may be specific goals for Utah, however they also present a path for other states and local governments to follow. Local involvement and priorities must be established to achieve a successful and implementable strategy.

Transferability of the Wasatch Front URM Risk Reduction Strategy is evaluated in multiple aspects including the ability to transfer the methods and procedures to a future mitigation project. The Strategy was designed to provide high-level recommendations that address critical risk-reduction strategies that can be broadly applied to all areas with URM buildings and moderate-to-high earthquake risk. This section highlights considerations when looking to transfer and replicate the Strategy.

Evaluate the administrative transferability for the Strategy to other State, Local, Tribal and Territorial locations.

- The target audience is intended to be policy makers with clearly defined and achievable actions, and this is directly transferrable to other strategic risk reduction efforts and for other future projects.
- The involvement of State Department of Emergency Management and Seismic Safety Commission (if applicable) as well as local government, academic, and non-profit leadership should be leveraged for generating ideas and must be willing to make the necessary policy and regulatory changes currently in place to advance the Strategy.
- The incorporation of local non-governmental organizations and private industry leaders willing to support the initiatives.

- Further the efforts to assemble the subject matter experts from local, state, academic, and federal partners will be applicable to all other projects. The formation of the risk reduction team is also part of a lesson learned.

Evaluate the administrative transferability to partnering federal agencies.

- Utilize Executive Orders to encourage risk reduction: Example - Establishing a Federal Earthquake Risk Management Standard ([EO: 13717](#)) - directing federal agencies to be more in tune with earthquake building standards. The Strategy recommendations can be applied to federal property and buildings to increase their earthquake resilience. These detailed recommendations for retrofits and the analysis of the hazards in areas will be transferable to other federal agencies and programs.

Evaluate the transferability of the project to other mitigation types.

- Leverage available natural hazard risk assessment tools to help understand the scope and financial impact of the current built environment as it relates natural hazards and mitigation strategies.
- Leverage the Strategy's recommendations and vision of promoting the retrofits for public shelters, existing programs, and building code adoption.
- The strategy should contain equitable recommendations and community engagement is needed for the strategy to be successful.
- Utilize data relating to the high risk and vulnerability of URM to inform future iterations and other risk reduction strategies.
- For projects that are in high-risk earthquake zones and addressing the risks of URM, the Strategy should be leveraged (with minor location-specific adjustments as needed).
- The Strategy was assembled and developed from several URM guidance documents but applied to the local issues and focused on the Wasatch Front in Utah. When transferred to other locations, similar thoughts should be injected into Strategy development.

Recommendations

The project team identified lessons learned, best practices, and recommendations through the development of the Strategy that can be applied to future projects and used for the selection of a future Investment Strategy pilot project. Recommendations have been categorized by the following: 1) Local Champion, 2) Federal Alignment, 3) Diverse Perspectives, 4) Cross-Jurisdictional Support, and 5) Appropriate Resource Support.

Local Champion

Future projects should be locally driven and local champions should be identified who can support the development and implementation of the project strategy. If strategy development is chosen for future work, the problem or need should address a local problem that cannot be solved without federal assistance. In development of the Strategy, the project team learned that having a local champion was critical for development, and absolutely necessary to support many of the best practices identified.

The MitFLG allowed for State/Regional expertise to proceed without pre-defining success. However, during the implementation of the Strategy, more coordination is warranted from the MitFLG to gain access to additional Federal programs in support of the Strategy's goals and recommendations.

Ability to Measure Success

Future pilot projects will benefit from building success measures and identifying alignment to the Investment Strategy from the beginning of the project. In Utah, integration was planned, however, much of the Investment Strategy work was paused during the COVID-19 response.

Working as a group to understand when the right time is to break into multiple teams. There was the main team, with FEMA and the State who worked with contractors to ensure the project was moving forward, manage risks, and identify next steps. There was another team of reviewers who were brought in from multiple government agencies, non-profit organizations, private companies, and private citizens. The larger team of reviewers mostly focused on their subject expertise and commented on topics within their spheres; few worked to globally improve the document.

- While local stakeholders were plentiful and brought on early, it was not until late in the process we realized there was a lack of involvement from other Federal Agencies and Significant lack of involvement from other State Agencies, potential reasons:
 - Other State Agencies were never invited by Project Team – somewhat counterintuitively, due to intense workload of the Strategy,
 - Other Federal Agencies were asked to help, but were limited in their ability at the time due to COVID-19 operations

- Ensure that level of Federal Support is adjusted based on the desire of the state and local government.
- Lack of clarity surrounding the importance of obtaining input and perspectives from outside the emergency management and engineering fields.

Strong Federal Alignment

Future Demonstrate projects should ensure strong alignment from the federal family beyond just FEMA. Many of the MitFLG agencies have the ability and resources to advance the Investment Strategy. FEMA had a strong role in the Strategy's development, and this ended up being beneficial in the long term due to COVID-19 and Earthquake responses.

- Better understand how to gain involvement of multiple Federal Agencies
 - We simply did not get much interest or support from other Federal Agencies – this was a missed opportunity to tie in other programs, expertise, funding, professional networks, though some of this work is still ongoing. The project team specifically asked for support from some Agencies, but there was limited interest/availability due to COVID-19.
 - We did get support from State/Local emergency management, as well as State Historic Preservation – all of which was critical
 - Note: Involvement from additional agencies (Education, Risk Management, Insurance Commissioner, housing/equity-focused orgs, etc.) would have been ideal
- Be prepared to support if needed. When this project started, the team did not know that a worldwide pandemic was around the corner or a M5.7 earthquake in Salt Lake County would occur. Proceeding full speed ahead during a pandemic reduced State/Local involvement in the early stages, and much of the load was carried by FEMA staff and contract support. This was necessary to keep the Strategy development on track.
 - In the Emergency Management world, interruptions are inevitable – slack should be built into the schedule for future projects
 - Contract constraints limited flexibility – we accelerated when we ideally should have slowed down

Diverse Perspectives and Cross-Jurisdictional Support

All Investment Strategy projects should include a diverse set of perspectives from local government. This cross-jurisdictional support as well as integration of non-profit, Academic, and faith-based organizations allow for local influence and issues to be easily identified, and risks mitigated, to ensure long-term project success.

- The unreinforced masonry building issue is fairly hazard specific. We did not get much buy-in outside of Salt Lake City/County. Future work should strive to incorporate as many partners as possible.
- Work by the State and local government, as well as nonprofits (like Envision Utah), and faith-based organizations, is needed. However, it is currently expanding into lifelines and cross-jurisdictional issues. So, it need not all be part of the Pilot as long as the Pilot helps accelerate existing local momentum. The Pilot seemed to help give other organizations confidence that the State/Federal Partners really did intend to see this work through.
- We did not have academic institution involvement in drafting - We did have academic reviewers, which was critical to ensuring a more inclusive and equitable URM Strategy – key academic partners should have been invited earlier (with funding, if possible) to catch these issues earlier.
- Tribal entities should be included. This project did not impact any tribal locations within Utah.

Resource Support

Dedicated resource (either internal or contractual) support is essential to any project success. It is important that the correct level of support is available. For the Risk Reduction Strategy, FEMA contract support staffing was available, but for similar projects, internal resources can be used in place of contract support.

- Having contract support is critical to ensure project completion and keeping the project on track. There are concerns that need to be addressed that were not with the URM Strategy.
- If there is a desire to publish work to FEMA’s website, the scope should include capacity to support document finalization, to include: concurrence, FEMA template formatting, and 508 compliance.
- It would be beneficial to leverage local support and expertise if possible, to ensure strong local buy-in and connections.

Please Note: COVID-19 significantly disrupted the emergency management world and impacted all that we do. The primary authors in FEMA Region 8, FEMA Region 10, and FEMA Headquarters hunkered down and went into survival mode to see this through. The State of Utah was so overwhelmed between COVID-19 and the Magna Earthquake, that their staff availability to contribute to this project was significantly reduced. Some of the above recommendations are a direct result and may not reflect “blue sky” execution.