UTAH SEISMIC SAFETY COMMISSION

Chair Robert Grow

Vice-Chair Steve Bowman
Vice-Chair Jessica Chappell

Utah Seismic Safety Commission

EARTHQUAKES.UTAH.GOV

UTAH SEISMIC SAFETY COMMISSION

- The commission is very active
- Has met every quarter since 1994
- No other voice represents the same breadth of interests concerning seismic risk

THE COMMISSION SHALL:

(a) review earthquake-related hazards and risks to the state of Utah…;

(b) prepare recommendations to identify and mitigate these hazards…;

(c) prioritize recommendations and present them to state and local government…;

(d) act as a source of information for individuals and groups concerned with earthquake safety…;

(e) prepare a strategic seismic planning document …; and

(f) update…the document and monitor progress….

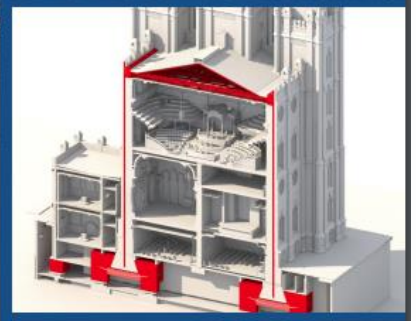
Putting Down Roots in EARTHQUAKE COUNTRY

Your Handbook for Earthquakes in Utah

2nd Edition

Developed by the:
Utah Seismic Safety Commission
Utah Division of Emergency Management
Utah Geological Survey
University of Utah Seismograph Stations
Structural Engineers Association of Utah

In cooperation with the:
U.S. Geological Survey
Federal Emergency Management Agency



Wasatch Front Unreinforced Masonry Risk Reduction Strategy

MARCH 2021

FEMA

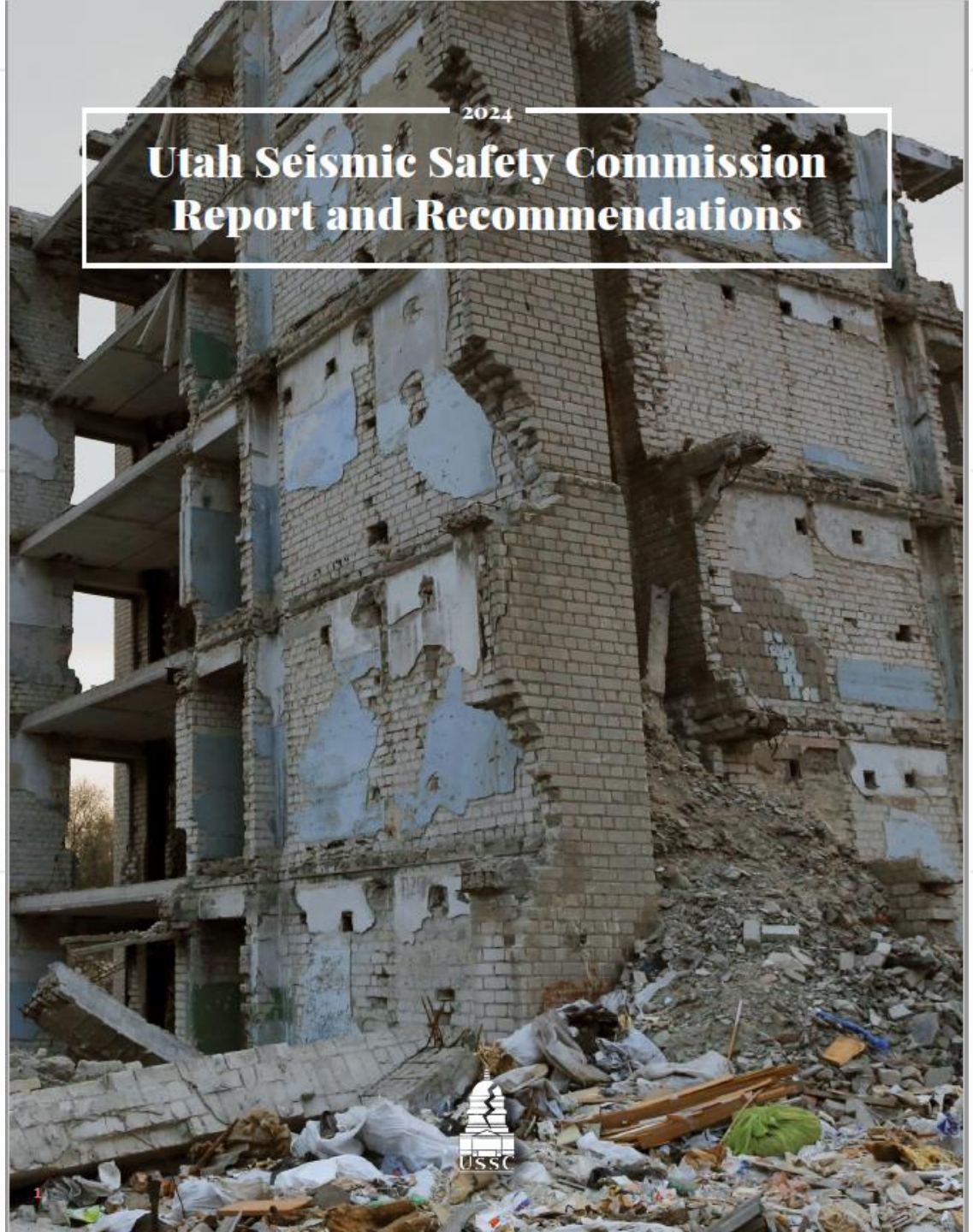
Utah Seismic Safety Commission

nehrp

Utah K-12 Public Schools Unreinforced Masonry Inventory

Methods, Findings, and Recommendations

February 2022

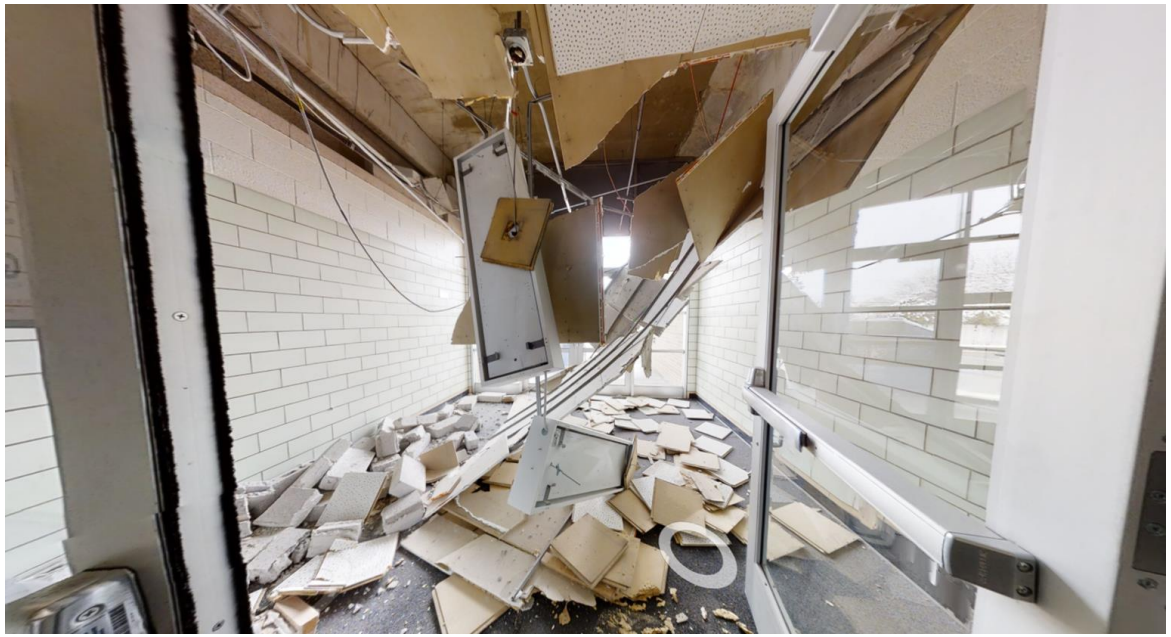

2024
Utah Seismic Safety Commission
Report and Recommendations
USSC

UTAH'S EARTHQUAKE RISK IS REAL!

43%

PROBABILITY OF
"THE BIG ONE"
(a 6.75-7.6 earthquake)
IN THE NEXT 50 YEARS

THIS IS A GOOD TIME TO TALK ABOUT UTAH'S RISK



2020 Magna Earthquake

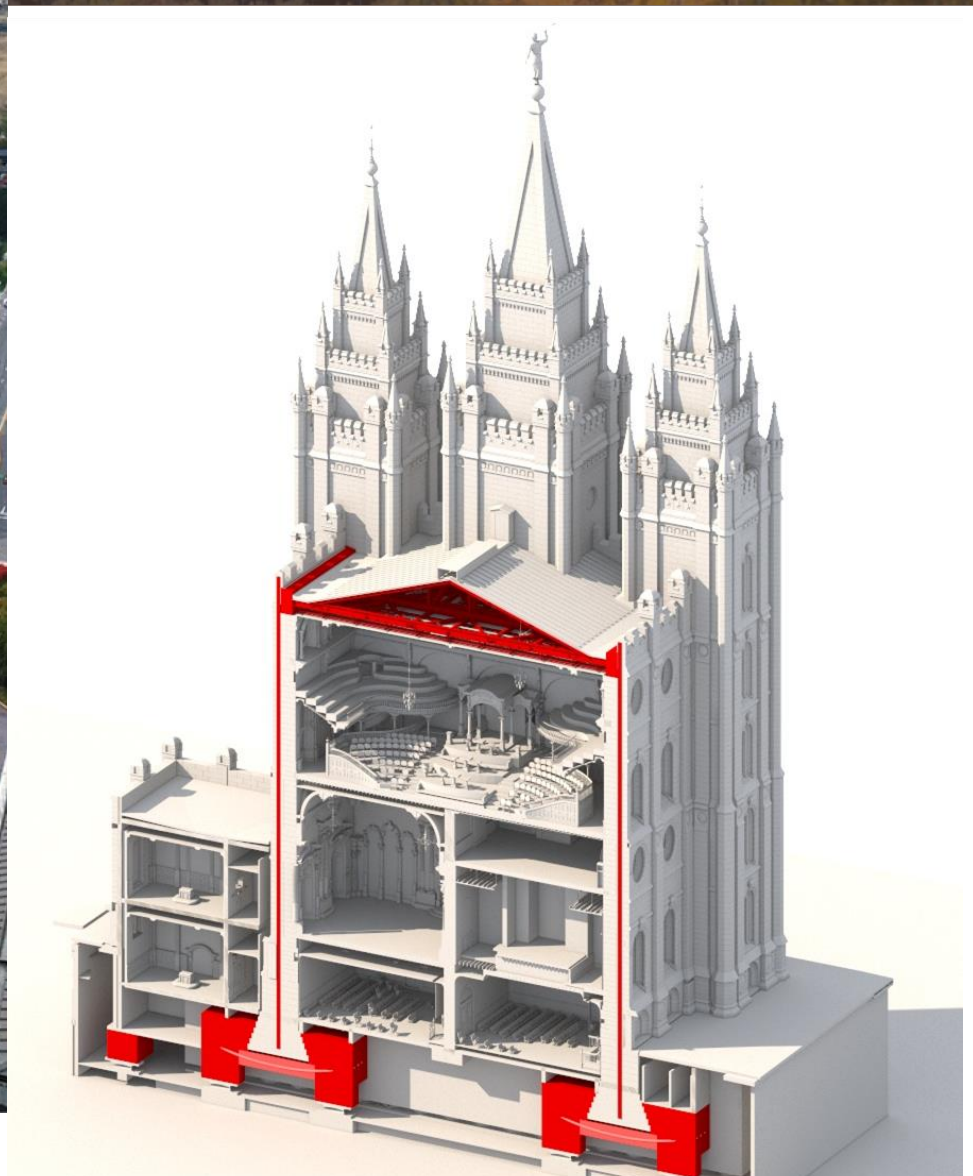
(this West Valley school was demolished and replaced)

TURKEY EARTHQUAKE of 2023

SIMILAR TO UTAH'S WORST-CASE SCENARIO


Turkey Earthquake 2023

SALT LAKE TEMPLE SEISMIC UPGRADE (2021-2026)



HOW BAD WOULD IT BE?

HAZUS ESTIMATES - 7.0 earthquake along the Wasatch Front

3,000+

Fatalities, and additional 7,400-9,300 critically injured

440,000+

Homes without power

480,000+

Homes without water

89,000

Displaced households

EERI, “Scenario for a Magnitude 7.0 Earthquake on the Wasatch Fault—Salt Lake City Segment,” updated based on conversations with FEMA

$75,000,000,000

FEMA ESTIMATE FOR **SHORT-TERM** ECONOMIC LOSSES

DEM HAZUS modeling of Lifeline Systems Analysis, 2021

$50,000,000 funded FY23

$150,000 funded FY22

USSC RECOMMENDATIONS:

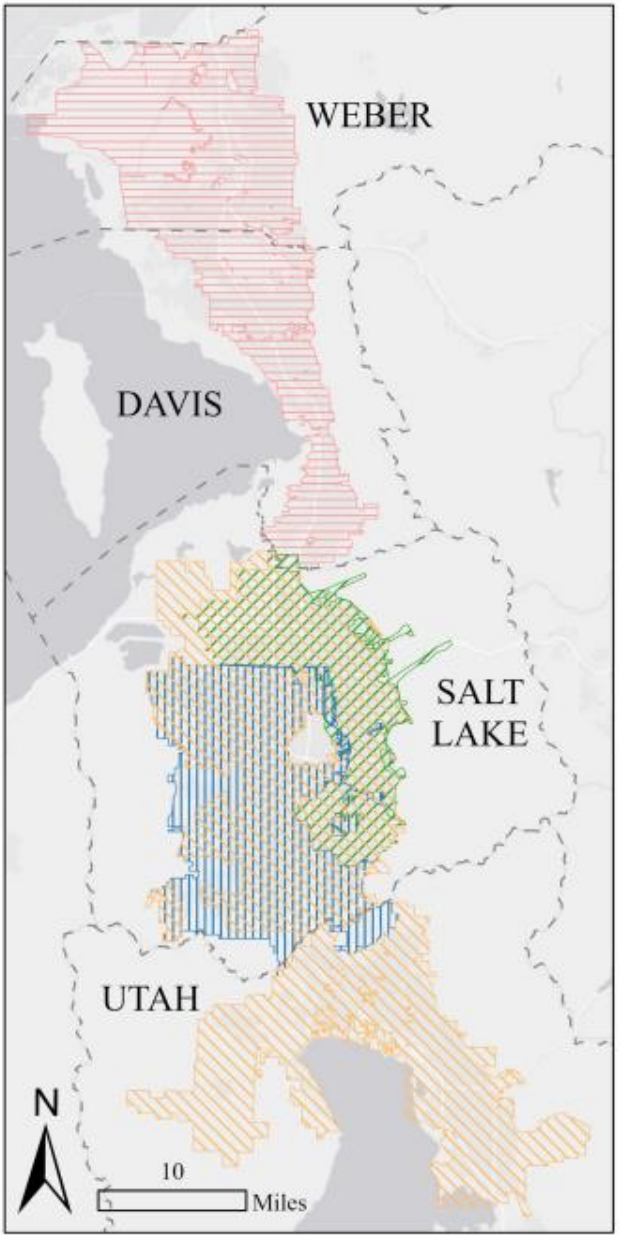
1. **KEEP WATER FLOWING.** Invest in seismic improvements for the four major water aqueducts that bring water to the Wasatch Front
2. **KEEP OUR KIDS SAFE.** Significantly limit the danger to tens of thousands of Utah children who attend school in seismically unsound buildings (all or part is URM)
3. **KEEP OUR COMMUNITIES AND MARKETS INFORMED.** Increase the public awareness of the high risk from Utah's 140,000 URM buildings
4. **KEEP OUR BUILDINGS STANDING.** Ensure adequate building code enforcement for large/important buildings
5. **EARTHQUAKE WARLY WARNING SYSTEM.** Invest in a system that could save lives before ground shaking begins

Why are a Million People Still Without Water after 3 months?

LIFELINES – CRITICAL UTILITY SYSTEMS

	DAY 1	DAY 2	DAY 7	DAY 30	DAY 90
Households without water	483,600	466,100	442,800	362,900	**332,800**
Households without electricity	444,600	251,200	105,900	27,300	**80**
Natural gas	Restoration to most structures within **two weeks**				
Sewer	Restoration time is likely **2-3 times** that of water restoration				

Areas Served by Aqueduct Projects



Jordan Aqueduct Reaches 1-4, Jordan Valley Water Conservancy District
Salt Lake Aqueduct, Metropolitan Water District of Salt Lake and Sandy
Alpine Aqueduct, Central Utah Water Conservancy District
Davis and Weber Aqueducts, Weber Basin Water Conservancy District

Recommendation #1: KEEP WATER FLOWING

- 1 aqueduct project from each major Wasatch Front water district
- Aqueducts **serve over 2 million residents**, and are susceptible to major damage as they cross the fault, landslide areas, liquefaction zone, and/or high ground shaking areas
- Total cost >$550M; gap is $175M; Legislature funded $50M; remaining gap is $125M

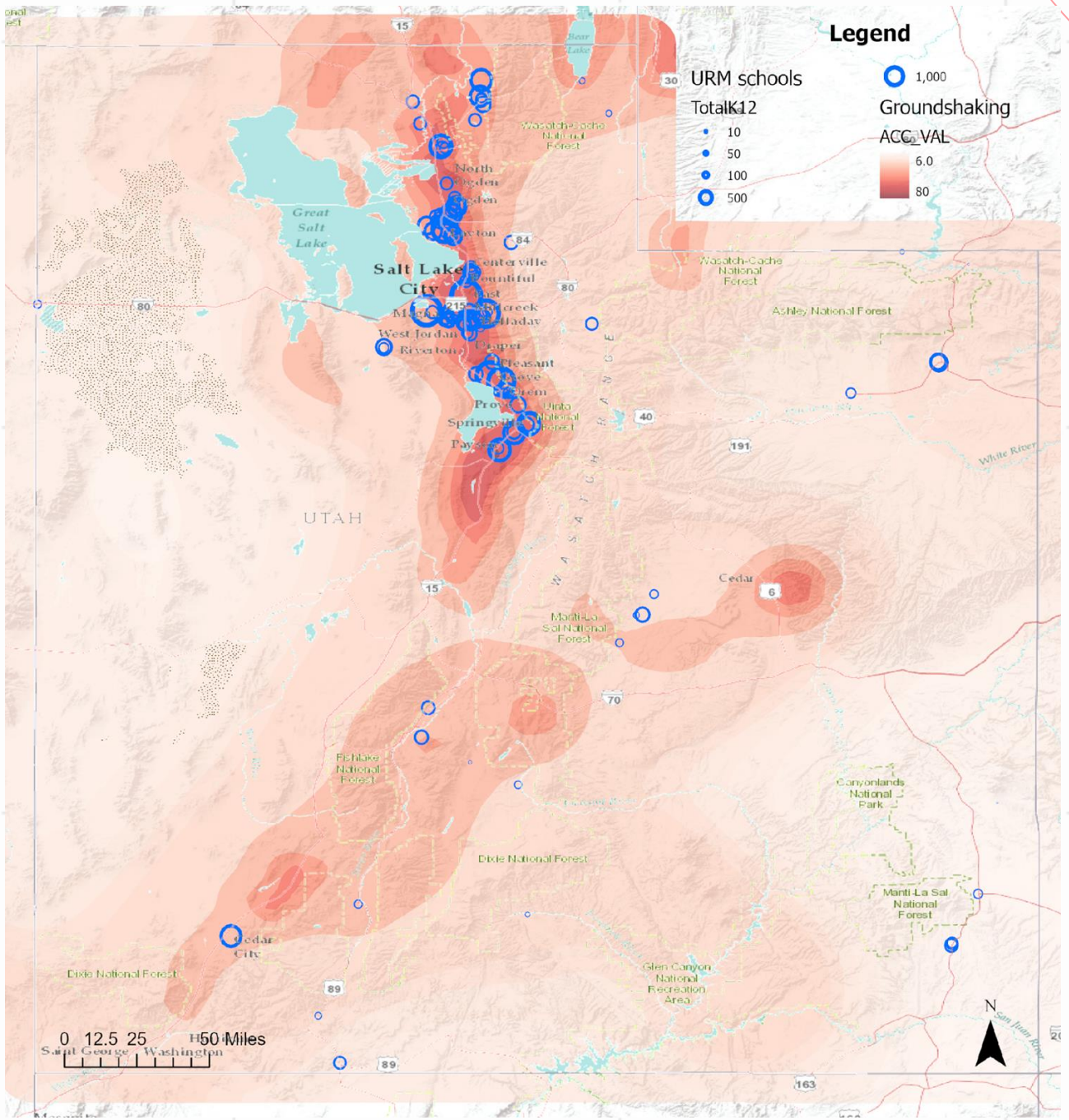
PHOTO CREDIT: WEBER BASIN WATER CONSERVANCY DISTRICT

Recommendation #2:
KEEP OUR KIDS SAFE

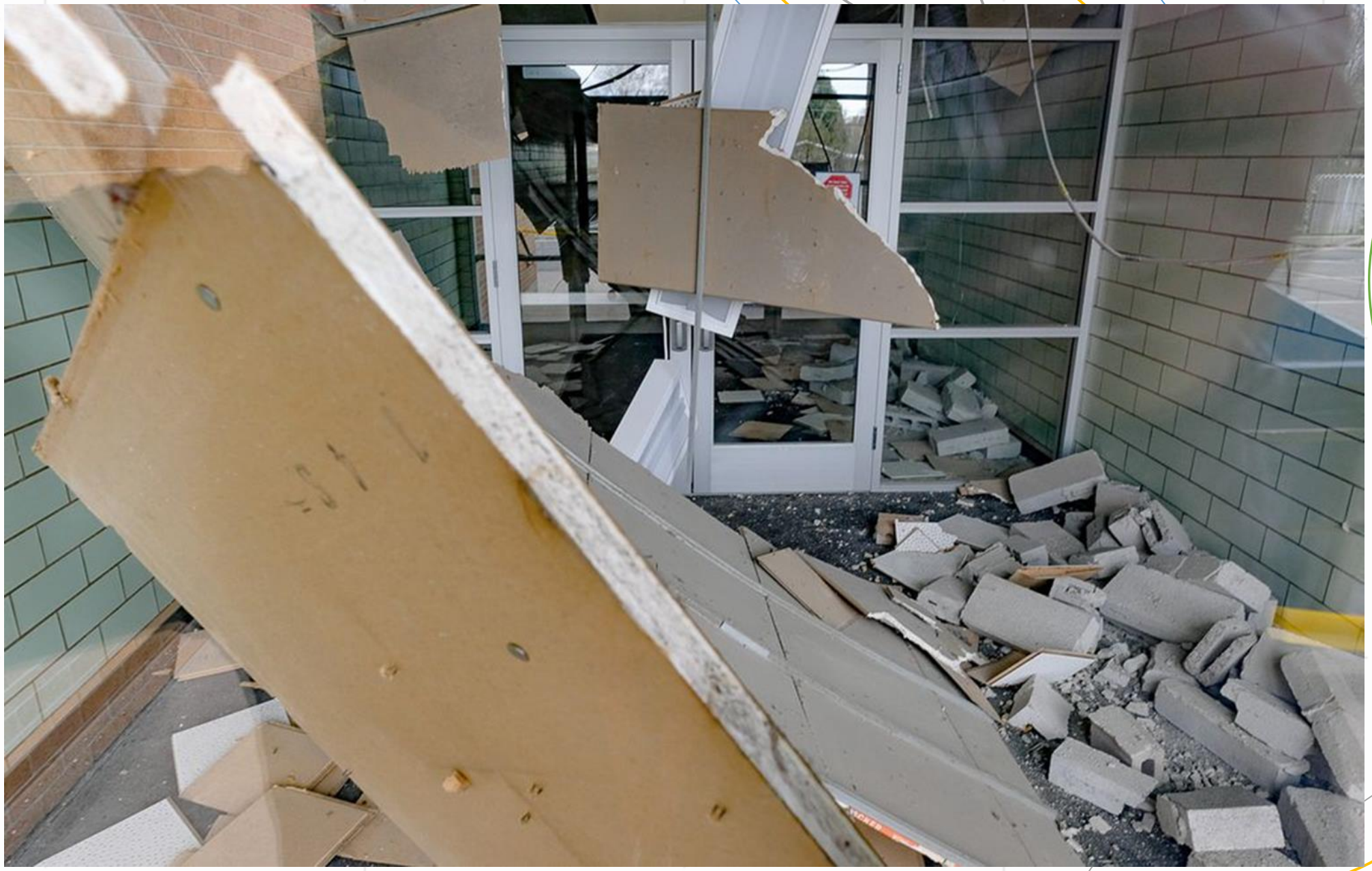
- About **130 school campuses in the state include URMs**. These schools serve at least **70,000 Utah children.**

Utah K-12 Public Schools Unreinforced Masonry Inventory

Methods, Findings, and Recommendations



URM SCHOOLS BY STUDENT POPULATION



WESTLAKE JUNIOR HIGH AFTER THE MAGNA 2020 EARTHQUAKE (PHOTO CREDIT SL TRIBUNE)

KEEP OUR KIDS SAFE

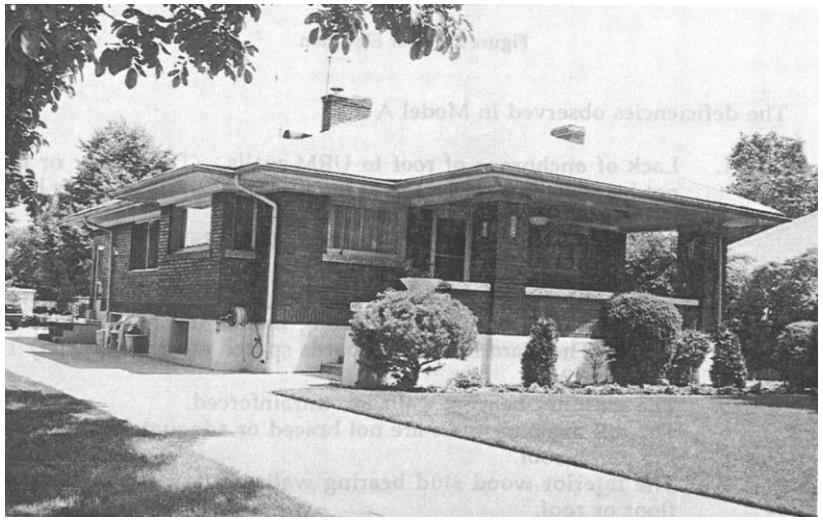
- **$4 million** would fund an engineering analysis of retrofit or replacement of each school and develop cost estimates so school districts can make wise decisions and pursue grants or bonds

WEST HIGH SCHOOL IS A URM SCHOOL THAT WAS RETROFITTED IN 1996.

Recommendation #3: INCREASE PUBLIC AWARENESS OF URMS

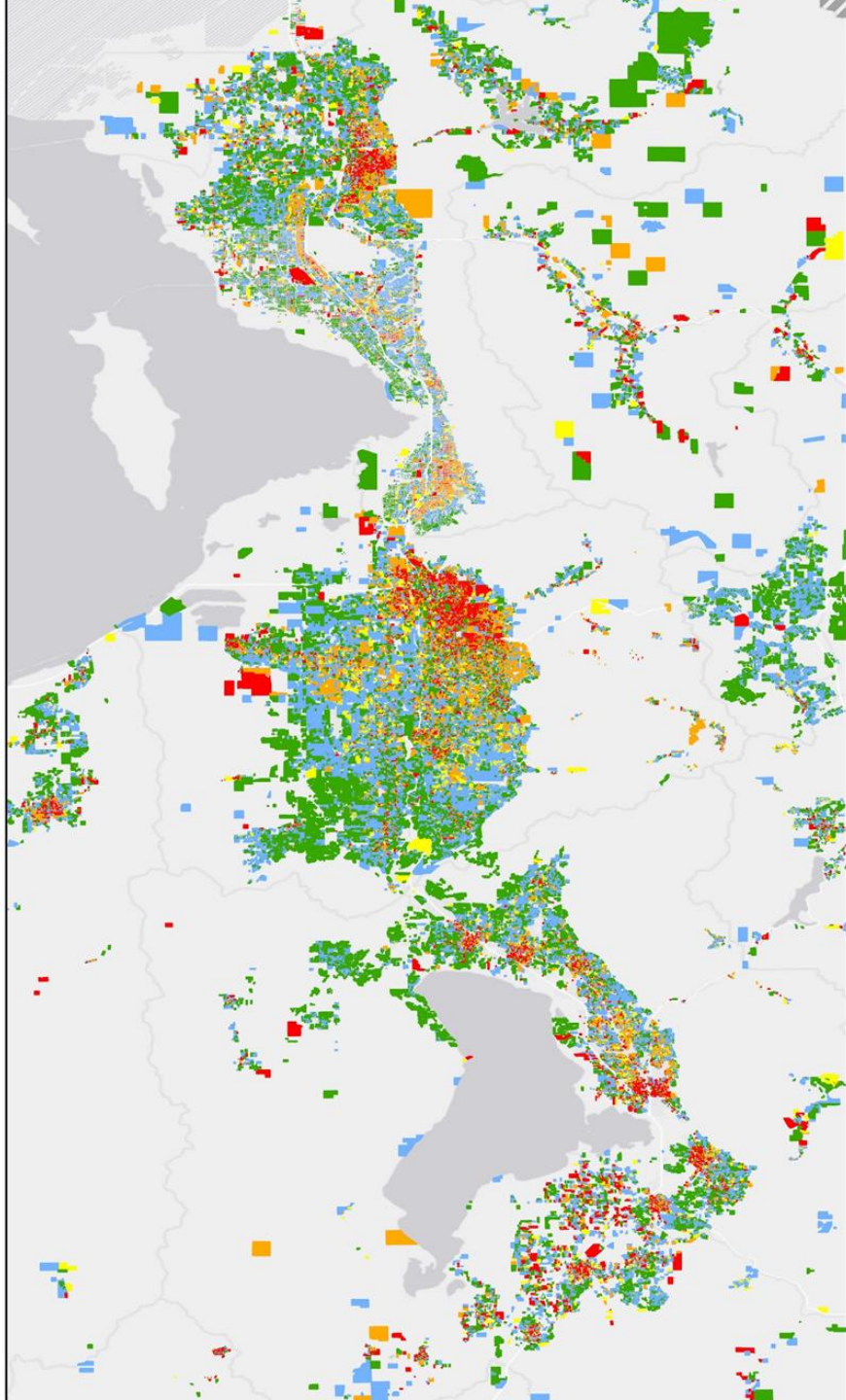
- Improved public awareness will increase market function and apply market pressure to upgrade more of these buildings

- A public awareness campaign would cost **$600,000** over 2 years



UNREINFORCED MASONRY BUILDINGS

- **URM BUILDINGS** were constructed in Utah up until 1976 and are scattered everywhere across the state
- **THESE ARE** single family homes, multifamily structures, offices, and **especially schools**
- **MOST OF OUR PROJECTED INJURIES AND DEATHS** occur in these buildings

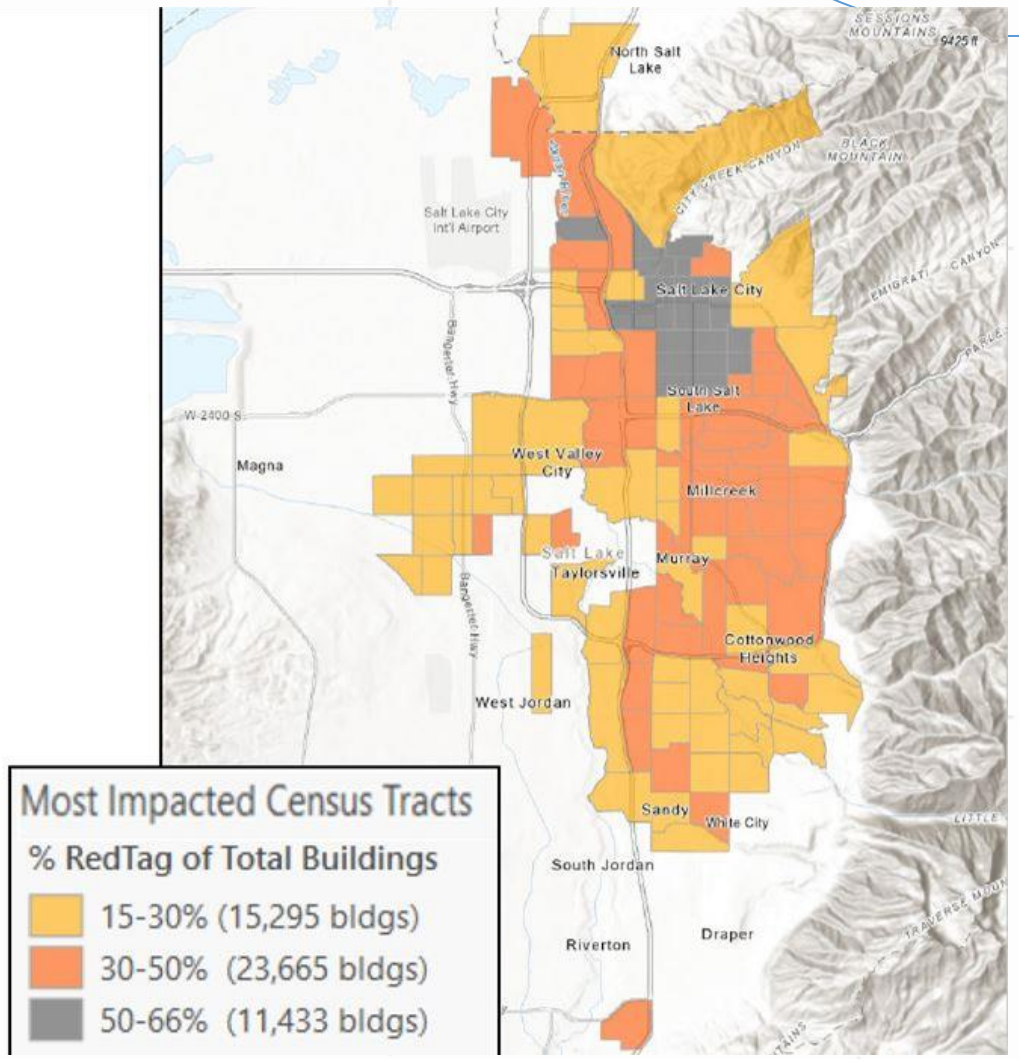


BUILDING DAMAGES

Search & Rescue
Building Damages

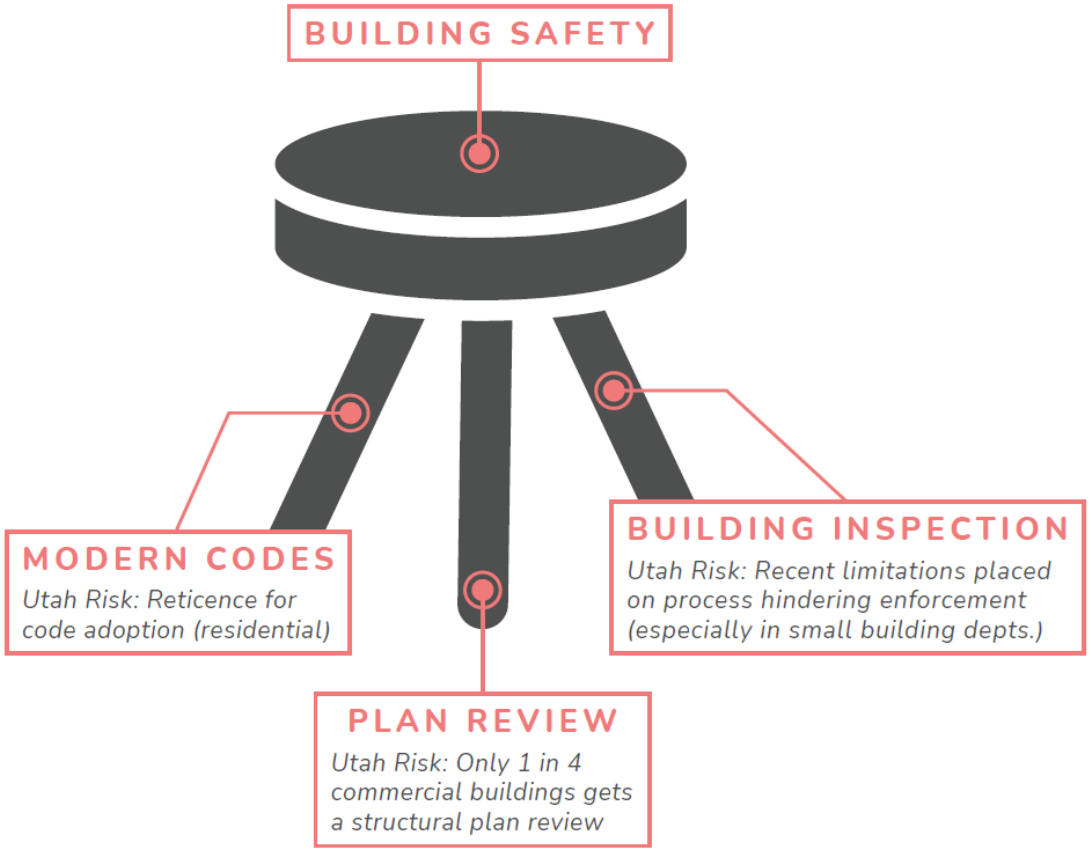
- **60,664 RedTag (complete damage) Buildings**
  - 57,787 in Salt Lake County (95.2%)
  - 2,280 in Davis County (3.7%)
  - 544 in Utah County (0.8%)
  - 35 in Weber County (0.05%)

- **35,811 YellowTag (extensive damage) Buildings**
  - 29,911 in Salt Lake County (83.5%)
  - 3,251 in Davis County (9%)
  - 2,083 in Utah County (5.8%)
  - 371 in Weber County (1%)



DEM HAZUS modeling of Lifeline Systems Analysis, 2021

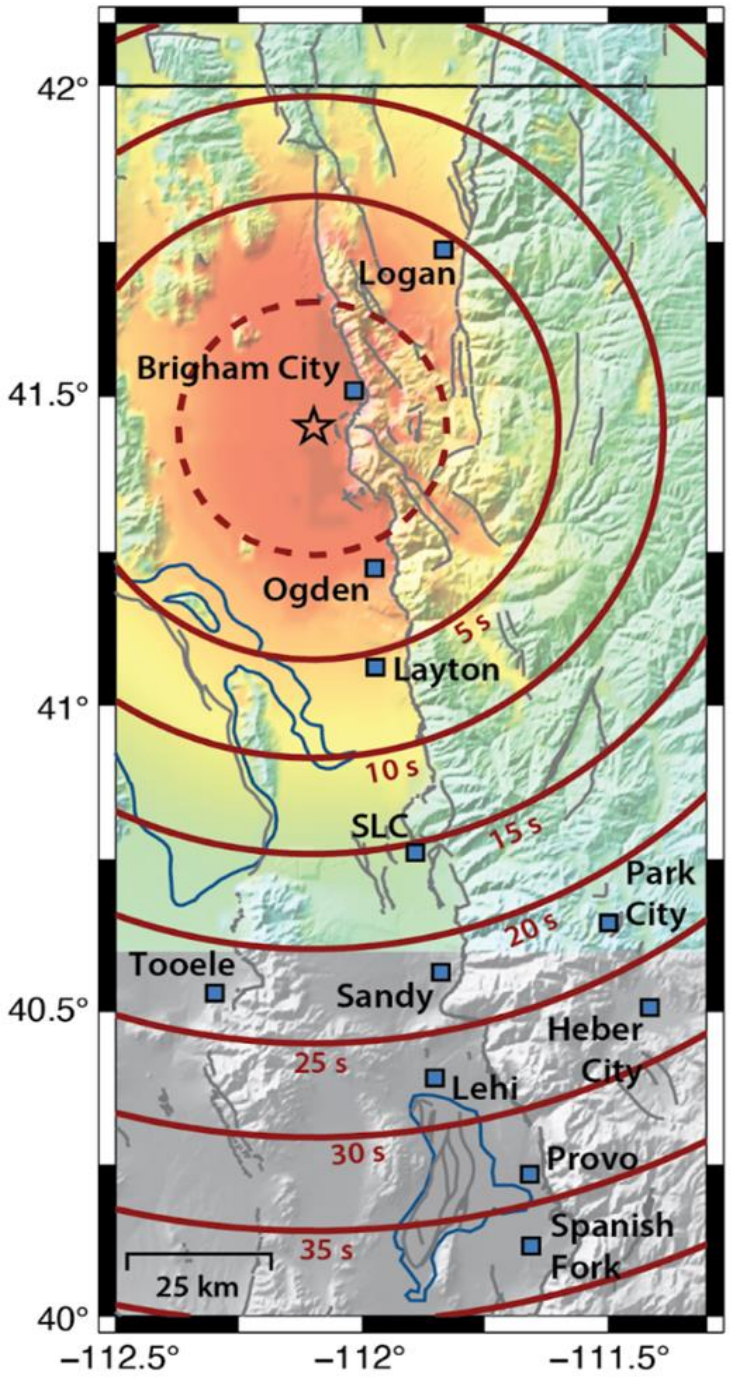
Recommendation #4:
KEEP OUR BUILDINGS STANDING

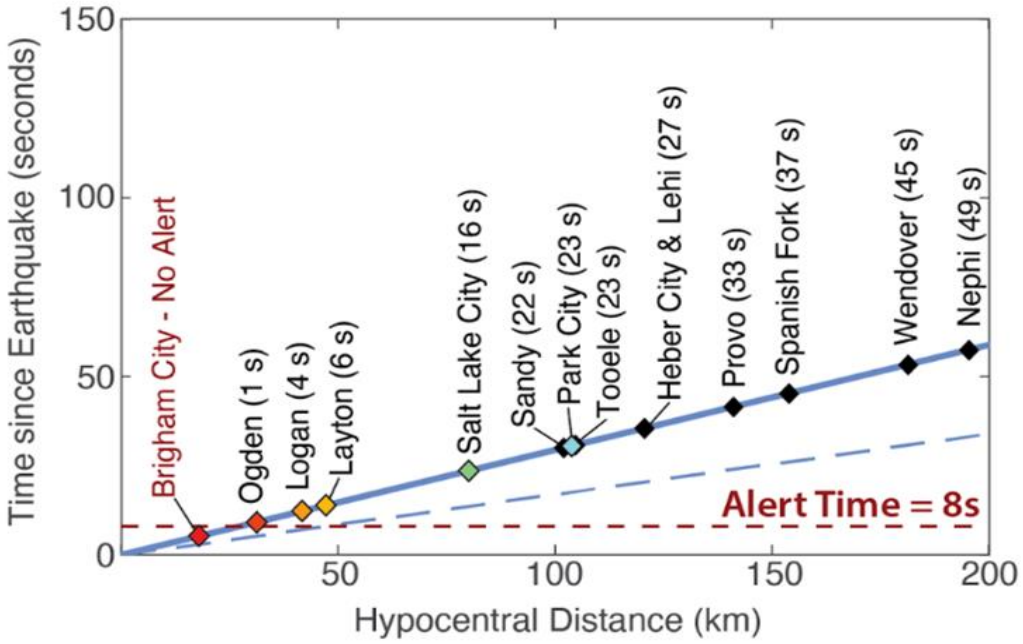


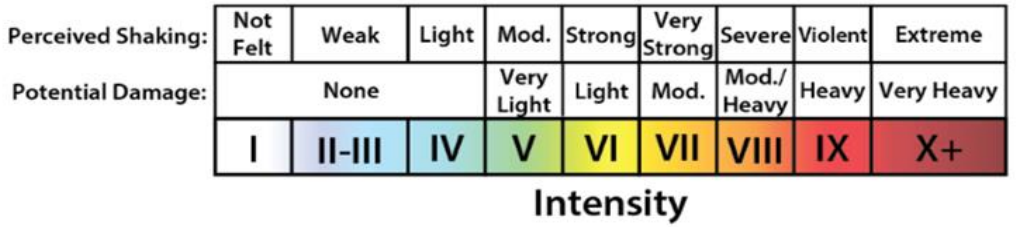
- **This recommendation is not advocating for any changes to the Utah Building Code**
- USSC recommends that hospitals, schools, police stations, and other buildings over 200,000 sq. ft. be required to undergo a plan review conducted by a Utah-licensed Professional Structural Engineer
- This ensures our most critical facilities are functioning following a large seismic event

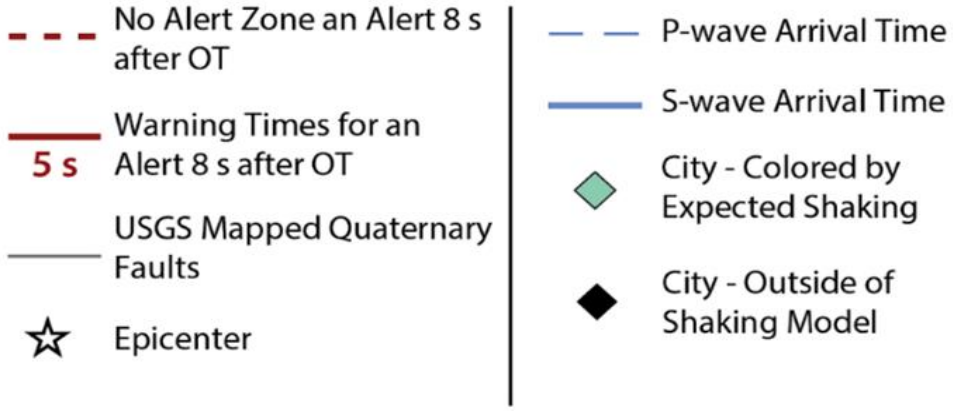
Recommendation #5:
KEEP UTAH READY TO RESPOND

- **$5M** to construct an Earthquake Early Warning System for the Wasatch Front, plus **$1M** operating cost per year
- An EEWS could provide seconds of warning time before ground shaking starts
- This provides enough warning to shut off trains, surgeries, and utilities and take other life-saving actions









If an M7 earthquake occurred near Brigham City …

Ogden
1 second of warning time

Salt Lake City
16 seconds of warning time

Provo
33 seconds of warning time

geology.utah.gov

QUESTIONS?

PROBABILISTIC V. DETERMINISTIC GROUND MOTIONS

- Current seismic design is governed by the lesser of probabilistic and deterministic ground motion
- On the other hand, the seismic upgrade of Salt Lake Temple will protect against the higher "deterministic" ground motion
- **This has raised a little understood issue: today's "probabilistic" construction standards are not aimed at the size of the earthquake we actually expect**