

## Earthquake Retrofit FAQ

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### **What about earthquake insurance?**

Currently, OGMM has all the usual property insurance coverage, except for earthquake insurance. In earlier years, the Property Committee looked into earthquake coverage but determined that the cost was too high. Instead, it was decided to self-insure. OGMM has been setting aside funds which would be used to repair or replace the buildings should they be damaged by a quake. The Meeting now has over \$234,000 set aside in the Earthquake Reserve.

The only building with a significant vulnerability to earthquakes is the Meeting House. HUB, our insurance company, has set the current replacement value for the Meeting House at \$638,000. This leaves a gap of \$404,000 if the Meeting House were damaged beyond repair by an earthquake.

The Meeting cannot secure actual quotes on earthquake insurance until any retrofit work is completed. Our broker speculated that earthquake insurance may cost \$25,000/year in premiums\* with a deductible of 15% of the replacement value of the buildings. This means that, should there be earthquake damage totaling \$200,000, OGMM would be responsible for \$95,700 of the cost of repairs, and the insurance company would cover the remaining \$104,300 of the total cost.

On August 20, 2020, the Meeting's insurance agent e-mailed the Property Committee that the campus buildings would not qualify for a reduction in earthquake insurance premiums "...unless [the Meeting House] were retrofitted so that the wooden building were bolted to the foundation." Property Committee's retrofit recommendation is designed to meet this condition, by bolting the Meeting House to a reinforced concrete foundation.

### **Footnote**

\*The premium estimate is due largely to the presumed vulnerability of the Meeting House to earthquakes. Our other three buildings meet or almost meet current earthquake building code standards.

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### **Will we be able to use the Meeting House and campus during the earthquake retrofit?**

Yes, but construction will be noisy. Construction of the new foundation will take about four weeks. Workers will cordon off construction under the Meeting House to protect students attending Friends Western School. Aside from the noise, activities can continue in the Meeting House as usual. There will be no construction on Sundays.

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### **How do we know that there is going to be a major earthquake during the life of our Meeting House?**

We don't. Scientists cannot predict when an earthquake will occur. However, the Meeting House is situated within three miles of faults capable of generating major quakes (6.9-7.0). This is larger than the Northridge quake (6.7) which caused more damage and deaths than any other California quake since the 1906 San Francisco quake.

Given that we cannot predict whether a major quake will occur tomorrow or 500 years from now, we will need to decide if it is prudent to do what we can, within our budget, to protect our Meeting House. A retrofit will bring our foundation up to current building code requirements. These requirements have been designed for earthquake safety.

It's like wearing seatbelts. We can't predict an accident nor whether, in any particular accident, seat belts will prevent deaths or injuries. But statistics show that wearing seat belts saves lives. So, when deciding whether to make everyone in the car wear seatbelts, one has to consider the prospect of looking back and wishing that one had.

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### **How do we know a foundation retrofit will be effective in preventing major structural damage to our Meeting House?**

It is not possible to know how the pattern of shaking of any particular quake will affect the structure of any particular building. However, bringing our Meeting House up to the current requirements of the building code will enhance its chances of escaping structural damage in a strong quake. [A 2019 study](#) conducted by the National Institute of Building Sciences\* found that bringing construction up to current building codes in regards to earthquakes has a cost benefit ratio of 12:1. That is, every \$1 spent retrofitting older buildings to meet current earthquake building codes saves \$12 in damage.

The accompanying photo is included in the California Earthquake Authority brochure. It shows two wood-frame houses side-by-side, one anchored to its foundation and one not. (We will be able to anchor our wood-frame Meeting House to the foundation only if we build a new reinforced concrete foundation.) The one without anchoring, on the left, slid off and experienced major structural damage. This is graphic, but only anecdotal evidence, for the value of anchoring a building to its foundation. However, the structural engineering experts whom we have consulted have unanimously recommended retrofitting so that the wood frame can be anchored to the foundation.



*These two houses, next door to each other, experienced the South Napa Earthquake, magnitude 6.0. (Anticipated maximum 7.0 quakes within 3 miles of our Meeting House would release 32 times more destructive energy than the South Napa quake.) Both houses are wood-frame like our Meeting House. The house on the right was retrofitted and did not experience major structural damage. The house on the left was not retrofitted, slid away from its foundation, and experienced major structural damage. This is indicated by the tilted rooflines and pillars on the porch. A red line drawn across the top of the photo shows how the roofline of the house on the left has tilted, whereas it has remained horizontal on the right. Note the chain link fence in front of the house on the left to prevent entry. [Source: [California Earthquake Authority](#), a nonprofit organization that offers earthquake insurance, established by the California Legislature]*

Building a reinforced concrete sister foundation or a replacement foundation and bolting of the wood-frame to the foundation are considered state-of-the-art earthquake retrofitting of an unreinforced brick foundation. However, this author was unable to find engineering studies of the effectiveness of sister foundations. And in September 9, 2020 e-mail, Melvyn Green, a leading expert on seismic retrofitting of historic buildings, stated that these studies have not yet been done. Both a sister foundation and a complete replacement foundation meet current building codes for earthquake safety, the same codes as new construction are required to meet. However, a sister foundation is not as similar to new construction as would be a replacement foundation.

These government agencies and structural engineers recommend retrofitting unreinforced brick foundations and anchoring the wood-frame to the foundation:

- **Melvyn Green, former Director of the Department of Building and Safety of the City of El Segundo, past President of the Structural Engineers Association of California, and past Chairman of the American Society of Civil Engineers Standards Committee on Seismic Rehabilitation of Buildings.** Mr. Green inspected the Meeting House during a complimentary consultation on May 13, 2020. He encouraged us to complete a foundation retrofit. In an e-mail of September 9<sup>th</sup>, he reiterated his recommendation to retrofit, whether by sister foundation or replacement foundation, "Slow careful deliberation, I understand. But don't overthink this and do nothing."

- **David Gaines, structural engineer with a specialty in seismic retrofits, who has inspected our Meeting House.** In an e-mail of April 24, 2020, Mr. Gaines wrote, regarding retrofitting the Meeting House, “I highly recommend the church consider having this work done [building a sister foundation and bolting to it] to preserve the building. In a moderate earthquake the foundations could crumble, sending the structure sideways with no restraint.”
- **Sarkis Nazerian, director of the City of Pasadena Department of Building and Safety.** In a phone conversation in May 2020, Mr. Nazerian strongly recommended retrofitting unreinforced brick foundations for a church such as ours.
- **The California Earthquake Authority (CEA),** a non-profit established by the California Legislature to provide earthquake insurance to California homeowners. This agency not only recommends retrofitting to current earthquake building code requirements but also pays homeowners up to \$3,000 to do so and lowers insurance premiums by as much as 25% when the retrofit is completed.
- **The California Seismic Safety Commission, a State agency.** [In its 2005 report](#) (when there were many more unreinforced masonry foundations than now), this Commission stated: “Unreinforced masonry—brick, concrete block, or stone—foundations often cannot resist earthquake shaking. They may break apart, or be too weak to hold anchor bolts. Homes may shift off such foundations during earthquakes, damaging the walls, floors, utility lines, and home contents...Solution: The most common approach is to replace all or part of the existing foundation with a poured reinforced concrete foundation.”

### **Footnote**

\*The National Institute of Building Sciences is a non-profit organization established by the U.S. Congress to conduct research on issues affecting construction.

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### **Will the retrofit reduce the likelihood of injuries or deaths?**

The retrofit is designed to protect the building structure. Except for when a building completely collapses, most earthquake injuries and deaths are due to falling objects. Our Meeting House is well-built and unlikely to collapse during an earthquake even if not retrofitted. The most likely damage would be crumbling of the foundation or the building slipping in regard to the foundation. Either would result in major structural damage that could be irreparable or very expensive to repair. The consequences for human safety are not possible to predict except that there is a concern that doors might jam and impede exiting. A retrofit would likely not act to prevent falling objects, the cause of most injuries and deaths in a severe earthquake.

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