

# Memo

**To:** Mayor, City Councilmembers, City Manager, and City Attorney

**From:** Alyssa Poblador, Administrative Specialist IV *AP*

**CC:** S. DEWOLFE, C. ZABALA

**Date:** June 15, 2017

**Re:** Update concerning Item 4.E. on the 6/19/17 Agenda

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Attached please find an update from Stephanie DeWolfe relating to Item 4.E. on the June 19, 2017 City Council Agenda.

**4.E. SEISMIC ORDINANCE UPDATE FOR NON-DUCTILE CONCRETE AND PRE-NORTHRIDGE STEEL MOMENT FRAME BUILDINGS**

# memo

Date: June 15, 2017

To: West Hollywood City Council

Prepared by: Community Development Department  
Stephanie DeWolfe, Community Development Director  
Cynthia Zabala, Acting Building Official

RE: SUPPLEMENT TO AGENDA ITEM 4E:  
SEISMIC ORDINANCE UPDATE FOR NON-DUCTILE  
CONCRETE AND PRE-NORTHRIDGE STEEL FRAME  
BUILDINGS

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The staff report for Item 4E provides a status report on the previously presented ordinance for mandatory seismic retrofit of buildings in West Hollywood and provides a discussion of questions posed by condo owners in non-ductile concrete and steel moment frame buildings. In this memo, staff presents an alternative to mandatory retrofit that is responsive to community concerns, but also revisits the background as to why there are safety concerns for non-ductile concrete and pre-Northridge steel moment frame buildings.

## **The Importance of Acting Now**

According to the USGS there is a 50% probability that a magnitude 6.0 will occur in the next 25 years in the Los Angeles area.

California is located in the "Ring of Fire" which according to the USGS has about 90% of the world's earthquakes every year. In the past several years we have seen some of the most devastating earthquakes happen around the ring including Chile's 2010 Maule M8.1 Earthquake, Japan's 2011 Tohoku M9.1 Earthquake, New Zealand 2011 Christchurch M6.3 Earthquake, and Taiwan 2016 Meining M6.4 Earthquake. Southern California, however, has not had a major earthquake since the 1994 Northridge Earthquake. In that earthquake several hospitals were not functional after the earthquake because they were non-ductile concrete or steel moment frame structures and it is estimated that 125,000 people were left temporarily or permanently homeless due to damage of homes.

A significant earthquake will not only affect life safety, but also loss of shelter and significant economic loss. USGS has recently published an earthquake scenario in Southern California known as the The Great Shakeout. This scenario expects an economic building loss of \$33 billion dollars and 1,800 deaths in Southern California.

Many of these deaths will be attributed to collapse of both non-ductile concrete and pre-Northridge steel moment frame buildings.

One way to reduce the devastation is to be proactive rather than waiting for a disaster to occur before addressing the seismic deficiencies in our existing building stock. The current building codes require new buildings to adhere to the most current building standards; however there is nothing in the Code that requires existing buildings to be upgraded unless the building is undergoing major alterations. As such, many city jurisdictions in California are now implementing mandatory seismic ordinances to reduce the risk of these existing seismically vulnerable buildings.

### **Non-Ductile Concrete Buildings**

Non-ductile concrete buildings are considered to be one of the most seismically vulnerable building types by the structural engineering community. Unlike wood and steel, concrete can't bend. It's known by engineers as "non-ductile." Instead of bending, concrete columns can snap like a piece of chalk. Structural engineers use steel reinforcing bars known as rebar to make the columns stronger and more flexible. The rebar forms a cage inside the concrete, allowing it to crack and bend without crumbling.

The poor performance of pre-1979 concrete buildings is well documented and can cause major damage and often collapse when they experience severe seismic shaking. The 1971 Sylmar San Fernando Earthquake caused \$500 Million dollars in property damage including several building collapses in two major hospital campuses. The earthquake claimed 65 deaths of which 49 deaths were attributed to masonry and non-ductile concrete buildings. Over the next decade following this catastrophic event, the engineering community began to research and implement better ways to design and construct these buildings so they can better sustain seismic shaking.

Building codes now require new concrete structures to provide additional reinforcement to improve ductility, but the code did not address existing buildings. Even buildings listed as "reinforced concrete" on the permits may not have enough steel to withstand seismic shaking. The only way to know whether an older concrete building is at risk is to have an engineer inspect it. The performance of older buildings in an earthquake can be improved by various strengthening methods. Retrofit standards for older buildings require them to be strong enough to remain standing so occupants can safely evacuate. Although those buildings may still experience damage, retrofits are intended to save lives.

### **Pre-Northridge Steel Moment Frame Buildings**

In the Northridge earthquake, many beam-to-column connections in steel moment-frame buildings experienced brittle fractures, even at low levels of shaking. Prior to this event, the connections were believed to be very ductile and were widely utilized in the construction of tall buildings.

There is some uncertainty regarding the number and extent of this problem in existing buildings and a majority of them have been left unaltered. In the Los Angeles area,

approximately 155 steel structures were surveyed after the earthquake with 60% of those found to have connection damage. As a result, they may be susceptible to collapse in the event of a major earthquake

Building codes have been updated to change the design and construction standards for new buildings, but as with non-ductile concrete, codes do not address existing buildings that were built under old standards. The performance of older steel frame buildings can be improved in a number of ways that will increase the likelihood that occupants will be able to evacuate safely after a major seismic event.

### **Alternatives**

It's clear that retrofitting buildings creates the greatest improvement in life safety, reduction in economic impact and overall resiliency of the community after a seismic event, however mandatory retrofitting can also be costly and cause financial hardship in some cases. Staff has been investigating alternatives to mandatory retrofit ordinances, and while the review of alternatives is not complete, below are a few possible options that would be responsive to the concerns of the community at this time:

#### **A. Mandatory Evaluation & Rating for Condominium Buildings**

- Require each building to be evaluated by a qualified seismic engineer to determine if there are any building deficiencies and if a retrofit may be necessary;
- Require a copy of the engineering report to be submitted to the City for verification and kept on file;
- Adopt a rating system that will translate the complex information in these reports into a language the public can understand (i.e. 1 – 3 stars, etc.);
- Adopt clear standards of what is required to be a 1, 2 or 3 star building;
- Allow the building owners to decide if and when they will retrofit the building.

Under this alternative, building owners would be aware of the potential vulnerability of their building and with this information an informed decision could be made as to whether or not they would like proceed with the retrofit of their building. The City would also be aware of where more vulnerable buildings were located in the event of catastrophic events and for the purposes of resiliency planning.

In cases where the HOA/building owner chooses not to retrofit the building, the financial hardship would be eliminated; however the building would remain vulnerable. Further, the rating system allows individual property owners, and potential owners, to understand the potential vulnerability of the building.

#### **B. Mandatory Evaluation & Rating for all Concrete & Steel Buildings**

As above, but implemented more globally for all buildings that fall within the concrete and steel construction types.

C. Mandatory Evaluation & No Rating System

A modification of the above alternatives would include the mandatory evaluations but eliminate the rating system;

D. No Ordinance; No Evaluation, Rating or Retrofit for Concrete and Steel Buildings

Council could choose to eliminate any further consider or evaluation, rating or retrofit of all concrete or steel buildings;

E. No Ordinance; No Evaluation, Rating or Retrofit for Condominiums

Council could choose to eliminate any further consider or evaluation, rating or retrofit just for condominium buildings;

F. Currently Proposed Ordinance

The currently proposed ordinance requires an individual evaluation of each building in order to determine if there are any building deficiencies and if a retrofit may be necessary. It then allows 20 years to complete the retrofits, or longer if the property owner requests an extension and can demonstrate financial hardship.

Additional alternatives that are currently being investigated include but not be limited to:

- a) limiting the deficiencies that are addressed under a mandatory retrofit ordinance;
- b) reducing building performance objectives in a catastrophic event; and
- c) extending time frames to complete the retrofits.

Options (a) and (b) would reduce the level of retrofit required and therefore potentially reduce the costs associated with retrofit work. Option (c) would increase the amount of time available for financing, although that would already be available through an extension under the currently proposed ordinance. Each one of these limitations will yield a different outcome in the reduction of seismic risk for the community and would require more extensive evaluation and further analysis.