# 2016 SAFER CITIES SURVEY

## 2018 SURVEY ADDENDUM

STRUCTURAL ENGINEERS ASSOCIATION
SEA
SOUTHERN CALIFORNIA

# SAFER CITIES SURVEY

**A partnership between**

**seaosc.org**

**and**

**drlucyjonescenter.org**

## Disclaimer

This Safer Cities Survey has been prepared by the Dr. Lucy Jones Center for Science and Society (DLJCSS) for the Structural Engineers Association of Southern California (SEAOSC), and is published as part of our association's educational program. While the information presented in the document is believed to be correct at the time of publication, the materials, practices, and understanding of the matters discussed are sometimes subject to differences of opinion and approach, and are constantly evolving. As such, neither SEAOSC nor its Board, committees, writers, editors, firms, or individuals who have contributed to this survey make any warranty, expressed or implied, or assume any legal liability or responsibility for the use, application of, and/or reference to opinions, findings, conclusions, or recommendations expressed herein. This survey should not be used or relied upon for any specific application without competent examination and verification of its accuracy, suitability, and applicability by qualified professionals. This survey is not intended to amount to minimum standards for any purpose. Users of this survey assume all liability arising from such use.

The user is advised to check updates/errata pertaining to this survey, which are posted at www.seaosc.org. Inquiries may be addressed to seaosc@seaosc.org.

Structural Engineers Association of Southern California
© 2016 SEAOSC
© 2018 SEAOSC
All rights reserved.
This document or any part thereof may not be reproduced in any form without the written permission of SEAOSC.

## SUMMARY

Studies show many types of buildings in California built under earlier versions of the building code are now known to be very vulnerable to earthquake damage and will be responsible for the majority of deaths in future earthquakes. Ordinances to encourage or mandate the retrofit of these buildings for improved seismic safety are the main tool available for local jurisdictions to reduce this risk. The Safer Cites Survey report (the Survey) provides an overview of the seismic ordinances that have been enacted or are under consideration in the jurisdictions of Southern California.

The 2016 Safer Cities Survey focused on six counties which comprise the main geographic area within which the **Structural Engineers Association of Southern California** (SEAOSC) represents practicing Structural Engineers. In this **2018 Survey Addendum**, the final three counties encompassing the full geographic range of SEAOSC membership; San Luis Obispo County, Kern County and Santa Barbara, are included.

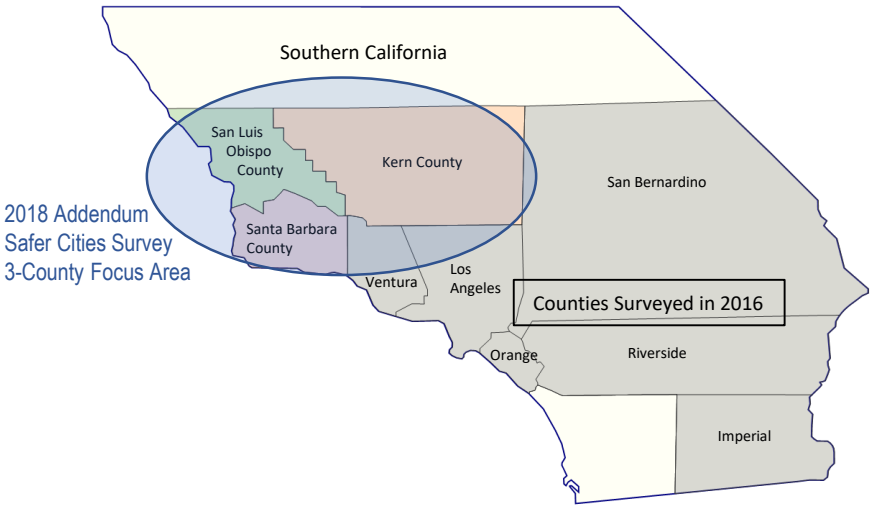



Figure 1A: Area of Southern California considered in this addendum

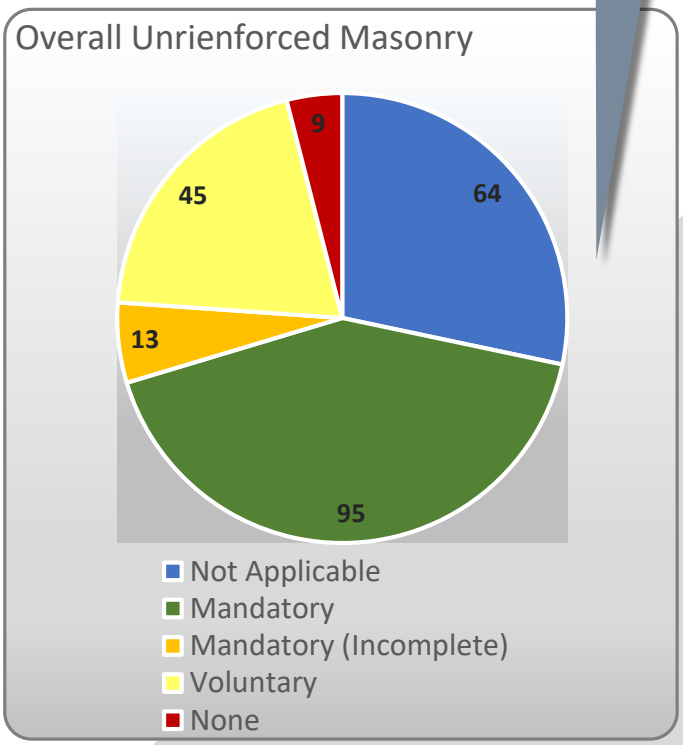
You may down load your copy of the 2016 Survey here:
https://seaosc.org/resources/Summit/2016SaferCitiesSurvey.pdf

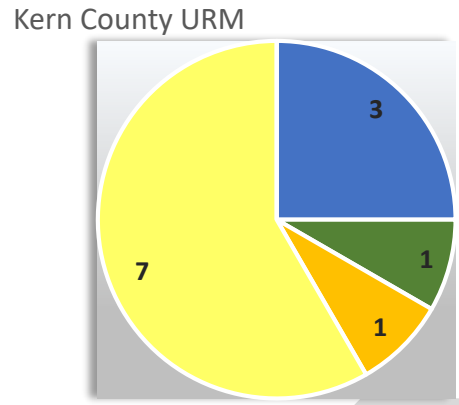
The 2018 Survey Addendum is available here:
https://seaosc.org/resources/Summit/SaferCitiesSurvey2018Addendum.pdf

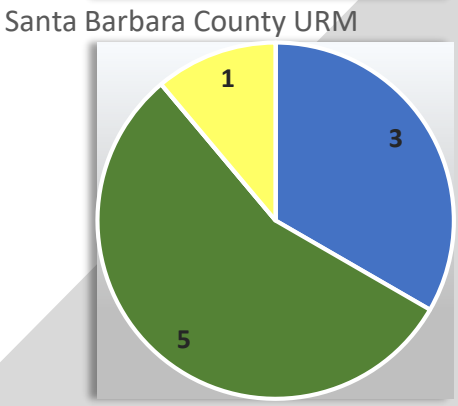
SAFER CITIES

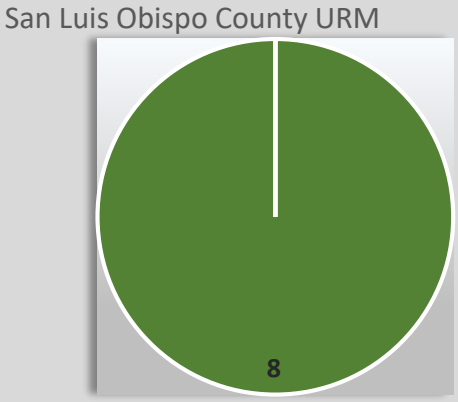
## Unreinforced Masonry (URM)

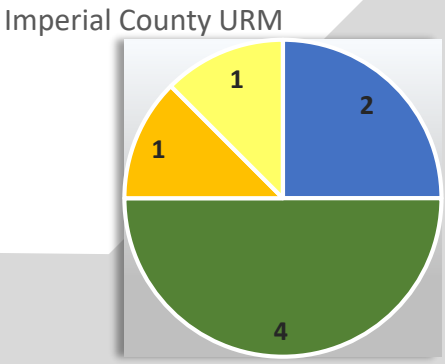
Because the 1986 California URM law requiring all jurisdictions in the earlier Seismic Zone 4 per the Uniform Building Code to develop a retrofit program, these programs are widespread. These buildings were prohibited from being constructed after 1935, several jurisdictions surveyed had no URM buildings and therefore no need for a program. The majority of the remaining jurisdictions have programs that mandate retrofit of URMs although not all have been successful in retrofitting or demolishing all of their URM buildings. Twelve jurisdictions have mandatory programs that achieved less than 50% compliance. Imperial and Los Angeles Counties have the highest rate of mandatory programs while San Bernardino County has the lowest.

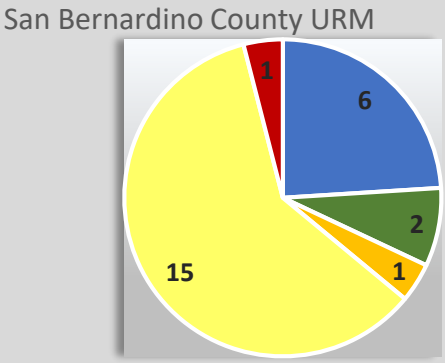


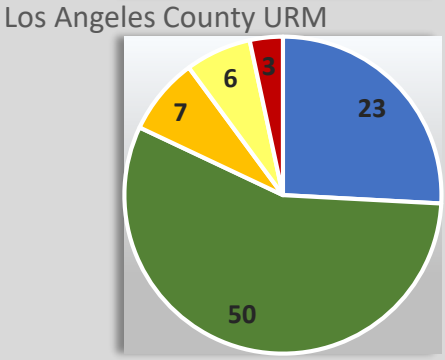



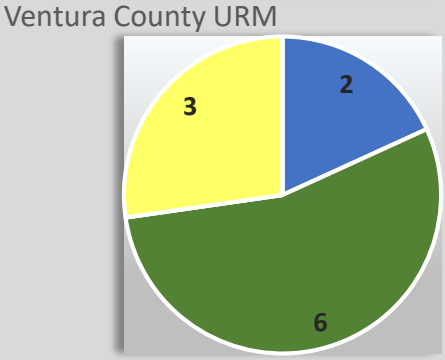



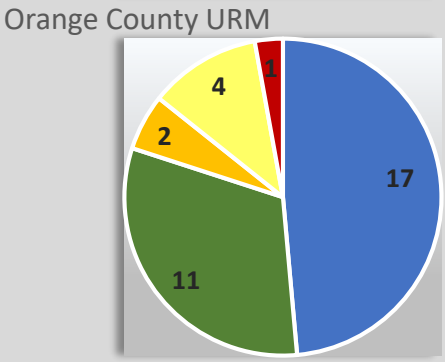



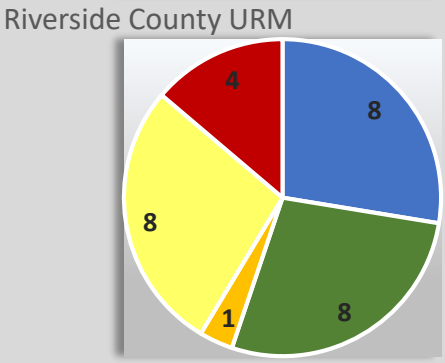
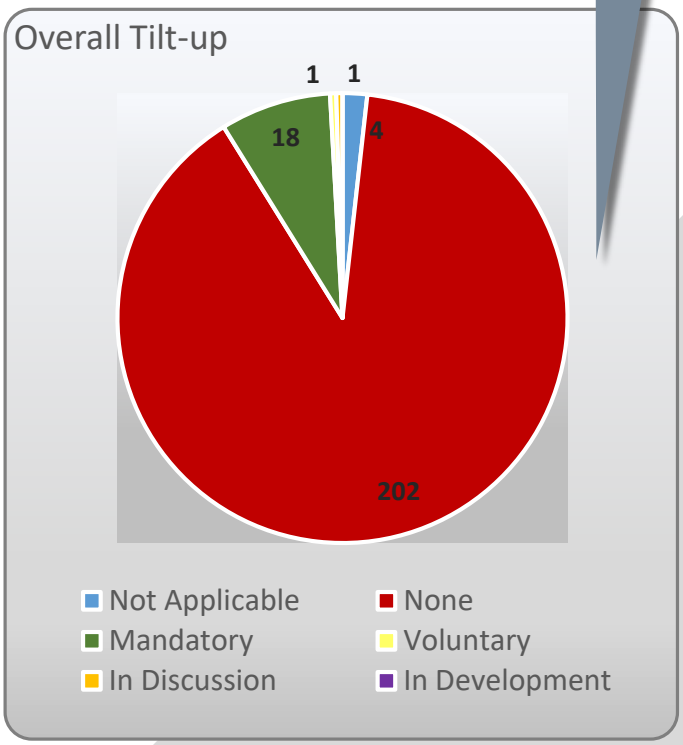
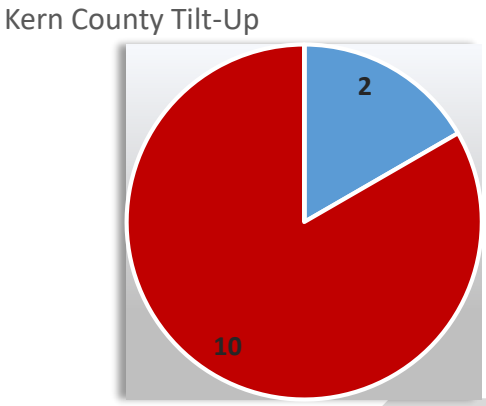



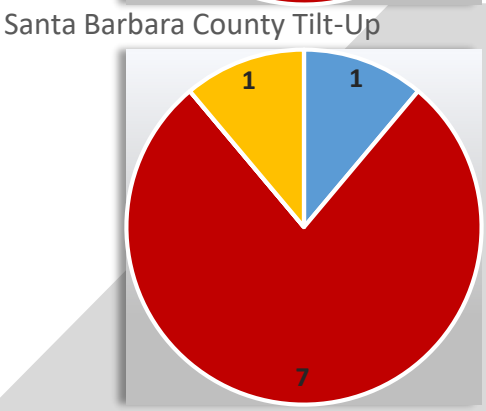

Figure 2A: Ordinances to address Unreinforced Masonry for all nine counties and by county

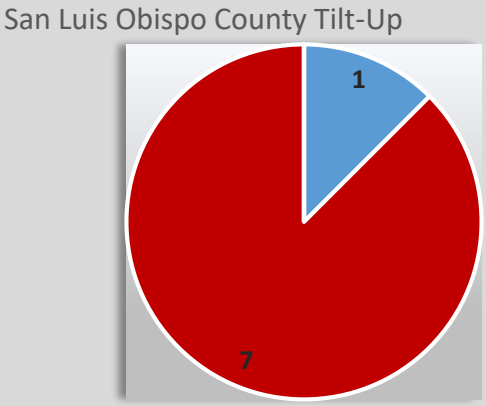
## Concrete Tilt-Up Wall Panels

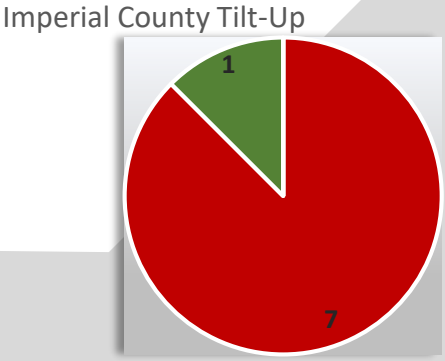
Tilt-up concrete buildings are those where walls panels are cast on site, typically laying flat on the surface of the building slab. When the panels have reached strength, they are lifted, or "tilted up", and tied to the building roof. Many of these buildings failed in the 1971 earthquake because roof-to-wall connections did not have adequate capcity. Building codes and standards have been improved and post-1976 tilt-ups have performed better. However, there is a vast inventory of older buildings, and even those with early 1980's detailing, that remain susceptible to wall anchorage failure. Again, in 1994 wall anchorage failure resulted in a number of partial building collapses leading several jurisdictions to adopt formal programs to upgrade older buildings after the Northridge earthquake.

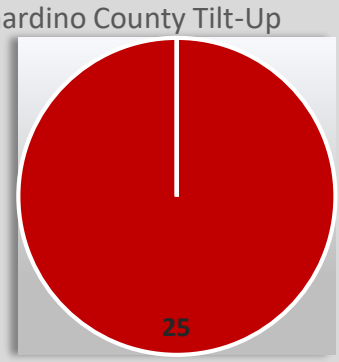


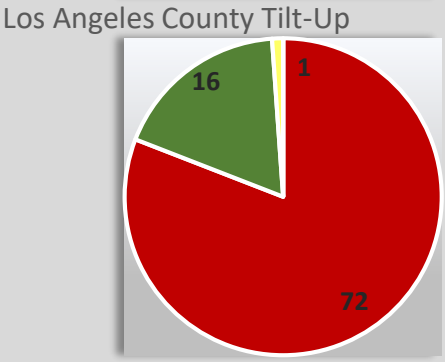



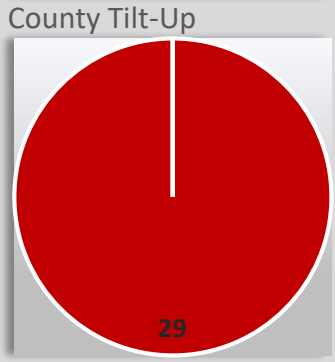



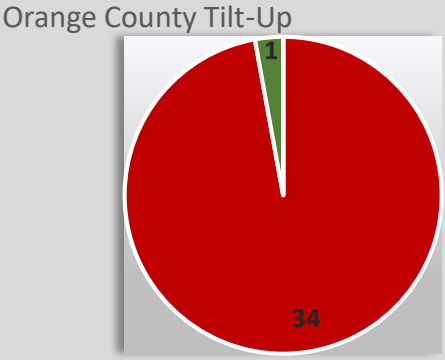



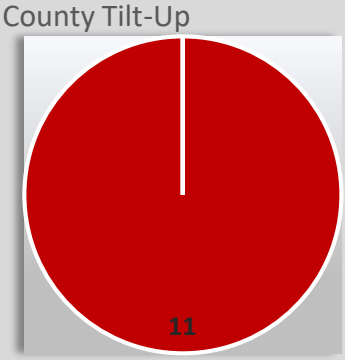
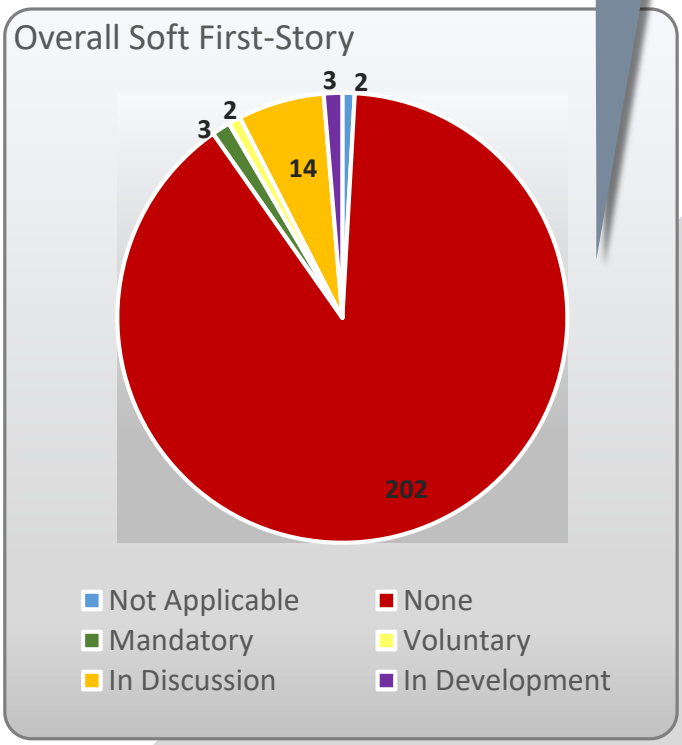
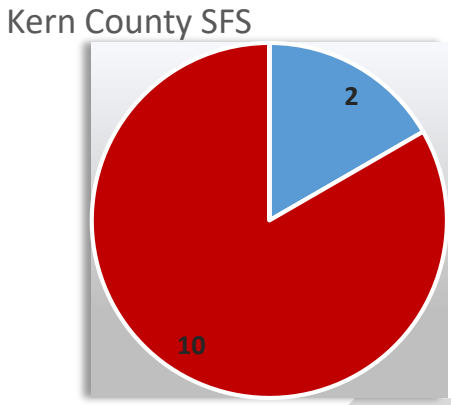



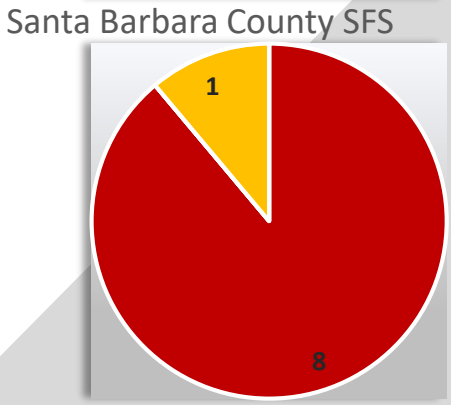

Figure 3A: Ordinances to address Tilt-Up Concrete buildings ror all nine counties and by county

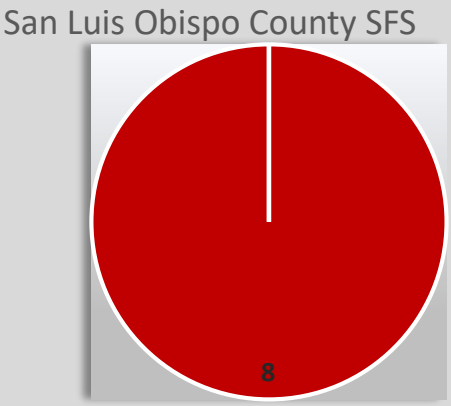
## Soft First-Story (SFS)

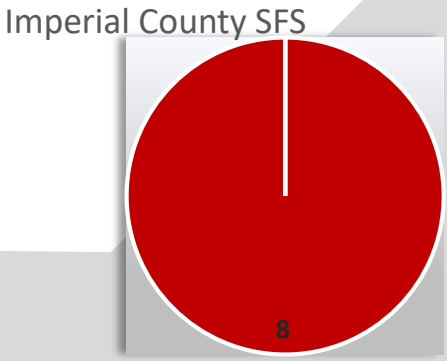
The 1989 Loma Prieta earthquake in the San Francisco Bay area and the 1994 Northridge earthquake together highlighted the problems of soft first-story construction practices. A "soft first-story" building is one where first floor walls have a significant number of large openings, such as for carport or retail windows. This makes the first story much weaker than the stories above and makes the building more likely to collapse at the first story. Because many of these are residential buildings, they represent a particularly critical threat to lives and a major loss to a community after an earthquake. This has resulted in several jurisdictions implementing retrofit ordinances and others to begin considering similar programs to address the problem.

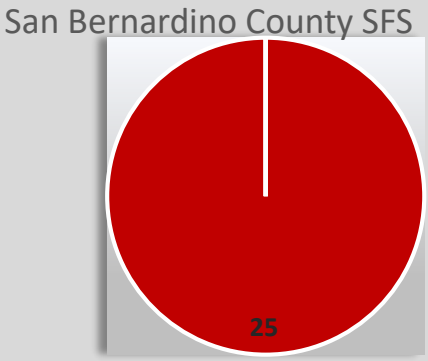


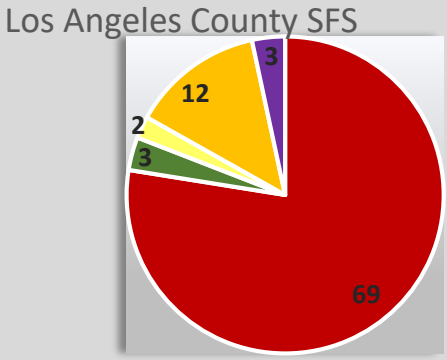



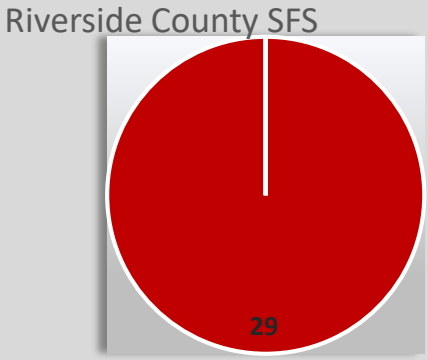



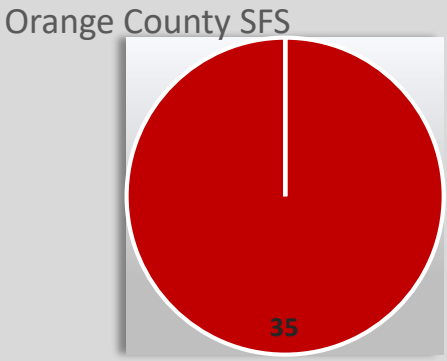



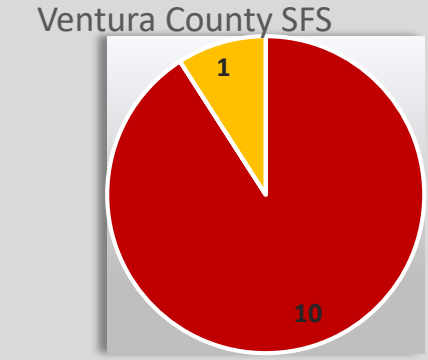
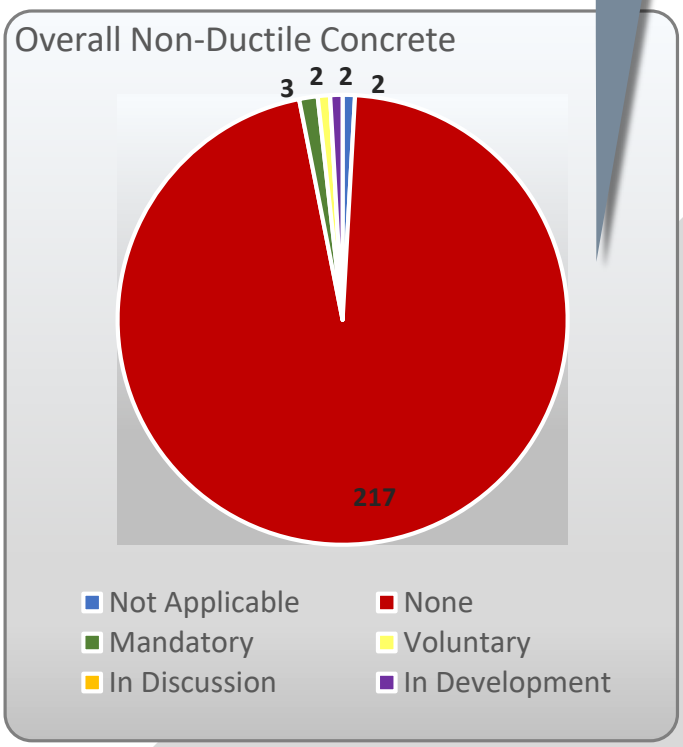
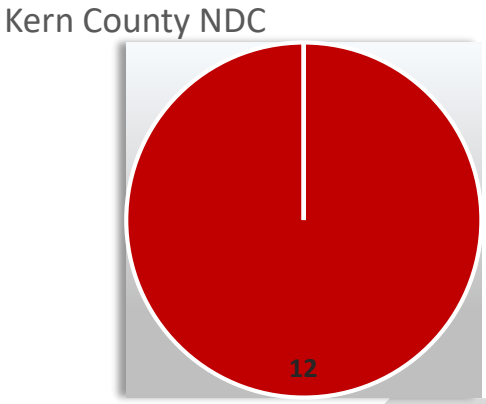



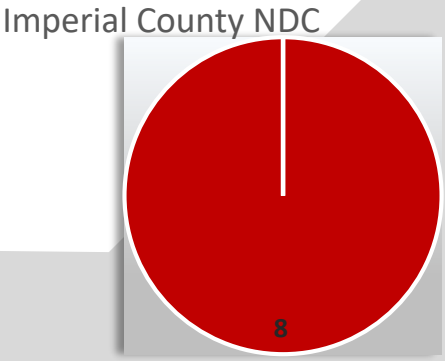

Figure 4A: Ordinances to address Soft First-Story Construction for all nine counties and by county

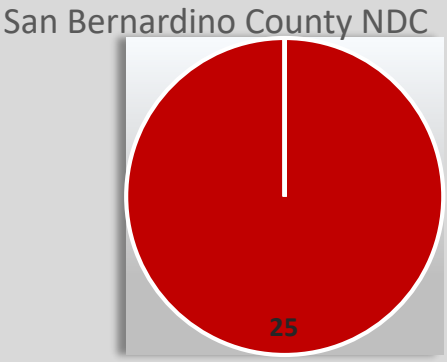
## Non-Ductile Concrete (NDC)

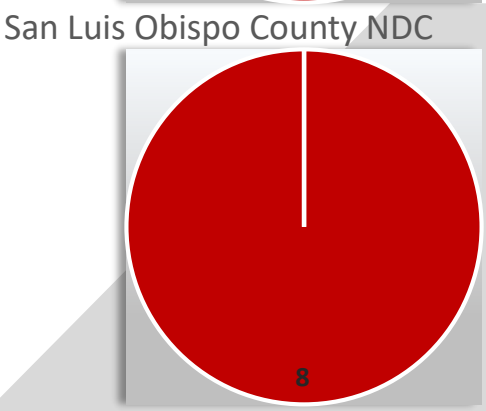
Concrete building constructed before 1976 likely contain non-ductile detailing including inadequate hoop steel to confine vertical column reinforcing and inadequate lap length of reinforcing splices. This leave the buildings susceptible to sudden and potentially catastrophic failure. Modern building codes adopted after 1976 continue advance the design and detailing requirements for concrete buildings to avoid similar weakness, however, thousands of concrete building remain vulnerable. Cities such as Santa Monica and Los Angeles are beginning to address these buildings through mandatory or voluntary retrofit ordinances.

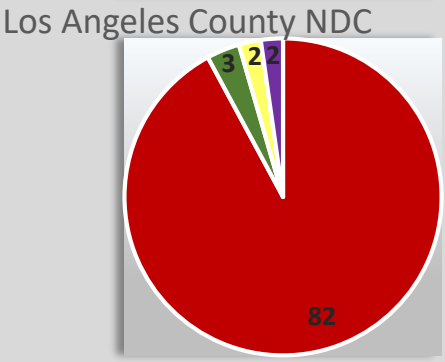


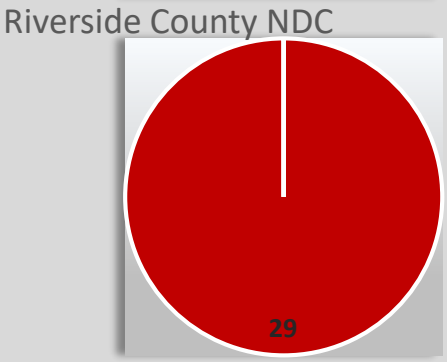



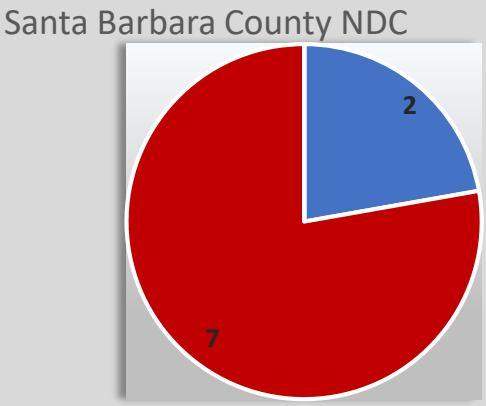



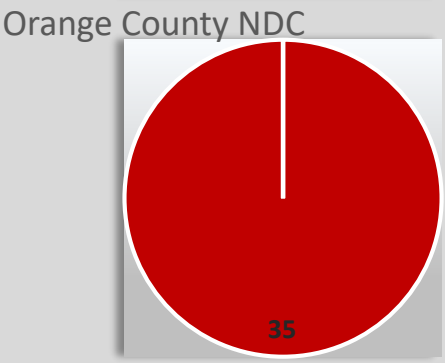



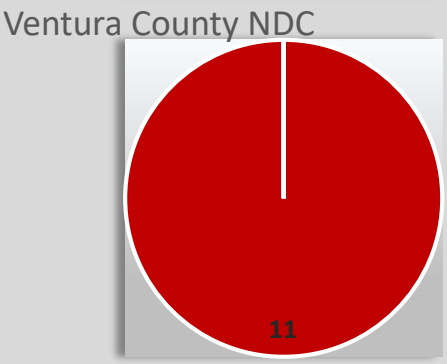
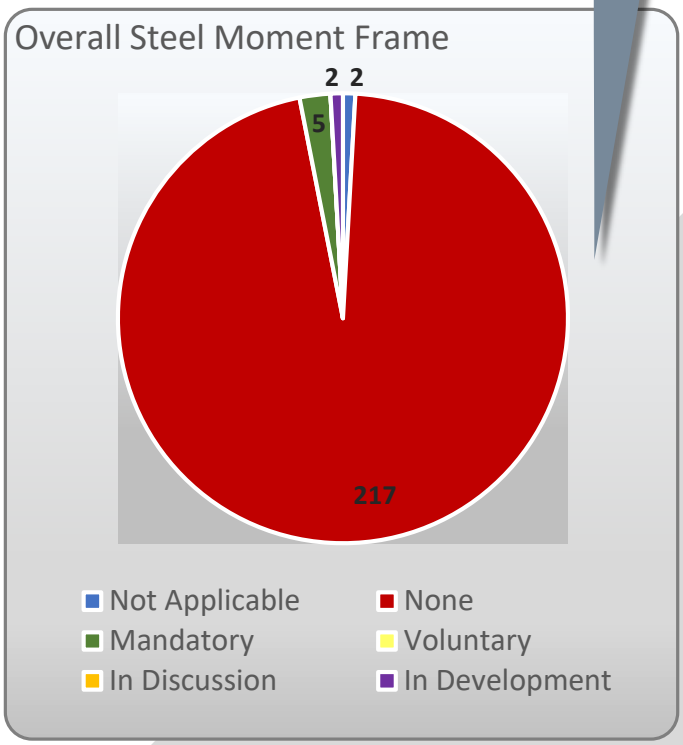
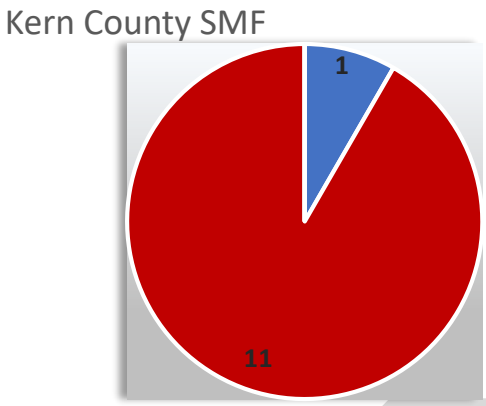



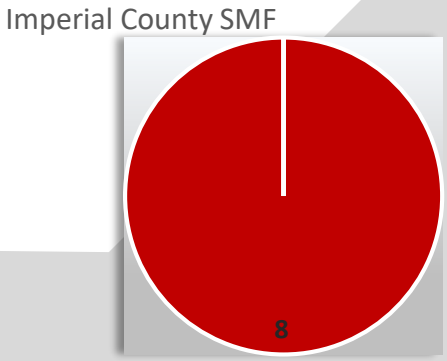

Figure 5A: Ordinances to address Non-Ductile Concrete Buildings for all nine counties and by county

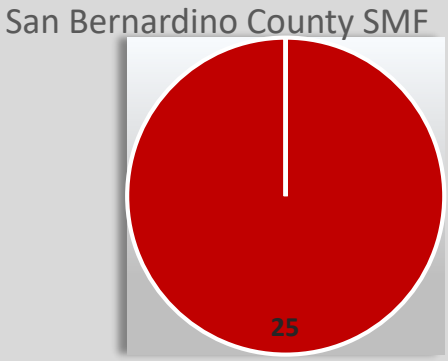
## Steel Moment Frame (SMF)

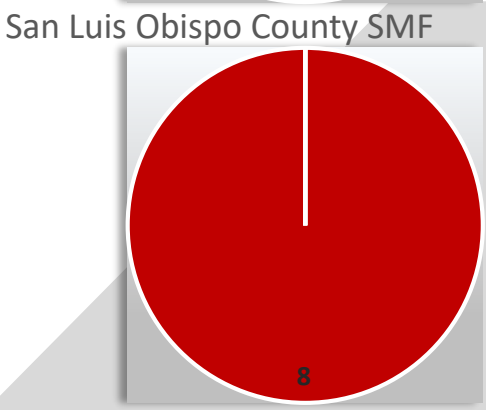
The vulnerable nature of pre-Northridge steel moment frame connections was discovered as an outcome of the 1994 Northridge Earthquake. Certain configurations of these connections are vulnerable to brittle fracture, increasing the potential damage threshold for steel moment frame buildings. The number of jurisdictions addressing this vulnerability is increasing.

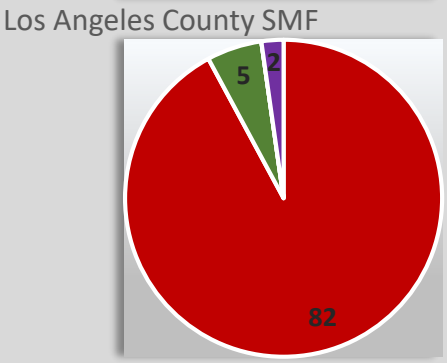


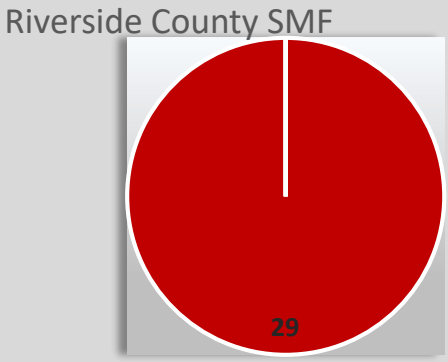



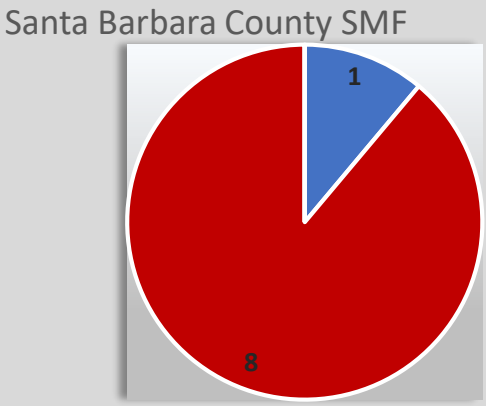



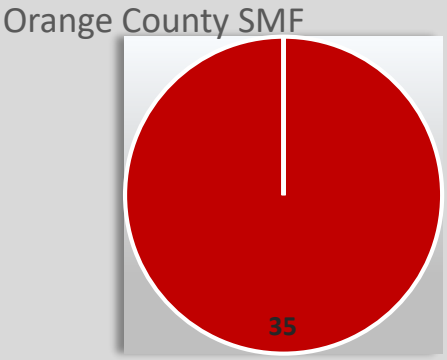



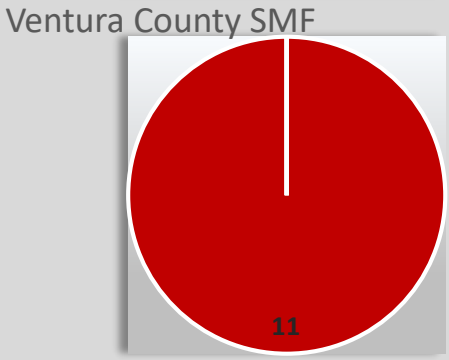
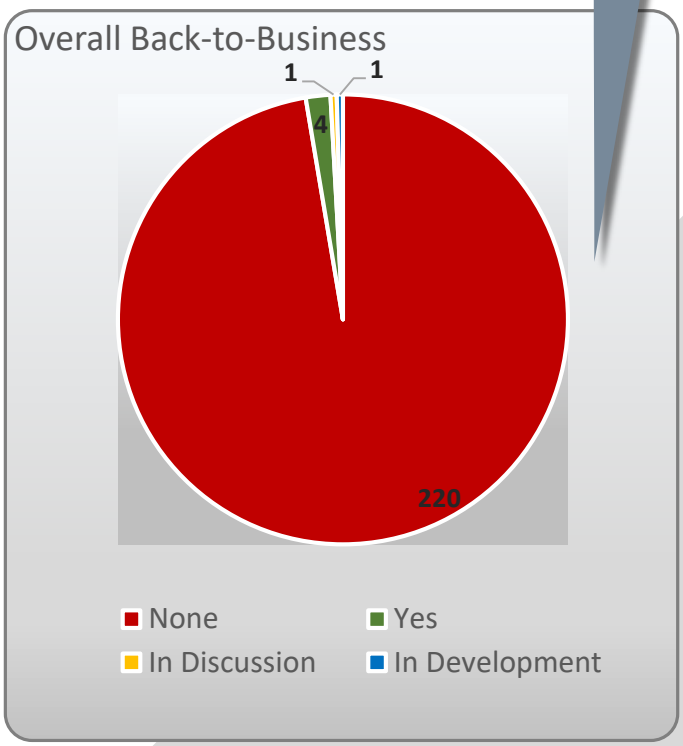




Figure 6A: Ordinances to address Steel Moment Frame Buildings for all nine counties and by county

## Back to Business Programs (B2B)

**A** Back-to-Business (B2B) Program (also known as a Building Occupancy Resumption (BOR) Program) is a partnership between Building Owners and the Jurisdiction, set up before an earthquake event, which allows the Building Owner to retain the services of qualified Structural Engineers to conduct post-event inspections of the Owner's building(s) on behalf of the Jurisdiction. The goal of the B2B program is to reduce the demand on the jurisdiction in the immediate aftermath of a disaster, and allow the Owner's engineering consultant to speed the re-occupancy of the building on behalf of the Owner and tenants.



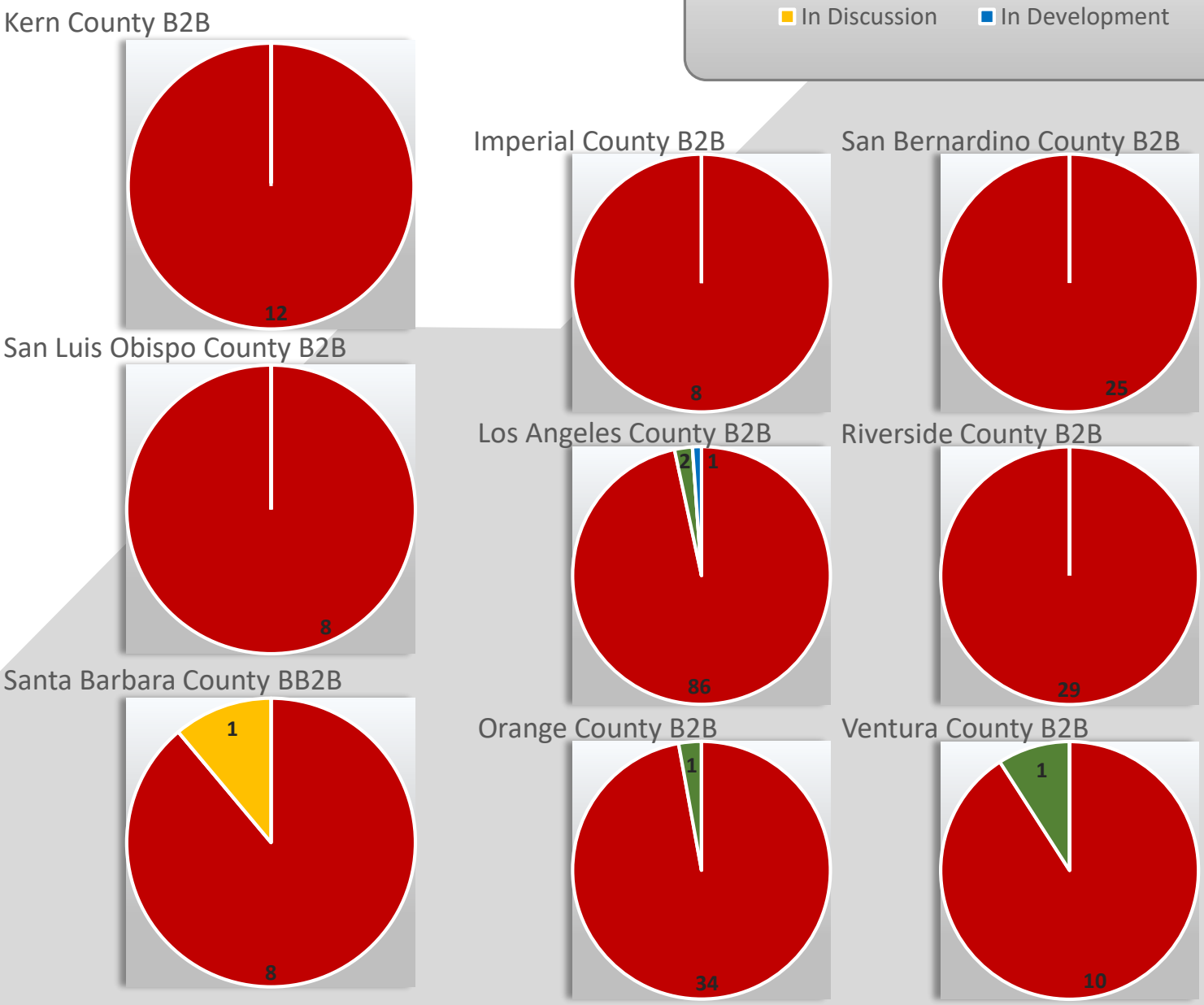




Figure 7A: Back-to-Business Programs for all nine counties and by county

**STRUCTURAL ENGINEERS ASSOCIATION OF SOUTHERN CALIFORNIA**
437 S. Cataract Ave., #4-B
San Dimas, CA 91773
Phone: 562-908-6131 Fax: 562-692-3425
Email: seaosc@seaosc.org
Website: www.seaosc.org