The Concrete Coalition and the California Inventory Project: An Estimate of the Number of Pre-1980 Concrete Buildings in the State

A report prepared by the Concrete Coalition

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Executive Summary

The Concrete Coalition: www.concretecoalition.org

The Concrete Coalition is a network of individuals, governments, institutions, and agencies with a shared interest in assessing the risk associated with non-ductile concrete buildings and developing strategies with which to mitigate that risk. The Coalition is a program of the Earthquake Engineering Research Institute, the Pacific Earthquake Engineering Research Center (PEER) at UC Berkeley, the Applied Technology Council and their partners, including the Structural Engineers Association of California, The American Concrete Institute, BOMA of Greater Los Angeles and the U.S. Geological Survey. With funding from the California Emergency Management Agency, the Concrete Coalition is helping California assess the size and scope of the potential risk by providing an educated estimate of the existing non-ductile concrete building stock.

For purposes of this project, the Coalition uses "pre-1980 concrete buildings" as a practical surrogate for "non-ductile concrete buildings." The Coalition has now estimated the number of pre-1980 concrete buildings in the 23 counties (and two additional cities) with the highest seismicity and exposure, using sidewalk surveys, public records, data compiled by government agencies, and a regression model. Coalition members recognize that there is a large uncertainty with some of these numbers, particularly those generated by the regression model, and encourage volunteers throughout the state to conduct surveys in the cities with questionable data. Over time it is expected that these estimates will improve and as more city surveys are provided, the robustness of the regression model will improve.

Table 1 summarizes the estimate as of this writing.

Table 1
Estimated Number of Pre-1980 Concrete Buildings
in the 23 Highest Seismicity and Exposure Counties of California

Private buildings	14,000—15,000
K-12 public schools and local government buildings	1670—1770
State government buildings, including UC and CSU buildings	540—710
Federal government buildings	9
TOTAL ESTIMATE	**16,000—17,000**

Not all of these buildings are collapse hazards or even prone to severe earthquake damage. The next level of inventory and loss estimation involves more careful study of specific buildings, applying our understanding of the riskiest structural conditions and details.

Under the leadership of Craig Comartin, a core group of volunteers managed the project, with the assistance of EERI staff. The project engaged more than 250 volunteers, from those who participated in early planning and project development meetings to those who spent weekends documenting building types in specific cities. A summer intern provided by PEER in 2009 gathered data for the regression model and interviewed volunteers about the nature of their estimates. A website was built to contain basic information on the building type as well as the individual reports from the cities (www.concretecoalition.org).

The Concrete Coalition
And The California Inventory Project

1. Introduction

The Concrete Coalition is a network of individuals, governments, institutions, and agencies with a shared interest in assessing the risk associated with non-ductile concrete buildings and developing strategies with which to mitigate that risk. The Coalition is a program of the Earthquake Engineering Research Institute, the Pacific Earthquake Engineering Center (PEER) at UC Berkeley, the Applied Technology Council and their partners, including the Structural Engineers Association of California, The American Concrete Institute, BOMA of Greater Los Angeles and the U.S. Geological Survey. With funding from the California Emergency Management Agency, the Concrete Coalition is helping California assess the size and scope of the potential risk by quantifying the existing non-ductile concrete building stock. In tandem with the work of the Coalition, PEER, through funding from the NEES program at the National Science Foundation, is identifying the most serious deficiencies associated with these buildings.

"Non-ductile" is an engineering term for a range of structural behaviors that, in concrete buildings, can lead to irreparable earthquake damage or outright collapse. The ductility of a concrete structure is a function of its materials, configuration, and structural detailing – attributes that are difficult to determine from typical public records or even from visual inspections. Based on knowledge of California building codes and engineering practice, the Concrete Coalition developed a practical surrogate definition for purposes of this initial inventory: structures involving certain concrete elements, designed prior to 1980.

The Concrete Coalition has estimated the number of pre-1980 concrete buildings in the 23 California counties with the highest seismicity and population, as well as two additional cities: Fresno and Bakersfield. 1980 was selected as the cutoff year for several reasons. Ductility requirements were introduced in the 1967 UBC, but the earthquake design loads increased significantly in 1976. Some jurisdictions adopted the UBC earlier than others. The combination of those three effects -- changes in detailing provisions, earthquake design loads, and local jurisdiction adoption -- suggest that buildings designed after 1980 should be significantly better than those designed before 1970. Buildings designed in the 1970s will vary. For a statewide count, the Concrete Coalition steering committee decided that 1980 is thus an appropriate cutoff year.

The estimation process included: 1) using volunteers to count and/or estimate the number of these buildings in individual jurisdictions; 2) developing a regression model based on parameters from the U.S. census and counts, where available, for each city in these 23 counties; and 3) acquiring statewide databases for public buildings and combining them with the city-based estimates. Coalition members recognize that there is a large uncertainty with some of these numbers, particularly those generated by the regression model, and encourage volunteers throughout the state to conduct surveys in the cities with questionable data.

The current estimate is that there are 16,000 to 17,000 pre-1980 concrete buildings in the 23 highest risk counties. Not all of these buildings are collapse hazards or even prone to severe earthquake damage. The next level of inventory and loss estimation involves more careful study of specific buildings, applying our understanding of the riskiest structural conditions and details.

One dimension of the data currently available is that the distribution of these buildings across the cities is uneven. Typically the older, larger cities have more of these buildings, but a few cities, such as San Francisco with its count of 3200 older concrete buildings, have disproportionately more such buildings. Again, many of these buildings will perform adequately in an earthquake, but understanding which ones won't and determining how many of those represent the highest risk (poor performance and high or critical occupancy) is an important next step. The collapse of even one of these buildings, if large, and fully occupied, could have significant consequences in any single jurisdiction in terms of loss of life, loss of housing, loss of a critical function (such as a government building or a business headquarters).

Non-Ductile Concrete Buildings

Buildings designed with insufficient detailing to resist seismic loads pose a significant risk in terms of monetary loss, social disruption, and casualties. Such existing vulnerable buildings are a major seismic safety problem in the world. Concrete buildings built prior to the implementation of modern codes and standards in the mid-1970s have performed poorly in recent earthquakes. Catastrophic damage or collapse has been seen in San Fernando, California (1971); Loma Prieta, California (1989); Northridge, California (1994); Kobe, Japan (1995); Chi Chi, Taiwan (1999); Kocaeli, Duzce and Bingol, Turkey (1999, 1999, 2003); Sumatra (2005); Pakistan (2005); and most recently Haiti (2010), Maule, Chile (2010), and New Zealand (2011).

In California, non-ductile concrete buildings support a full range of occupancies and uses, including code-defined "essential services." Severe damage can lead to critical loss of housing, costly loss of property, and business interruption, and partial or complete collapse can of course result in large numbers of casualties. In fact, a scenario based on a repeat of the 1906 San Francisco earthquake confirms that a large proportion of the deaths and serious injuries would be attributable to the collapse of non-ductile concrete buildings, finding that "50% of the casualties are coming from 5% of the buildings" (Kircher et al., 2006). Unfortunately, few building officials in the major metropolitan areas of the western U.S. and Canada know how many of these buildings are in their jurisdictions.

Building On the NEES Grand Challenge Project

Although non-ductile concrete buildings are at risk of substantial damage and collapse in earthquakes, not all non-ductile concrete buildings are equally hazardous. Understanding what makes such a building vulnerable is one of the purposes of a National Science Foundation--funded NEES Grand Challenge project at PEER entitled "Mitigation of Collapse Risk in Older Concrete Buildings". This ongoing project aims to develop effective strategies for identifying seismically hazardous older concrete building construction and promoting effective mitigation strategies (PEER 2009). The major components of the Grand Challenge project are to develop a non-ductile concrete building inventory for the city of Los Angeles, to estimate collapse risk of that inventory using existing tools (e.g., HAZUS) and the best available ground motion models, to improve risk assessment tools for non-ductile concrete buildings through targeted testing and numerical simulation work, and to re-assess the collapse risk with the improved tools.

NEES Grand Challenge participants have been working for several years, using a variety of tools, to develop an inventory of pre-1976 concrete buildings in the city of Los Angeles. They are using a variety of databases and tools, including county assessors' data, publicly available databases, and online satellite imagery. Their findings for the city of Los Angeles have been incorporated into the Concrete Coalition's estimate, although it is important to note that their project used 1976 as the cut-off date and all other Concrete Coalition cities used 1980.

2. Techniques used by Volunteers for Inventory Estimates

EERI worked with volunteers from its Regional Chapters in Northern and Southern California to estimate the number of privately-owned non-ductile concrete buildings in various California cities. Both chapters have dozens of members who are dedicated to reducing seismic risk through the application of engineering knowledge and the adoption and enforcement of sound seismic safety policies and practices.

To start the project, members of the project steering committee (see Appendix A) made estimates for four pilot cities (including the city of Los Angeles, through the PEER/NEES project, Berkeley, San Francisco and Long Beach). Presentations of the different approaches were made to meetings in both Northern and Southern California, and are available at the Concrete Coalition website. EERI developed this website to serve as the communication hub and data repository for the project, providing background information as well as accepting data from volunteers. See Appendix B for a complete list of Concrete Coalition volunteers.

Volunteers selected cities in the targeted counties. Using a variety of techniques (see Table 2), each volunteer gathered data and developed an estimate of the number of pre-1980 buildings. The estimates excluded certain structure and building types (including tilt-up buildings), as described in Section 3 and Appendices C and D. The volunteer effort also largely ignored buildings for which existing databases and regulatory records already existed, such as K-12 public schools, universities and hospitals.

Table 2: Techniques used by volunteers in California cities

CITY	Sanborn Maps	Zoning Maps	Google Earth	Street Surveying	Building Officials	Tax Assessor's Data	Internet	Library Research	Engineer Firm Archives	Other Online Databases	Other
Alameda	X	X	X	X	X			X			
Albany	X		X	X	X						
Berkeley	X			X	X	X				X	
Burlingame			X	X			X				
Calabasas				X							X (familiarity with city)
Daly City	X		X	X			X				X (US Census; city-data.com; Daly City History Guild)
El Cerrito	X		X	X	X						
Elk Grove				X							
Emeryville	X			X							
Eureka		X		X	X						
Fairfax		X		X	X						
Fremont	X	X		X			X				X (land use plans, housing rprts)
Fullerton		X	X	X	X				X		X (loss estimates)
Glendale	X	X	X	X	X						X (building permits)
Long Beach		X	X	X	X						
Mill Valley	X		X		X				X		
Millbrae			X	X	X						
Napa	X		X	X							
Navato		X	X	X			X				
Oakland	X		X								
Pasadena	X	X	X		X						
Piedmont			X	X	X		X				
Redwood City	X			X							
Richmond	X	X		X							
Riverside				X	X						
San Bernadino				X	X						
San Francisco	X		X	X							
San Jose	X		X	X		X	X				
San Leandro	X	X		X	X						
San Rafael	X		X		X						X (loss esitmates)
San Ramon	X										
Santa Monica		X	X	X	X	X					
Santa Rosa	X	X	X	X							
Solana Beach		X		X			X				X (local inquiries)

Different cities needed different approaches, which is one reason why it was important to have volunteers who lived in the cities or were familiar with them participate in developing the estimates. Knowledge of local development patterns and history can also explain variations in the estimates. For example, the city of Alameda contains an old naval base, which is one reason why the estimate is so much higher than it might otherwise be for a city of a similar size. In addition, some useful techniques might not work in all jurisdictions. Sanborn maps, for example, might not be available or up to date in some cities.

For small cities it is possible to simply identify areas where older concrete buildings might be present and do some quick field work for verification. In large cities, however, this is impractical, and more strategic methods must be used.

Each volunteer report included an explanation of how the number of buildings was estimated from available data sources. Section 6 of this report includes detailed examples from three cities.

Many volunteers used online satellite imagery (such as Google Earth) as a starting point to identify areas of interest. Although it is difficult and inaccurate to identify a building's structure type from satellite imagery, it is relatively easy to distinguish residential neighborhoods from industrial or commercial areas. This allows for residential areas dominated by woodframe houses to be eliminated and industrial or commercial areas to be further examined by field work. After identifying areas of interest, most volunteers proceeded to field work and street surveying of those areas.

The survey effort for Burlingame provides an example of how some volunteers used Google Earth to map city limits and to isolate areas of interest (Figure 1). The full Burlingame report can be found at the Concrete Coalition website.

Figure 1: Burlingame volunteers' use of Google Earth

Another commonly used data source was Sanborn maps. Sanborn maps were produced for fire insurance purposes and updated until the 1980s. For this inventory, volunteers were interested in buildings constructed before 1980; therefore, some of these maps were extremely helpful. Not all of the maps in all jurisdictions were updated as late as the 1980s, so for some cities the data needed to be supplemented by other sources. Sanborn maps generally show the outline of each building, its construction materials, height, and other attributes, sometimes including its use or occupancy (Figure 2). Since buildings found on 1980s-era Sanborn maps could have been demolished or retrofitted, most volunteers also did field work to verify the map data. Figure 2 shows part of a page from the Sanborn map of Redwood City.

Figure 2: Sanborn map of Redwood City

To confirm or supplement satellite imagery, Sanborn maps, and other source materials, almost all of the volunteers did some sort of field surveying by foot or car. For smaller cities, it was possible to do field work for all the areas of interest and actually count all the expected pre-1980 concrete buildings. Where this was impractical due to the size of the city, field work was usually done for some areas of interest, and a factor was applied to extrapolate from the sample to the city as a whole.

Professional judgment was applied where architectural elements covered or obscured a building's structure.

3. Guidance Provided for Volunteers

Several guidance documents were prepared to help the volunteers through the process including:

- Volunteer Guidance Manual which explained the project, provided tips from work on pilot cities, and explained how to upload data. See Appendix C.
- A file called WHAT TO COUNT, which anticipated questions about what types of buildings to include in the count (Figure 3). The full document is available in Appendix D.

These are also both available at the project website.

Concrete Building Types	Count Data	Optional – Other Databases Available	Do Not Count Data
Concrete Frame with Masonry Infill	X		
Wood-frame Residential on Conc. Podium	X		
1-story Cast-in-Place Concrete with Wood Roof (including walls with pilasters)	X		
Concrete Shear Wall with Steel Gravity Frame	X		
Mixed Construction[2]	X		
Tilt-ups			X
Dual System with Concrete Shear Wall[3]			X
Parking Garages	X		
Buildings Whose Concrete Elements are Limited to Fire Walls Between Sections			X
Buildings Whose Concrete Elements are Limited to Basement or Retaining Walls			X

[2] Includes horizontal additions of concrete as well as buildings with concrete lateral load systems in one direction only.
[3] Do not need to make exceptional efforts to verify whether a building has a dual system or not, but if you know, don't count it.

Figure 3: Example Sheet from WHAT TO COUNT instructions

Volunteers answered a standard set of questions online and also uploaded any supporting documentation. Reports then became visible on the website by clicking on a map of the target counties (Figure 4).

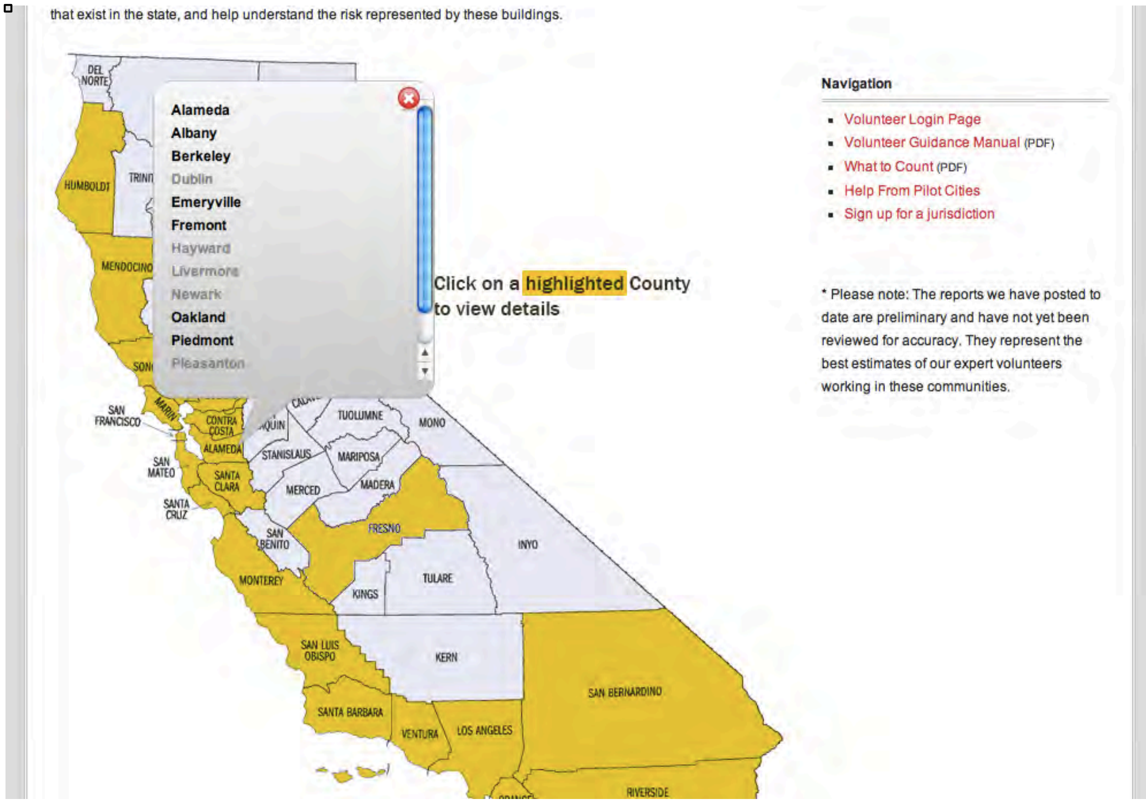


Figure 4: Map of California with highlighted counties. Clicking on a county opens a list of cities. Cities in dark font are those for which a report is available.

The project used an online database to store the data as it came in from volunteers. In addition to providing a summary estimate of the number of pre-1980 buildings, volunteers also attached files showing their field work and their methodology. Many of these files are complete enough to support additional work in the next phase of the project. In the next phase, the Concrete Coalition hopes to work with individual jurisdictions to determine which of these buildings are the most vulnerable, and what mitigation strategies might be most appropriate.

4. Using Regression Analysis to Derive Numbers for Cities

Volunteers were able to provide estimates for only some of the approximately 350 cities in the 23 high seismicity/high population counties and 2 additional cities. While these estimates represented 25% of the population in these 23 counties, they only represent a small number of the cities. Thus, it was necessary to extrapolate from these volunteer estimates to arrive at a complete building count. Professor Peter May, University of Washington and member of the Concrete Coalition Steering Committee, developed a regression model to derive estimates for those cities where we had no volunteer estimates. The 350 cities' populations range from under 100 (Vernon) to over four million (Los Angeles). Of particular interest was the number of buildings in 28 cities within the 350 cities in the project with populations over 150,000. These are more likely to have substantial numbers of pre-1980 concrete buildings.

Two factors made it challenging to do a straightforward extrapolation from the counted sample to the full building stock. First, the volunteers' building counts were based on opportunistic rather than statistically random samples; that is, the volunteers selected which cities to work in. Second, the number of large cities was not enough to permit generalizing to cities with populations greater than 500,000.

The volunteers' estimates were therefore supplemented with other information to inform the desired extrapolation. In particular, the building stock in a jurisdiction is related to its population growth and development over time. We developed a prediction model based on these relationships. We first derived simple statistical models for the inventoried cities, relating the number of pre-1980 concrete buildings to each city's population, housing stock, land area, and development history. Population data came from the 2000 Census, while most of the housing data were obtained from the 2005—2009 American Community Survey of the American Factfinder, U.S. Census Bureau. In some of the smaller jurisdictions, these housing data were obtained from the 2000 U.S. Census of Housing. We were able to predict the number of pre-1980 concrete buildings for non-inventory cities by substituting relevant Census data for those jurisdictions into the statistical prediction model.

Derivation of the appropriate statistical model entailed balancing statistical assumptions, predictive accuracy, and meaningful relationships. Two regression models are shown in Table 3. The "final model," which was used to estimate building counts for non-inventory cities, is preferred because it has a lower standard error of prediction while meeting other desired statistical criteria.

Table 3. / Inventory Regression Prediction Models

Variable	Regression Coefficients [a] Initial Model [b]	Final Model [c]
Number of housing units (ln)	.780*** (.098)	.809*** (.097)
Percent built before 1939 (ln)	.756*** (.125)	.675*** (.132)
Percent in structures with 20 or more units (ln)	.706*** (.242)	.706*** (.241)
Constant	-7.663*** (1.057)	-7.711*** (1.033)
Model Statistics		
Number of observations	29	27
Adjusted R^2	.84	.85
F-value for overall model	49.181***	50.154***
Standard Error of Prediction	.691	.675

*** p < .01

[a] Cell values are the unstandardized coefficients for predicting the natural log of the number of pre-1980 concrete buildings in inventory cities. Standard errors are in parentheses.

[b] Excluding four outliers: Pasadena, Piedmont, Riverside, and San Bernardino

[c] Excluding six outliers: Fremont, Pasadena, Piedmont, Richmond, Riverside, and San Bernardino

Several choices were made in developing these models. Because the inventory and Census data are highly skewed (long right tail in the distributions), the data had to be transformed using natural log transformations to meet Ordinary Least Squares regression assumptions of linear relationships. A variety of models, with different demographic and housing data, were derived. The two models shown here provided the best statistical fit and substantive interpretation of the estimated relationships. It makes sense that the number of pre-1980 concrete buildings is positively associated with increased population, greater numbers of structures with 20 or more housing units, and greater numbers of pre-1939 buildings. The latter is a measure of the age of the building stock while the percentage of buildings with 20 or more units is a measure of the type of buildings. Efforts to incorporate measures of density, employment ratios of various kinds, and other indicators of the housing stock did not result in prediction models with as good a fit as these. Identification of outliers in the fit of the data and visual inspection of estimated residuals led to re-estimates without the outliers, as reflected in these two statistical models.

Predictions of the number of pre-1980 concrete buildings for non-inventoried cities were made by substituting relevant values for each city into the final prediction, then exponentiating the predicted value according to the formula:

> Number buildings = Exp (-7.711 + (.809 * ln (housing units) + (.675 * ln (percent built before 1939) + (.706 * (ln percent with 20 or more housing units)))

Using this formula, the predicted number of pre-1980 concrete buildings for the cities within the 23 high seismicity counties, plus Bakersfield and Fresno, is 13,790. Substituting the actual values from the inventories where available provides an estimate of 14,136. Given that the prediction errors are quite broad—more than quadruple the estimates themselves—these estimates provide a false sense of precision even if a rounded value of 14,000 is used. As a consequence, it is best to consider the estimate as an order of magnitude estimate rather than a precise point estimate.

Table 4. Inventory Predictions for Cities over 150,000 Population

City	2000 Population	Pre-1980 Concrete Buildings: City Inventory Estimate	Pre-1980 Concrete Buildings: Predicted Value
Los Angeles	4,018,080	1,500	3,088
San Diego	1,255,540		509
San Jose	912,332	363	205
San Francisco	739,426	3,200	1,855
Long Beach	492,912		396
Fresno	461,116		101
Sacramento	456,441		202
Oakland	395,274	1,300	683
Santa Ana	340,368		100
Anaheim	331,804		77
Bakersfield	295,536		51
Riverside	290,086	5	130
Chula Vista	210,497		33
Glendale	207,157	160	243
San Bernardino	205,010	5	81
Fremont	200,468		36
Huntington Beach	194,457		27
Irvine	186,852		4
Oxnard	183,628		20
Fontana	181,640		14

City	2000 Population	Pre-1980 Concrete Buildings	
		City Inventory Estimate	Predicted Value
Moreno Valley	178,367		4
Santa Clarita	177,158		12
Ontario	172,701		22
Rancho Cucamonga	172,331		9
Oceanside	166,108		27
Garden Grove	166,075		25
Pomona	162,140		48
Santa Rosa	154,212	55	58
Total for inventoried cities only listed above			6,343
Total for all cities listed above, replacing estimates with predicted values only			8,060

The results for cities with populations greater than 150,000 (Table 4) illustrate some of the limitations of the modeling. One is the difficulty of predicting values for the largest cities. The estimate for Los Angeles is twice what the inventory process provided, while that for San Francisco is only 60 percent of what the inventory found. These prediction errors reflect the limited number of larger cities for which data could be used to refine the prediction model. A second difficulty is predicting values for cities that are more recently developed and thus less likely to have pre-1980 buildings of any kind.

Differences between predicted and inventoried values may be useful for assessing the quality of the field estimates. The statistical prediction and field inventory constitute estimates with different bases. Divergence in the two estimates suggests values that differ from the norm. In most cases the difference can likely be explained by the particular circumstances of the jurisdiction's development patterns that make it unsuited for a generic prediction model. It may be that in future phases of the Concrete Coalition better surrogates for older concrete buildings can be found that can be incorporated into the model.

This extrapolation of field-based inventories underscores the difficulty of establishing regional estimates of specialized categories of buildings. The validity of such predictions is based on development of valid predictive models and accurate data. In this case, the predictive model is limited by several key considerations:

- The main limitation is that the jurisdictions for which inventory data were collected do not constitute a random sample. Any statistical-based prediction model assumes the data are "representative" of the larger population of interest. This is a statistical sampling limitation that cannot be overcome with additional data. As a consequence, any estimates of prediction intervals are likely to be in error and estimates of the number of buildings for cities not in the inventory are also subject to error. The basic problem is the degree of error is unknown.

- Assuming the variation in inventory data and cities that were obtained through the observational methods at least approximate that found in the overall population of cities, the prediction model can be considered an approximate basis for gauging the overall number of pre-1980 non-ductile concrete buildings. Stated differently, it provides a basis for a "best guess" for which one cannot statistically bracket that guess. (The inventory data suffer this same problem as there is no basis for establishing statistical confidence intervals for them.)

The regression model predictions by each city in each of the 23 counties are given in Appendix F.

Coalition members recognize that the numbers generated by this model are only approximations. The Coalition is hopeful that additional volunteers will be able to provide more precise estimates for additional cities, which can then be used to further calibrate and refine the regression model. The Coalition is particularly interested in finding volunteers who can provide estimates for some of the jurisdictions with populations over 150,000.

5. Incorporating Data from Available Databases

Databases of some buildings already exist, so the Coalition attempted to obtain them and combine their contents with the volunteers' estimates and the regression predictions. With a few exceptions, volunteers were instructed to ignore buildings that were clearly in one of these categories.

The existing databases cover many, but not all, public buildings, as well as certain private buildings already subject to specific legislation or regulation. Table 5 categorizes the buildings counted from databases.

Table 5: Data Sources for Public and Specially-Regulated Private Buildings

Building Category	Counted by Volunteers' Inventories	Counted from Available Databases
City or County buildings	• Government offices • Services (fire stations, jails, etc.) • Other public facilities (auditoriums, museums, etc.)	• K-12 public schools (DSA, 2008)
State buildings	• Community College facilities	• Various State Agency facilities (DGS, 2008) • Court facilities (AOC, 2004) • University of California facilities (Luckle and Perez, 2010; various campus facilities lists) • California State University facilities (Space and Facilities Database Management System Facility Report 2009; Luckle and Perez, 2010)
Federal buildings	• Post offices • Prisons • Other buildings not managed by GSA.	• GSA-designed or built facilities (GSA, 2009)
Private buildings	• All, unless noted otherwise	• Hospitals regulated by the Office of Statewide Health Planning and Development

Table 6 summarizes the estimated count of 2044 pre-1980 concrete buildings from each of the data sources identified in Table 5, for each of the counted jurisdictions. (Appendix F also contains all the estimates by city, including volunteer estimates, regression model estimates, and database estimates.)

Table 6: Estimated Number of Pre-1980 Concrete Buildings from Available Databases, in Jurisdictions of Interest

County	K-12 Public Schools	State Agency Facilities	Court Facilities	UC Facilities	CSU Facilities	Federal Buildings
Alameda	161	2	5	25	3+	
Contra Costa	61	5	2			
Fresno (City of Fresno only)	31	2			1+	
Humboldt					6+	
Kern (City of Bakersfield only)	25	1	3		Unknown	
Los Angeles	644	62	29	12+	13+	3
Marin	44	10				
Mendocino			2			
Monterey	22	27	2		Unknown	
Napa	4	31				
Orange	103	18	6	Unknown	4+	1
Riverside	25	4	1	Unknown		
Sacramento	76	26	1		1+	2
San Bernardino	74	31	2		Unknown	
San Diego	45	1	7	Unknown	Unknown	
San Francisco	51	2	1	1+	Unknown	
San Luis Obispo	3	37	1		36	
San Mateo	30	5	1			2
Santa Barbara	21	2	2	1+		
Santa Clara	138	10	3		8+	
Santa Cruz	9		2	3+		
Solano	3	13	4		Unknown	
Sonoma	13	40	1		3+	
Ventura	23	6			2+	
Yolo	13	5	2	2+		
Total	1619	340	77	45+		8

The following sections summarize each of the main database sources.

K-12 Public Schools

Our count of 1619 pre-1980 concrete school buildings is based on data compiled under the authority of Assembly Bill 300 (DGS, 2002). The AB 300 effort counted buildings designed on or after July 1, 1978, so it might have missed some of the "pre-1980" buildings we are counting. Also, our estimate is based on the State Architect's data as it stood in 2008 (DSA, 2008) and does not reflect the recent update (DGS, 2011). For purposes of this statewide estimate, these two differences are expected to be negligible.

The AB 300 effort identified about 9600 non-woodframe pre-1978 buildings statewide; about 7600 of those are in the "Zone 4" area of highest seismicity, and about 6000 of those were categorized by DSA as the most vulnerable structure types. The 1619 pre-1980 concrete buildings thus comprise a group of buildings about one fourth the size of the group DSA originally prioritized. (Because our jurisdictions of interest do not align exactly with DSA's seismicity categories, and because DSA has twice revised its categorization of the most vulnerable structure types, it is difficult to say how many of our 1619 buildings are being tracked by DSA as eligible for certain mitigation programs.)

The K-12 buildings are all low-rise structures, the tallest one just four stories. Of the estimated 1619 K-12 buildings, 1472 (91%) are one story tall, and another 122 (8%) are two stories.

DSA categorized the buildings with a slightly modified set of structure types from the evaluation guidelines known as FEMA 310 (DGS, 2002). For our estimate, we considered five of those types as likely to meet the Coalition's counting criteria. Table 7 gives the breakdown of the estimated 1619 K-12 buildings by height and by structure type. (The "Mixed or Unknown" structure types might include structural materials other than concrete.)

Table 7: Pre-1980 Concrete Public School Buildings by Height and Structure Type

Structure Type (DGS, 2002)	1 Story	2-4 Stories
Concrete Moment Frame	328	39
Concrete Shear Wall (Rigid or Flexible Diaphragm)	786	76
Concrete Moment Frame with Masonry Infill (Rigid or Flexible Diaphragm)	30	0
Precast Concrete Frame (with or without shear walls)	74	3
Mixed or Unknown	254	29

Table 7 shows that the concrete public school buildings are largely squat shear wall structures. However, it is worth remembering that the work done under AB 300 was essentially a triage based on quick reviews of original construction plans. More recent engineering investigations of 38 seismically vulnerable school buildings found that 18 had been misclassified by the AB 300 triage (OPSC, 2011). This does not necessarily mean that buildings thought to be concrete are in fact not concrete. More likely, some buildings thought to be concrete frame could have been found to include concrete shear walls. Still, this finding points to the relative uncertainty of the AB 300 data.

State Agency Facilities

Our count of California state agency buildings is based on data compiled for the Coalition by the Department of General Services (DGS, 2008). In addition to the 340 counted buildings, DGS lists 59 concrete structures that have been rated as Seismic Risk Level II or III, meaning that their resistance to collapse is essentially as good as one would expect from a new building or, for our purposes, from a building designed and constructed after 1980.

The 340 buildings serve 14 state agencies and a variety of occupancies, including:

- Department of Corrections: 78 buildings, including inmate housing
- Department of Developmental Services: 92 buildings, including housing for disabled children and adults

- Department of Mental Health: 73 buildings, including housing and treatment facilities for the mentally ill
- Military Department (National Guard): 24 armories.

As with the K-12 schools, the 340 DGS-listed buildings are predominantly concrete shear wall structures:

- Concrete moment frames: 14 buildings
- Concrete shear walls: 325 buildings
- Concrete moment frame with masonry infill: 1 building.

Court Facilities

Our count of California Judicial Branch facilities is based on data compiled by the Administrative Office of the Courts to support the transfer of court facilities from county to state management (AOC, 2004). The AOC identified 452 court facilities comprising about 700 distinct structures. After certain facilities were exempted from evaluation (due to size, age, etc.) 225 facilities comprising about 356 structures were evaluated using the national standard known as ASCE 31 (an updated and standardized version of FEMA 310). From the statewide AOC records, we identified 104 pre-1980 concrete structures, of which 77 are in the jurisdictions of interest. Our count ignored buildings exempted from the AOC inventory due to post-1988 retrofit (such as the Humboldt County Courthouse in Eureka) and buildings known to have been retrofitted since the 2004 evaluations (such as the B.F. Sisk Courthouse in Fresno).

We considered the same concrete structure types as DSA considered for the AB 300 survey of public schools, plus the structure type that combines steel moment frames with concrete shear walls.

These 77 court buildings contrast with the pre-1980 concrete school buildings. More than 90 percent of the school buildings were only one story tall. Of the 77 court facilities, only ten are a single story, and 31 are four stories or taller.

Like the schools, however, the 77 court facilities are predominantly concrete shear wall structures:

- Concrete moment frames: 2 buildings (both one story)
- Concrete shear walls: 45 buildings (up to 13 stories)
- Concrete moment frame with masonry infill: 1 building (5 stories)
- Precast concrete frames: 1 building (5 stories)
- Steel frame with concrete shear walls: 28 buildings (up to 17 stories).

University of California Buildings

The UC and CSU campus inventories were developed from various databases and reports that have been prepared for each campus. EERI interns combined much of these data. Many of these campuses have active seismic safety programs, where campus officials have been systematically identifying the most hazardous buildings, and retrofitting them. The UC system adopted a policy in 1975 requiring the seismic evaluation of its buildings, and the CSU system adopted such a policy in 1993. According to a California Watch investigation, there are 10 buildings remaining on the UC list that are highly vulnerable (Perez 2010). According to the CSU system, there are 28 such buildings, in a priority one class, as of 2010 (CSU Seismic Ratings 2010). It can be assumed that some significant percentage of these buildings will be concrete, but we do not necessarily know. Coalition volunteers recognize that there is uncertainty with these numbers; in particular it is not clear from these numbers if these are only buildings that are awaiting retrofit. Some of the numbers seem very low to volunteers familiar with these campuses. On the other hand, if the buildings have already been retrofit they would likely not be in the same category of concern as buildings awaiting retrofit. For one CSU campus, Cal Poly San Luis Obispo, we were able to conduct a careful inventory that found 36 count-eligible buildings, but all but one are 1-3 stories tall (and 25 are 1-2 stories), and all but one have shear walls. The one without shear walls has an ordinary moment resisting frame. All 36 were deemed acceptable by CSU's seismic evaluation program in the 1990's.

Table 8: Estimates Of Pre-1980 Concrete Buildings on University Of California Campuses

	Complete Building List (from facilities depts.)	Complete Concrete Bldg List	# Pre-80 Conc Bldgs	# Campus Bldgs	# Pre-80 Bldgs	# Pre-50 Bldgs
Berkeley	Y	Partial	25	~270		
Davis	Y	N	2—10+	~1200		
Irvine	Y	N		556	179	9
UCLA	Y	N	10	400	91	18
Riverside	N	N				
Merced	N	N				
UCSD	Y	N		~650	240	28
UCSF	N	N	1			
Santa Barbara	N	N	1			
Santa Cruz	N	N	3			

- UCB has the most complete information related to older concrete buildings, including UC Berkeley Seismic Action Plan; Comerio et al 2006; Luckle and Perez, 2010. The building list for UCB came from the Seismic Action Plan and does not include any dates for building construction:
- Davis, Irvine, UCLA & UCSD building list seems to include spaces/areas such as garden sheds, temporary storage, etc. which may be a reason why the number of campus buildings is so large
- Irvine & UCSD building lists include UBC designation for each structure

California State University Buildings

Table 9: Estimates Of Pre-1980 Concrete Buildings on California State University Campuses

			Partial					
	Complete Bldg List	Complete Conc Bldg List	# Conc Bldgs	# Pre-80 Conc Bldgs	# Campus Bldgs	# Pre-80 Bldgs	# Pre-50 Bldgs	# Bldgs from Luckle & Perez
Bakersfield	Y	N			76	28	0	
Channel Islands	Y	N	2	2	45	19	15	2
Dominguez Hills	Y	N	1	1	57	33	0	
East Bay	Y	N	3	3	61	28	0	2
Fresno	Y	N	1	1	182	136	0	1
Fullerton	Y	N	4	4	91	34	5	
Humboldt	Y	N	6	6	103	70	5	1
Long Beach	Y	N	3	3	106	80	0	3
Los Angeles	Y	N	5	5	44	18	0	3
Maritime Academy	Y	N			46	22	8	
Monterey Bay	Y	N			72	51	51	
Northridge	Y	N	2	2	89	24	0	
Pomona	Y	N	2	2	194	86	18	
Sacramento	Y	N	1	1	71	33	0	1
San Bernardino	Y	N			81	25	0	
San Diego	Y	N			153	65	17	
San Francisco	Y	N	1		84	31	9	
San Jose	Y	N	8	8	84	40	6	4
San Luis Obispo	Y	Y	42	36	125	74	15	
San Marcos	Y	N			29	0	0	
Sonoma	Y	N	3	3	46	25	0	
Stanislaus	Y	N	2	2	74	38	0	2
Total			86	79	1913	960	149	

Sources: Space and Facilities Database Management System Facility Report 2009; Luckle and Perez, 2010, engineering reports prepared by seismic safety evaluation program in the early 90's by various engineering firms for DSA; Seymour 2009 Cal Poly Senior Project: Inventory of Non-ductile Concrete Buildings in San Luis Obispo.

Federal Buildings

Our count of Federal government buildings is based on data compiled for the Coalition by the General Services Administration Region IX (GSA, 2009). GSA provided a list of 14 facilities with concrete structure types, of which 13 are in our jurisdictions of interest. Three were omitted from our count because they have either been strengthened or removed from the GSA inventory since being evaluated. Two others were omitted because they were designed and built after 1980.

The remaining eight buildings range in height from two to eight stories. Two are listed as concrete moment frames (one 2-story and one 6-story). The balance are listed as concrete shear wall structures.

Hospitals

The Office of Statewide Health Planning and Development manages public and private hospital facilities in California. OSHPD's Facilities Development Division runs a Seismic Mitigation Program to comply with the mandatory retrofit ordinance known as SB 1953.

In 1994, OSHPD was tracking 2673 buildings ate 490 acute care facilities. Potentially, the number of pre-1980 concrete hospitals in this group could be around 1000. However, the Coalition omits these from our count because the implementation of SB 1953 assures that the risks associated with them are being mitigated.

6. Three Example Approaches Used By Volunteers

To give other jurisdictions interested in conducting a building inventory with volunteers, this section describes three examples of volunteer approaches in different jurisdictions—one (Alameda), where the volunteer, David McCormick, used a combination of techniques including Sanborn maps, meeting with the building official and sidewalk observations; one (San Francisco), where the lead volunteer, Stephen Kadysiewski, led a team that counted every concrete building on the Sanborn maps, then conducted random site visit verifications and made adjustments based on additional knowledge, and where an additional group of almost 100 volunteers conducted a sidewalk survey of downtown areas; and one (San Luis Obispo) where an engineering student, Emmett Seymour, surveyed all the buildings on the CSU campus and estimated the number of buildings in town. As discussed earlier, there were other techniques used by volunteers (refer to Table 2 for a summary), and all these approaches are documented by the individual volunteers on the Concrete Coalition website. In addition, the counts for each city are listed in Appendix F as well as the Concrete Coalition website.

City of Alameda

An inventory of these buildings in the City of Alameda was conducted by David McCormick, an EERI member and principal at Simpson Gumpertz & Heger. The City of Alameda consists of Alameda Island and Bay Farm Island, which is no longer an island but is attached by fill to Oakland adjacent to the Oakland International Airport. Alameda is largely a residential city with a population of about 75,000 people. It has two small business districts, Webster Street and Park Street, and also is home to the decommissioned Alameda Naval Air Station and the Coast Guard.

McCormick began the inventory of Alameda by using his thorough knowledge of the city to identify areas expected to have older concrete buildings. He biked throughout the city focusing on commercial and industrial areas where larger buildings would more typically be located. During his field work, David took pictures of identified and suspected concrete buildings and recorded the number of stories, apparent irregularities, occupancy, building adjacencies, building condition, etc. One difficulty he encountered was gaining access to some military buildings on the old Naval Air Station. Also, classifying buildings that are a mix of structure types and materials often required engineering judgment and expertise. It was not uncommon for McCormick to have to walk around the buildings to where there are fewer architectural finishes and look for board forms from cast-in-place concrete construction. He also used techniques like looking inside the buildings, knocking on the walls, looking for elevated floors/cripple walls and looking for retrofits to identify the structure type.

After the initial field work, McCormick and another Concrete Coalition volunteer, Marguerite Bello, contacted Alameda's building official, Greg McFann, who provided much assistance. McFann had members of his staff access the Assessor's property tax data and provided access to zoning maps and Sanborn maps. From the Assessor's data, information was pulled regarding the total number of buildings in Alameda as well as the total number of pre-1980 buildings. The zoning maps helped identify residential districts that could be eliminated, since most residential areas are made up of wood framed buildings. The Sanborn maps proved valuable since they were updated until the mid-1980's. There was uncertainty in identifying several buildings on the maps and those required revisiting. Also, the Naval Air Station was not included in the dated Sanborn maps. Extensive notes were taken from the Sanborn maps of buildings that needed this additional verification in the field.

Next, McCormick did library research on the history of Alameda's buildings. He found work by Woodruff Minor and various reports used to qualify buildings in Alameda for the National Register of Historic Places. These reports identified the construction types.

McCormick then combined his findings from his initial field work, the Sanborn maps and his library research. He found conflicts for 10-15% of the concrete buildings from his combined list. After verification using Google maps, McCormick revisited parts of the city to clear up the discrepancies. He found that some buildings shoen on the Sanborn maps had been demolished or were inaccurately identified. He also found that he simply missed some buildings during his initial field work. McCormick estimates that his initial field work included approximately 85% of the final total number of pre-1980 concrete buildings.

McCormick then compiled all his information and finalized his building count for the inventory of Alameda. There were a number of buildings he did not include in the count because they were either unoccupied storage buildings, wood warehouses separated into sections by concrete firewalls or podium structures with concrete block shear walls. In the end, there were twenty-four pre-1980 buildings he could not be certain about. The results yielded the number of concrete buildings in Alameda to be in the range of 138 to 162 and the number of pre-1980 concrete building to be in the range of 126 to 150. Many of the buildings counted were one story and contained many shear walls. Also, concrete buildings on school and hospital sites were observed but not counted because there are separate databases that include that information.

City of San Francisco

Most of the material in this section is extracted from material written by Steve Kadysiewski and available on the Concrete Coalition website under the City of San Francisco report.

Introduction

The inventory of pre-1980 concrete buildings in San Francisco was based on the Sanborn fire insurance maps and was produced in phases. In Phase 1, volunteers met at the San Francisco public library and counted every concrete building on each of the 1200 Sanborn maps available for the city. The Phase 1 estimate from the maps was 3,851 buildings. Phase 2 involved a field verification of a random sample from the maps, and led to Phase 3, an adjustment of the initial count to reflect demolished structures, structures constructed after 1980, concrete block buildings, etc. The Phase 3 estimated count of pre-1980 concrete buildings is roughly 3,200. Approximately half of the buildings have one or two stories. The field count was further corroborated by a sidewalk survey with participation from almost 100 students and practicing engineers who looked at approximately 850 concrete buildings in the downtown area (Phase 4, described below).

Additionally, it is estimated that there are a total of 130,000 buildings of all types in San Francisco today, of which 115,00 were built before 1980. The total number of concrete buildings of all ages is estimated as 4,000.

Phase 1: Extracting Information From All the Sanborn Maps

In Phase 1 the number of concrete buildings was determined for every map in each of the 11 Sanborn volumes for San Francisco. Due to time limitations, not all available information was recorded for each concrete structure. Rather, the total number of concrete (or suspected concrete) buildings on each map was recorded. The number of these concrete buildings that were residential, public assembly, parking, or institutional type buildings was also recorded. The criteria for deciding whether to count a particular structure was based on the Coalition's guidance (see "What to Count" in Appendix D). Buildings identified as built in 1980 or later were not counted.

Some concrete block bearing wall buildings were also counted in Phase 1. The means for correcting this error are discussed below. Also discussed below are the sources of uncertainty and possible errors in the final count.

The data for all the maps is given in the file "San_Francisco_2009_05_10.xls", available under the City of San Francisco on the Concrete Coalition website (California Inventory project). The Phase 1 count estimated the number of pre-1980 concrete buildings in San Francisco as 3,851.

Phase 2: Initial Verification by Small Group of Volunteers

The Sanborn maps in the San Francisco Library were updated until approximately 1985. In order to check the current accuracy of the maps, and to determine the number of buildings demolished since the last update, it was decided to perform a verification based on field, or "sidewalk," inspection. A sample of 70 map pages (out of about 1200 for the whole city), five from each of eleven volumes, was chosen, partly randomly, and partly based on areas with high concrete building counts. For each of the selected maps, a full set of information available for each suspected concrete building was extracted. Each of these buildings was visited, and findings recorded. In some cases, it was possible to determine the current status by using Google Streetview, which was also helpful for virtually visiting the site. (The results of these site visits were recorded in Excel "Verify" files. The full set of Verify files is contained in the file "Field_Verification_Summary_rev_2.xls" on the Concrete Coalition website under San Francisco.)

Phase 3: Adjustment of Results

Some of the pre-1980 buildings shown on the 1985 Sanborn maps have been demolished. Assuming that the difference between the original count for the selected maps and the verified count is due mostly to demolition, and also the removal of concrete block structures from the total, the original count of 3,851 was multiplied by the verification ratio of 87.5% to arrive at a value of 3,368. However, there were other uncertainties that needed to be considered, including possibly overcounting by a small percentage, because of unclear markings on the Sanborn maps, and possible undercounting because of not seeing that a building was actually concrete. Modification factors for these possibilities were added to the count of 3,368 to arrive at a revised estimate of 3,200.

Phase 4: Sidewalk Survey by a Large Group of Volunteer Engineers and Students

The inventory was then supplemented by a detailed sidewalk survey of the downtown area, organized by the Northern California chapter of EERI, EERI staff, and the Structural Engineers Association of Northern California. Ninety-three volunteers, including 44 students from Stanford, UC Berkeley, San Jose State, San Francisco State, and UC Davis, looked at about 850 buildings in 9 neighborhoods.

The purpose of the sidewalk survey was to supplement the earlier inventory work led by Kadysiewski. The Phase 1-3 work suggested that it might be possible, with enough volunteers, to generate a detailed building-by-building inventory for a large jurisdiction. With building-specific data, we will be able to say not only how many pre-1980 concrete buildings exist in San Francisco, but how they are distributed by age, occupancy, size, and structure type. Importantly, as Phases 2 and 3 showed, field work could also confirm and correct the data compiled initially from Sanborn maps.

From previous building inventory efforts, and from the recognition that concrete buildings are not as easily identified from the street as other structure types, the organizers knew that volunteers would need to work from lists of specific addresses. The Phase 1-3 work confirmed that such a list could be produced with high reliability. Thus, the first step was to produce an address list.

Volunteers from UC Berkeley's EERI student chapter along with some of the volunteer practicing engineers produced address lists from the 41 Sanborn map pages with the most concrete buildings (identified in Phase 1). In addition, one student from UC Berkeley and an EERI staff member took high resolution digital photographs of each of the 41 Sanborn map pages in the downtown area. The photographs were printed and used on the survey day as guides for the volunteers. These preparatory steps took several weeks to organize and execute.

For the field survey itself, teams of two to four students and engineers (with at least one practicing engineer per team) were each assigned an area of about four city blocks. Each team was issued a photo of the relevant Sanborn map survey sheets pre-printed with the addresses of interest (Figure 5). In addition to recording selected characteristics of the buildings, surveyors were asked to take at least one picture of each building.

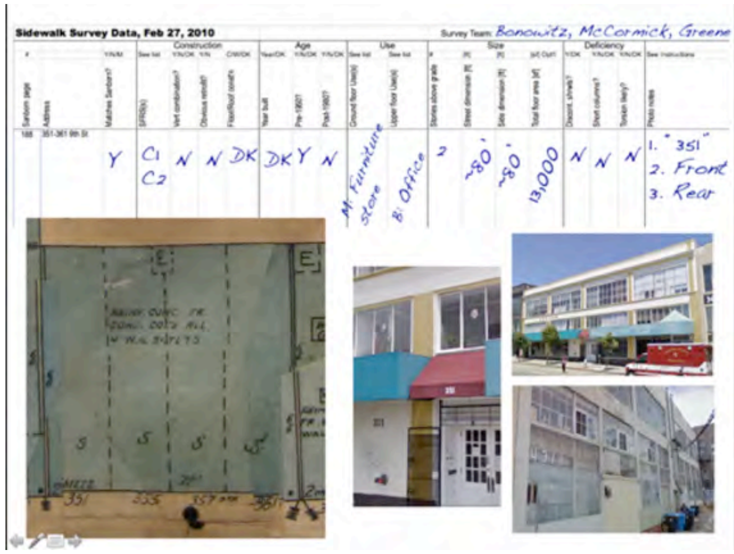
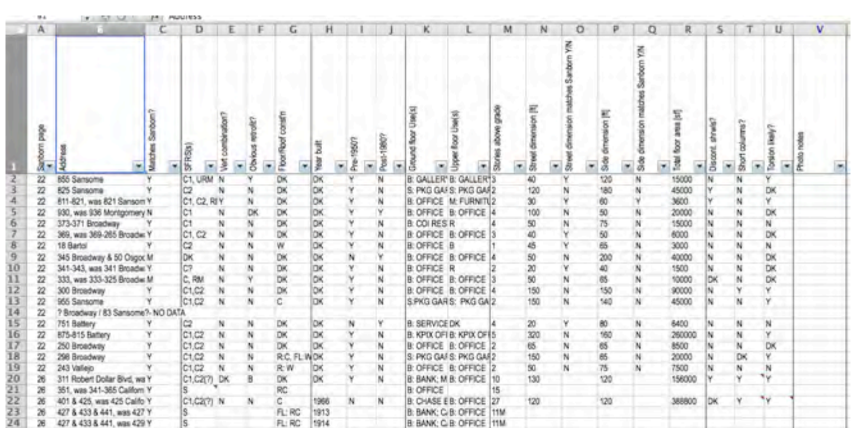


Figure 5. Each team was issued a data collection form pre-printed with addresses of the properties of interest. Pre-survey training on how to complete the forms was provided.

The key to the success of the survey was the preparation and the detailed instructions about what was to be collected, how to enter data in the form, and the types of data collection problems and inconsistencies surveyors were likely to encounter. Before going into the field, all surveyors participated in a half-hour training session. Topics included how to read the Sanborn maps, how to identify a concrete building, how to organize and identify photos so they could be easily cataloged later, tips for taking useful photos, and guidelines for the general conduct of the effort. Surveyors were given several copies of a one page FAQ document to hand to building owners, tenants, or members of the public curious about the inventory collection. See Appendix E.

With the sidewalk work complete, some of the students who participated in the survey spent two days entering the information from the survey forms into a master spreadsheet. Figure 6 shows the structure of the worksheet. Summarizing the data for a large survey like this can be a major effort, and the fact that the data compilation was able to occur during students' spring break was a benefit for the project.



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
1	Sanborn page	Address	Matches Sanborn?	SFRS(s)	Vert combination?	Obvious retrofit?	Floor/Roof constr'n	Year built	Pre-1950?	Post-1980?	Ground floor Use(s)	Upper floor Use(s)	Stories above grade	Street dimension [ft]	Street dimension matches Sanborn Y/N	Side dimension [ft]	Side dimension matches Sanborn Y/N	Total floor area [sf]	Discont. shrwls?	Short columns?	Torsion likely?	Photo notes
2	22	855 Sansome	Y	C1, URM	N	Y	DK	DK	Y	N	B: GALLER*	B: GALLER*	3	40	Y	120	N	15000	N	N	Y	
3	22	825 Sansome	Y	C2	N	N	DK	DK	Y	N	S: PKG GA	S: PKG GA	2	120	N	180	N	45000	Y	N	DK	
4	22	811-821, was 821 Sansom	Y	C1, C2, R	Y	N	DK	DK	Y	N	B: OFFICE	M: FURNITU	2	30	Y	60	Y	3600	Y	N	Y	
5	22	930, was 936 Montgomery	N	C1	N	DK	DK	DK	Y	Y	B: OFFICE	B: OFFICE	4	100	N	50	N	20000	N	N	DK	
6	22	373-371 Broadway	Y	C1	N	N	DK	DK	Y	N	B: COI RES	R	4	50	N	75	N	15000	N	N	N	
7	22	369, was 369-265 Broadw	Y	C1, C2	N	N	DK	DK	Y	N	B: OFFICE	B: OFFICE	3	40	Y	50	N	6000	N	N	DK	
8	22	18 Bartol	Y	C2	N	N	W	DK	Y	N	B: OFFICE	B	1	45	Y	65	N	3000	N	N	N	
9	22	345 Broadway & 50 Osgoo	M	DK	N	N	DK	DK	N	Y	B: OFFICE	B: OFFICE	4	50	N	200	N	40000	N	N	DK	
10	22	341-343, was 341 Broadw	Y	C?	N	N	DK	DK	Y	N	B: OFFICE	R	2	20	Y	40	N	1500	N	N	DK	
11	22	333, was 333-325 Broadw	M	C, RM	N	Y	DK	DK	Y	N	B: OFFICE	B: OFFICE	3	50	N	65	N	10000	DK	N	DK	
12	22	300 Broadway	Y	C1,C2	N	N	DK	DK	Y	N	B: OFFICE	B: OFFICE	4	150	N	150	N	90000	N	Y	Y	
13	22	955 Sansome	Y	C1,C2	N	N	C	DK	Y	N	S:PKG GAR	S: PKG GA	2	150	N	140	N	45000	N	N	Y	
14	22	? Broadway / 83 Sansome?- NO DATA																				
15	22	751 Battery	Y	C2	N	N	DK	DK	N	Y	B: SERVICE	DK	4	20	Y	80	N	6400	N	N	N	
16	22	875-815 Battery	Y	C1,C2	N	N	DK	DK	Y	N	B: KPIX OFI	B: KPIX OF	5	320	N	160	N	260000	N	N	Y	
17	22	250 Broadway	Y	C1,C2	N	N	DK	DK	Y	N	B: OFFICE	B: OFFICE	2	65	N	65	N	8500	N	N	DK	
18	22	298 Broadway	Y	C1,C2	N	N	R:C, FL:W	DK	Y	N	S: PKG GA	S: PKG GA	2	150	N	65	N	20000	N	DK	Y	
19	22	243 Vallejo	Y	C1,C2	N	N	R: W	DK	Y	N	B: OFFICE	B: OFFICE	2	50	N	75	N	7500	N	N	N	
20	26	311 Robert Dollar Blvd, wa	Y	C1,C2(?)	DK	B	DK	DK	Y	N	B: BANK; M	B: OFFICE	10	130		120		156000	Y	Y	Y	
21	26	351, was 341-365 Californ	Y	S			RC				B: OFFICE		15									
22	26	401 & 425, was 425 Califo	Y	C1,C2(?)	N	N	C	1966	N	N	B: CHASE E	B: OFFICE	27	120		120		388800	DK	Y	Y	
23	26	427 & 433 & 441, was 427	Y	S			FL: RC	1913			B: BANK; C	B: OFFICE	11M									
24	26	427 & 433 & 441, was 429	Y	S			FL: RC	1914			B: BANK; C	B: OFFICE	11M									

Figure 6: Structure of the worksheet compiling information from the sidewalk survey

There were two major outcomes from the Phase 4 survey. First, it confirmed the Phase 1-3 counts and adjustments as very accurate. This suggests that, for those jurisdictions where Sanborn maps are available, it is possible to derive a reliable inventory using the counting and sample verification process. This might be particularly useful for older, larger jurisdictions where it is not possible to make a field visit to every block that might have such buildings. Second, it engaged a number of engineers and students in a practical use of their knowledge and skills, helping to build the community knowledge-base with respect to non-ductile concrete buildings.

Cal Poly Campus and City of San Luis Obispo

An inventory of concrete buildings in San Luis Obispo, California was done by Emmett Seymour, an EERI member, as his senior project at Cal Poly, San Luis Obispo. He chose to divide the city of San Luis Obispo into two parts: Cal Poly's campus and the rest of the city. This approach was rational as well as efficient, since different resources and historic patterns apply to the two groups of buildings.

The strategy for identifying pre-1980 concrete buildings on Cal Poly's campus was fairly straightforward. First, Seymour gathered information about the building stock on campus from "Campus Architectural History – Building List" posted on the Cal Poly Facilities department website. This document contained general information about each building on campus, including its completion date, structural system, and construction cost. The descriptions of the structural systems were vague, however, and more thorough information was needed.

Next, Seymour worked with Rex Wolf, a veteran of the Cal Poly Facilities department and an authority on the campus' development history. Using a map of the campus, Wolf identified from memory the construction materials and structural systems of about 80 percent of the campus buildings. For buildings that were not identified, Seymour and Wolf examined the structural plans. Once all buildings had been identified by material and structural type, Seymour went through the list of concrete buildings eliminating tilt-up buildings and buildings that were built under modern codes utilizing ductile detailing and construction.

Overall, 36 campus buildings were identified as being potential non-ductile concrete structures. From the building plans, Seymour was able to record information about the gravity system, lateral system and date on the plans of each building. He supplemented the plan information with photographs of each building. Thirty-five of the 36 buildings are between one and three stories; the Administration Building is five stories tall. Also, all but one building on the list has a shear wall lateral force resisting system.

Wolf also made available the records of a campus seismic survey done in 1992 as part of a CSU system-wide program. The 1992 seismic study found that all the buildings on Cal Poly's campus satisfied the program's criteria for earthquake safety.

A different strategy was used to locate pre-1980 concrete buildings in the off-campus portion of the City of San Luis Obispo. Working with historic Sanborn maps, a land use map of the city, and Google Earth satellite imagery, Seymour isolated "areas of interest" in the city where older concrete buildings were more likely to be found. He then methodically surveyed these areas in person, recording notes and taking photographs of suspected concrete buildings.

The land use map facilitated identification of commercial (as opposed to residential) development. To make the map more useful, Seymour transferred an outline of the commercial areas and city limits to a satellite image from Google Earth. It is not practical to identify a building's structural system using Google Earth, but by zooming in and out it was possible to pinpoint the exact areas and particular buildings to target during the field work.

Sanborn maps of San Luis Obispo proved useful even though they had been updated only until about 1960. Seymour located the maps at the San Luis Obispo County Historical Museum. He searched the maps for buildings color coded blue and identified as concrete (but not concrete block), noting the address, number of stories, structural system, and other mapped data for each one.

Through field work, Seymour found that the majority of the concrete buildings identified in that area from the Sanborn maps were still in place. He also found the younger areas of the city utilized mostly CMU and light gauge steel construction instead of concrete. The concentration of older concrete buildings was in the downtown and neighboring areas. In the field, Seymour supplemented the Sanborn information and took photographs. Overall, he identified 27 concrete buildings designed or built with pre-modern codes. The majority of these buildings are retail stores and restaurants in the downtown area. Three of the identified buildings had plaques on them stating they are URM buildings, although the Sanborn maps and Seymour's field work indicate they are mostly concrete or have concrete walls. There were also two buildings that were possibly concrete but could not be verified; therefore, they were not included in the total count of twenty-seven buildings.

Seymour's search of Cal Poly's campus and the City of San Luis Obispo yielded a total of sixty-three buildings. Including the possibility of overlooking or misidentifying a few buildings, he estimated there to be 60-70 buildings eligible for the Coalition's inventory in San Luis Obispo. The buildings on Cal Poly's campus make up more than half of the inventory. The majority of the concrete buildings identified in the city are 1 to 2 stories.

7. Using the Inventory Data: Next Steps for the Concrete Coalition

The Concrete Coalition will continue to study and refine the inventory of pre-1980 concrete buildings, particularly by encouraging volunteers in more cities to conduct surveys. By increasing the inventory estimates provided by volunteers, it becomes possible to further refine the prediction model, giving us more confidence in the state-wide estimates. In addition, further inventory work may make it possible to identify better surrogates for older concrete buildings that can then directly improve the regression model.

But we believe that the current estimate, based on the three strategies described in this report (volunteer estimates, regression analysis, and access to statewide databases) is valid enough that it is important to also take steps to move on to using the inventory. The first set of tasks focuses on using engineering knowledge, through the volunteer network, to understand which of these buildings represent the highest risk, and to identify appropriate retrofit technologies. This next level of inventory and loss estimation involves more careful study of specific buildings, applying our understanding of the riskiest structural conditions and details. Specific tasks that could help understand these buildings and how to retrofit them include:

1. Have individual volunteer engineers in the Concrete Coalition write up descriptions of particular building types. Develop a template that volunteers follow for these standard types. These would typically be buildings they have worked on--they can access drawings, are familiar with retrofit approaches, etc. It might be possible to build this template in such a way, similar to Wikipedia, that other engineers can comment on the descriptions.
2. Have volunteers and student interns go through the databases of photos from past earthquakes, categorizing typical damage to concrete buildings, which will help us understand the most typical damage patterns and the most vulnerable features.
3. From tasks above, develop categories of buildings at most risk. Develop a screening procedure that would help owners and jurisdictions identify if they have buildings in these categories. (Work underway with PEER and ATC will identify appropriate retrofit strategies).
4. Conduct several pre-event surveys in pilot jurisdictions, to collect baseline data on older concrete buildings, particularly those in close proximity to strong motion stations, and those that have been retrofit. This would then help evaluate effectiveness of retrofit, after the next big event, as well as provide baseline data that would be useful in any analysis after the next event.
5. Develop guidance for one-story wood-roof concrete buildings. Knowledge exists right now about how to retrofit these buildings.

The Concrete Coalition is also proposing a set of targeted tasks that are focused on developing tools to help cities understand the problem and the range of options currently available for mitigating the risk. The Coalition hopes to work with two to four pilot cities to help city officials understand the problem and options for mitigating risk:

1. Develop a step-by-step toolkit for jurisdictions that would like to develop their own inventories of older concrete buildings
2. Prepare guidance for jurisdictions on typical types of concrete buildings—some typical types are found throughout west coast cities. Develop local taxonomies—since much construction is similar up and down the coast, this taxonomy would apply to many jurisdictions
3. Share information about triggers, incentives, and policies across jurisdictions. These include case studies from:
   - Los Angeles—loft conversions
   - UC Berkeley—retrofit program
   - Palo Alto—parking credits for retrofitted buildings
   - Seattle –negotiated retrofits
4. Develop an awareness-building program for multiple stakeholders—government officials, community leaders, building owners, etc. Work through Shake-Out events.
5. Generate a set of talking points for cities—current consensus on these buildings, ways they typically perform, etc.

The Concrete Coalition project has brought together practicing engineers and academics to use their skills and knowledge to estimate the number of older concrete buildings in California. The Coalition hopes to continue to refine the estimates; readers who question the numbers presented here are encouraged to contribute information that will further improve these estimates. Together, the earthquake engineering community can move forward in understanding and addressing the risk posed by these older buildings.

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Appendix A: Project Steering Committee

Appendix A: Project Steering Committee

Craig Comartin, Project Chair CDComartin Inc

Nick Alexander, Degenkolb Engineers

Thalia Anagnos, President, EERI and San Jose State University

Wendy Beomecke, CA OES (now California Emergency Management Agency)

David Bonowitz, S.E.

Michael Cochran, WAI

Nick DelliQuadri, Consultant

Ken Elwood, University of British Columbia

Heidi Faison, PEER, UC Berkeley

Marjorie Greene, EERI

Bill Holmes, Rutherford & Chekene

Victoria La Mar Haas, CA OES (now California Emergency Management Agency)

Joan MacQuarrie, City of Berkeley

Chris Martin, AC Martin Partners

Peter May, University of Washington

Dave McCormick, Simpson Gumpertz Heger

Jack Moehle, PEER, UC Berkeley

Chris Rojahn, Applied Technology Council

Fred Turner, CA Seismic Safety Commission

Susan Tubbesing, EERI

Appendix B: Complete List of Concrete Coalition Volunteers

CONCRETE COALITION VOLUNTEERS

LAST	FIRST	AFFILIATION
Abo-Shadi	Nagi	Engelkirk
Akici	Ersen	UC Berkeley
Alexander	Nick	Degenkolb Engineers
Alimoradi	Arzhang	JAMA
Altoontash	Arash	ABS Consulting
Anagnos	Thalia	SJSU
Anderson	Sonia	
Ansari	Mehri	Ansari Inc
Arnold	Scott	Fyfe Co LLC
Aslani	Hesaam	RMS
Bansal	Aarti	Stanford University
Barrilleaux	Jared	ZFA Structural Engineers
Bartoletti	Stacy	Degenkolb Engineers
Basualdo	Laura	Stanford University
Bello	Marguerite	Bello & Associates
Biscombe	Lauren	Stanford University
Bonowitz	David	consultant
Borchers	Eric	Rutherford & Chekene
Brackmann	Emily	Moffatt & Nicol
Breiholz	Dave	Breiholz Qazi Engineering Inc
Brocher	Tom	USGS
Buckalew	Jonathan	UC Berkeley
Bwarie	John	City of Los Angeles
Cassel	Anthony	Y2 Structural
Celestino	Alvaro	Degenkolb Engineers
Celikbas	Ayse	Rutherford & Chekene
Chang	David	City of Los Angeles
Chang	Wayne	Structural Focus
Chang	Tammy	UC Berkeley
Chau	Jasper	
Chen	Yu-Ning	Degenkolb Engineers
Chen	Albert	Thornton Tomasetti
Cheng	Michael	California Institute of Technology
Cho	In Ho	California Institute of Technology
Chow	Paul	KPFF Consulting Engineers
Cloke	Steve	County of LA
Cochran	Michael	WAI
Comartin	Craig	CDComartin Inc
Comerio	Mary	UC Berkeley
Cooper	Tom	T.W. Cooper Inc.
Cordova	Paul	Simpson Gumpertz & Heger
Corona	Benito	
Cox-Nitikman	Martha	BOMA of Greater LA

CONCRETE COALITION VOLUNTEERS

Davies	Mike	H.J. Brunnier Associates
Davis	Hal	Rutherford & Chekene
Deierlein	Greg	Stanford University
DelliQuadri	Nick	former LA Building official
Dogruel	Seda	Hinman Consulting Engineers
Dooley	Terry	ACE Mentor Program
Duggan	Daniel	G&E Engineering Systems
Duong	Anh	SJSU
Edewor	Kevwe	SFSU
Ekwueme	Chukwuma	WAI
Elhassan	Rami	IDS Group Inc
Elkhoraibi	Tarek	Bechtel
Elwood	Ken	University of British Columbia
Erkus	Baris	Arup
Esfandiari	Ross	RES Engineers
Espino	Daniel	Crosby Group
Fagent	Dennis	ZFA Structural Engineers
Faison	Heidi	UC Berkeley
Falero	Jeff	Rivera Consulting Group
Fathali	Saeed	Rutherford & Chekene
Fennie	Ned	Fennie & Mehl Architects
Ferguson	Mary	Stanford University
Fong	Franklin	
Freeman	Sig	Wiss, Janney, Elstner Associates Inc
Friedman	David	Forell/Elsesser Engineers
Gavan	John	KPFF Consulting Engineers
Gilligan	Mark	Tipping Mar
Girouard	Randy	ZFA Structural Engineers
Gorman	Mark	URS
Green	Mel	Mel Green & Assoc
Guh	Jeff	Arup
Gunay	Selim	UC Berkeley
Gur	Turel	MMI Engineering
Hachem	Mahmoud	SOM
Hadidi	Rambod	MACTEC
Haight	Jeff	Ehlen Spiess & Haight Inc
Hamburger	Ron	Simpson Gumpertz & Heger
Hammond	David	FEMA US&R Structures Sub-group
Hanson	Bob	
Harburg-Petrich	Patti	Walter P Moore
Hart	Gary	WAI
Hau	Han	CSA Dept
Hayes	Dustin	Barrish Pelham & Associates Inc
Heaton	Thomas	California Institute of Technology
Heckman	Vanessa	California Institute of Technology

CONCRETE COALITION VOLUNTEERS

Hemmatyar	Casey	TMAD Taylor & Gaines
Hernandez	Ricardo Rafael	Degenkolb Engineers
Hess	Richard L.	Hess Engineering
Hill	Paige	Stanford University
Hilmy	Said	IDS Group Inc
Hirsch	Eph	consultant
Hobach	Doug	Hohbach-Lewin, Inc
Holmes	Bill	Rutherford & Chekene
Hudson	Marty	MACTEC
Hussain	Saif M.	Coffman Engineers
Ibarra	Marc	BW Smith Structural Engineers
Islam	Saiful	SBISE
Ivey	Robert	Holland & Knight LLP
Jalalian	Afshar	Rutherford & Chekene
Javadi	Shawn	
Jephcott	Don	consultant
Johnson	Martin	ABS Consulting
Johnson	Nate	Rivera Consulting Group
Jonas	Chris	ZFA Structural Engineers
Jongeward	Adam	
Kaasa	Victoria	UC Berkeley
Kadysiewski	Steve	Bechtel
Kam	Weng Yuen	University of Canterbury
Kansara	Ray	RK Associates
Kasdi	Nur	Johnson Western Gunite
Kaszpurenko	Mike	Structural Engineers Collaborative
Kazemi	Ali	
Kelleher	Thomas	UC Berkeley
Kenyon	Lance	MHP Structural Engineers
Kim	Insung	Degenkolb Engineers
Krebs	Andy	SOM
Kumabe	Colin	City of Los Angeles
Kumar	Amit	City of Portland
Kuo	Heinz	
Lai	James S.	Retired
Langdon	Nathan	Tipping Mar
Langenbach	Randolph	Conservation Tech Consulting
Le	Tim	Parsons
Lee	Jaclyn	Stanford University
Legg	Mark	Legg Geophysical
LeGrue	Jeremiah	Hohbach-Lewin Inc.
Leung	David	UC Berkeley
Lew	Marshall	MACTEC
Lew	Franklin	Retired
Liang	Kevin	

CONCRETE COALITION VOLUNTEERS

Liao	Lawrence	Nishkain Messinger
Liel	Abbie	Univ of Colorado Boulder
Lin	Cheng-Ming	Englekirk
Lindorfer	Kurt	PARADIGM Structural Engineers, Inc.
Luevano	Vanessa	Insight Structural Engineers
Lujo	Julieth	SFSU
Lyons	Bob	BJSCE
MacQuarrie	Joan	City of Berkeley
Maguire	Marion	ICC
Mahoney	Mike	FEMA
Malatesta	Aaron	Stanford University
Manheim	Dan	Tennebaum-Manheim
Manjunath	Chaya	SJSU
Marin	Nik	SJSU
Martin	Valerie	Rutherford & Chekene
Martinez	Joseph	
Maupin	Alice	Grossman & Speer & Associates Inc
May	Peter	Univ of Washington
McCormick	Dave	Simpson Gumpertz & Heger
Mehrain	Mike	URS
Mengelkoch	Samuel	Structural Focus
Mester	Matthew	Degenkolb Engineers
Miller	Mahalia	Stanford University
Mochizuki	Gary	Structural Solutions
Moehle	Jack	UC Berkeley
Moore	Mark	consultant
Morrow	Guy	RMS
Naaseh	Simin	Forell/Elsesser Engineers
Naeim	Farzad	JAMA
Nagar	Pooja	SJSU
Nastar	Navid	Brandow & Johnston Inc
Negrete	Ruben	UC Berkeley
Nelson	Tim	Degenkolb Engineers
Nelson	David	KNA Consulting Engineers Inc
Ng	Kenneth	Stanford University
Ng	Alice	UC Davis
Nguyen	Minh	SJSU
Nudel	Allen	
Nunziata	Tom	UC Berkeley
Olson	Leah	UC Berkeley
Ozeryansky	Dmitry	Yu-Strandberg Engineering
Pan	James	Wiss, Janney, Elstner Associates Inc
Paumier	Nick	UC Berkeley
Perkins	Jeanne	ABAG
Petak	Bill	USC

CONCRETE COALITION VOLUNTEERS

Petuskey	Alex	UC Berkeley
Pham	Derek	CDM
Phelan	Jake	Stanford University
Plazola	Edgar	Insight Structural Engineers
Pomerleau	David	IDS Group Inc
Powers	Jason	ZFA Structural Engineers
Prasad	Badri	Thornton Tomasetti
Rafiee	David	Simpson Gumpertz & Heger
Raheja	Naresh	RMS
Rand	Meghann	Rutherford & Chekene
Redmond	Lucy	Rutherford & Chekene
Revelli	Peter	Rutherford & Chekene
Revelli	Jen	Stanford University
Richter	Tobias	Areva NP Inc
Rivas	Ricardo	Biggs Cardosa
Rodgers	Janise	GeoHazards International
Roi	Jeff	Degenkolb Engineers
Rojahn	Chris	ATC
Rulifson	Greg	Stanford University
Russell	James	
Sampson	Jed	City of Portland
Sanchez	Julio	Fyfe Co LLC
Sarabandi	Pooya	RMS
Sarmiento	Joe	PARADIGM Structural Engineers, Inc.
Schleiffarth	Lynne	Stanford University
Scholer	Christopher	SJSU
Schotanus	Marko	Rutherford & Chekene
Seligson	Hope	MMI Engineering
Sempere	Carlos	Forell/Elsesser Engineers
Shapiro	Dan	SOHA Structural Engineers
Sharpe	Roger	retired
Sherrow-Groves	Nick	UC Berkeley
Shien Chou	Jamie	SJSU
Shiu	Sabina	Forell/Elsesser Engineers
Sigala	Mario	Robinson Meyer Juilly & Associates
Silver	Doug	Coffman Engineers
Skokan	Matt	Saiful/Bouquet Structural Engineers
Spears	Rodney	Retired
Spivey	Justin	Tipping Mar
Stewart	Jamal	UC Berkeley
Stockinger	Herb	Stockinger Structural Engineering
Strand	Don	SBISE
Swensen	Scott	Stanford University
Talaat	Mohamed	Simpson Gumpertz & Heger
Tanikawa	Sachiko	

CONCRETE COALITION VOLUNTEERS

Tanner	Bryce	Arup
Taylor	Joshua	Bentley Systems
Telleen	Karl	Rutherford & Chekene
Tennebaum	Nancy	Tennebaum-Manheim
Tepel	Robert & Alice	State Mining & Geology Board
Thomas	Eric	City of Portland
Thorman	Rob	ZFA Structural Engineers
Tijoe	Martin	Stanford University
Tipping	Steve	Tipping Mar
Tobin	L Thomas	Tobin & Associates
Todd	Peter	SunPower Corp
Toranzo	Luis	KPFF Consulting Engineers
Totten	Greg	PARADIGM Structural Engineers, Inc.
Tporakci	Tuncer	TRT Structural Engineering
Tremayne	Bill	Holmes Culley
Tubbesing	Susan	consultant
Turner	Fred	SSC
Turner	Sean	Structural Group Inc
Vadani	Behrvz	Matrix Seismic Corp
Van Benschoten	Paul	Coffman Engineers
Varney	Greg	KPFF Consulting Engineers
Ventura	Carlos	University of British Columbia
Vignos	Rene	Forell/Elsesser Engineers
Von Berg	Eric	Newmark Realty Capital
Walters	Mason	Forell/Elsesser Engineers
Warner	Chris	ZFA Structural Engineers
Waterman	Charles	Toft, DeNevers & Lee
Welliver	Barry	BHW Engineers
Weyl	Laura	Stanford University
White	Marguerite	SJSU
Whitehurst	Laura	Walter P Moore
Williams	Jeff	PARADIGM Structural Engineers, Inc.
Williams	David	Stanford University
Wilson	Luke	ZFA Structural Engineers
Wong	Kenneth	SFSU
Wong	Ivan	URS
Wu	Stephen	California Institute of Technology
Wyllie	Loring	Degenkolb Engineers
Yang	Frances	Arup
Yegorov	Maksim	UC Berkeley
Youssef	Nabih	Nabih Youssef & Associates
Zagers	Bryan	Coughlin Porter Lundeen
Zamanian	Amir	IAPMES
Zhang	Benjamin	
Zimmerman	Reid	UC Berkeley

Appendix C: Volunteer Guidance Manual

The California Inventory Project of the Concrete Coalition

Guidance Manual for Volunteers

November 2009

Guidance Manual for Volunteers

- The following slides provide a brief introduction to volunteers in the California Inventory Project (numbers refer to slide #s)

Introduction

- Thank you for agreeing to volunteer for the California Inventory Project, which is a program of the Concrete Coalition. Background information on this program is available at www.concretecoalition.org
- Volunteers in California are developing estimates for cities in the 22 highest seismic risk counties of the number of pre-1980 concrete buildings. We want to get an approximate estimate of how many such buildings exist in the state, to help us understand the size of the problem.
- The next step will be determining which small subset of these buildings are truly vulnerable in an earthquake—PEER, one of the partners in the Concrete Coalition, has a major research grant to determine critical deficiencies for these buildings and to suggest possible fixes.

Cities Where we are Looking for Volunteers

- To sign up for a city, first check the website to see if a report already exists for the city. Then, send Marjorie Greene at EERI an email (mgreene@eeri.org) and let her know which city you would like to volunteer for.
- See Table 1 on the next page. We are currently looking for volunteers in cities in the right hand column. However, if you are interested in a different city, please let us know. We'd be happy to accommodate you.

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CONCRETE COALITION CALIFORNIA INVENTORY PROJECT
PROGRESS AS OF NOVEMBER 2009

COUNTY	Volunteer Survey Complete	Survey Started or Soon to Start	Concrete Coalition Would like Survey
Alameda	Alameda	Hayward	
	Albany		
	Berkeley		
	Emeryville		
	Fremont		
	Oakland		
	Piedmont		
	San Leandro		
Contra Costa	El Cerrito	Pleasant Hill	Antioch
	Richmond		Concord
	San Ramon		San Pablo
Humboldt	Eureka		
Marin	Fairfax		Larkspur
	Mill Valley		
	Novato		
	San Rafael		
Mendocino			
Monterey			Monterey
			Pacific Grove
			Salinas
Napa	Napa		
San Francisco	San Francisco		
San Luis Obispo			San Luis Obispo
San Mateo	Burlingame	San Carlos	Belmont
	Daly City	Redwood City	Menlo Park
	Millbrae	San Mateo	San Bruno
			South San Francisco
Santa Clara	San Jose	Los Gatos	Mountain View
	Los Altos		Palo Alto
	Milpitas		Santa Clara
			Sunnyvale
Santa Cruz			Santa Cruz
			Watsonville
Solano			Vallejo
Sonoma	Santa Rosa		Petaluma

What Concrete Coalition Volunteers Need to Count (next 5 slides)

- Prepared by Dave McCormick and David Bonowitz

If in doubt, count it and note that you have counted it.

6

Concrete Building Types	Count Data	Optional – Other Databases Available[1]	Do Not Count Data
City Buildings	X		
County Buildings	X		
State Buildings		X	
Post Offices	X		
County and State Courthouses		X	
Federal Office Buildings and Courthouses		X	
Hospitals Regulated by OSHPD		X	
Utility-owned Bldgs. including Substations	X		
Grade K-12 Public Schools		X	
UC and CSU	X		
Community Colleges	X		
Private Schools and Colleges	X		
Military Bases and Facilities	X		

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[1] Volunteers must indicate if they counted these building types.

Concrete Building Types	Count Data	Optional – Other Databases Available[1]	Do Not Count Data
Prisons	X		
Special Districts including Pump Stations and Buildings at Treatment Plants	X		
Churches	X		
Port Buildings	X		
Regional, County and City Parks	X		

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[1] Volunteers must indicate if they counted these building types.

Concrete Building Types	Count Data	Optional – Other Databases Available	Do Not Count Data
Concrete Frame with Masonry Infill	X		
Wood-frame Residential on Conc. Podium	X		
1-story Cast-in-Place Concrete with Wood Roof (including walls with pilasters)	X		
Concrete Shear Wall with Steel Gravity Frame	X		
Mixed Construction[2]	X		
Tilt-ups			X
Dual System with Concrete Shear Wall[3]			X
Parking Garages	X		
Buildings Whose Concrete Elements are Limited to Fire Walls Between Sections			X
Buildings Whose Concrete Elements are Limited to Basement or Retaining Walls			X

[2] Includes horizontal additions of concrete as well as buildings with concrete lateral load systems in one direction only.
[3] Do not need to make exceptional efforts to verify whether a building has a dual system or not, but if you know, don't count it.

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Concrete Building Types	Count Data	Optional – Other Databases Available	Do Not Count Data
Retrofitted Buildings[4]	X		
Abandoned Buildings	X		
Buildings in Areas Scheduled for Redevelopment	X		
Building-like Nonbuilding Structures[5]	X		
Nonbuilding-like Nonbuilding Structures[6]			X
Concrete Structures Supported on Piers or Wharfs over Water	X		
Buildings used for Storage – No Occupancy	X		

Do not include concrete block buildings without concrete walls.

[4] Obtain approximate retrofit date is possible.
[5] Includes campanile, substation and pumping stations.
[6] Includes silos, tanks, bridges, canopies, covered walkways and monuments.

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Reminder - Ultimate Goal

Your City	
Category	ESTIMATE
Total Number of Buildings	Possible Source: Assessors' Data
Total Number of Concrete Buildings	+ or - 10 –20 %
Pre-1980 Buildings	Possible Source: Assessors' Data
Pre-1980 Concrete Buildings	+ or - 10 –20 %

A range is ok—Also provide some documentation on how you arrived at your estimate—you can write a few sentences on the same page where you enter your contact information (see below for how to enter information online)

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Tips to Identify Concrete Buildings

- Walk behind the building – fewer architectural finishes
  - Look for form boards
- Look inside
- Look for elevated floor/ cripple wall – probably wood
  - Vents
- Knock on wall
- Differentiate from tilt-ups
- Look for retrofits more typical of URM

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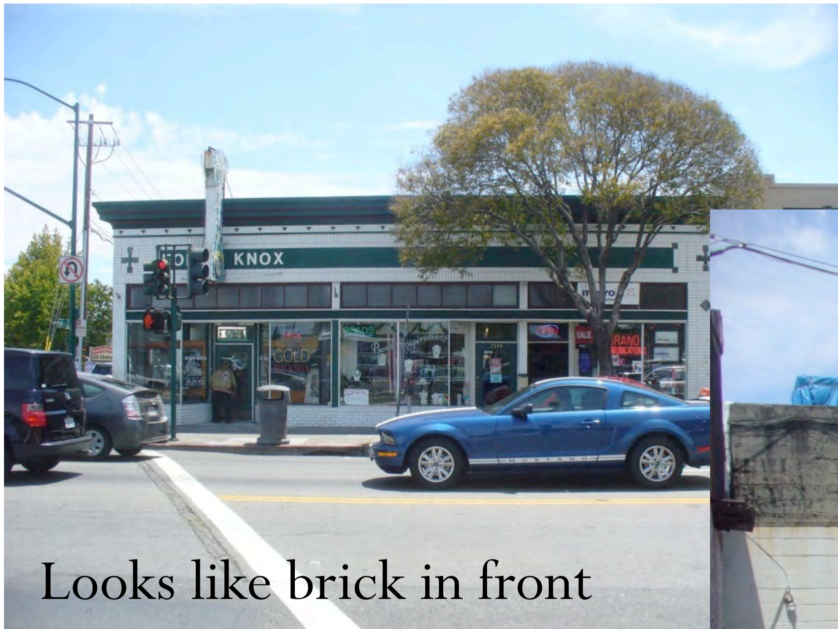
Tilt-ups – Not Included in Count

Look for joints or pliasters

SIMPSON GUMPERTZ & HEGER
Engineering of Structures and Building Enclosures

13



Looks like brick in front

Concrete in the back

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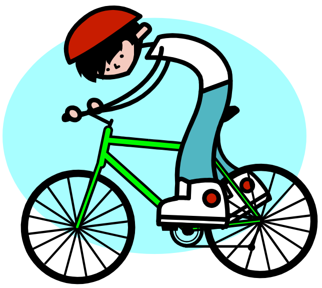
Help from Various Cities

- At the beginning of this project there were a number of presentations made from "pilot cities", with ideas for how to approach developing these estimates. These presentations are available at:
  http://www.concretecoalition.org/?page_id=291
- On the next few pages, there are some tips from the City of Alameda (led by Dave McCormick), and Burlingame (led by Karl Telleen)

Tips from Alameda Survey



- "Walk" the City (bike ride actually)
  - Focus in commercial districts and where larger buildings are located
    - Used knowledge of City
    - Alternate approach would be to use Google
- Contact Building Official and ask for help
  - Assessor data
  - Zoning map
  - Sanborn maps

- Visit library
- Iterate until satisfied

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Data Sheet Used

1538 Webster/Alameda Pizza +

No. of Stories	**1**
Irregularities	**Open front**
Occupancy	**Commercial**
Adjacency	**One side**
Condition	**No deterioration observed**
Comments	**Verified concrete**
	Brick veneer
	Parapet bracing

Tips from Burlingame Survey

Burlingame, CA	
Use Google Earth to define city limits	
Use Google Earth satellite image to visually identify areas of possible concrete buildings (i.e. exclude areas that are clearly wood single-family homes)	
Print out satellite images of identified areas for field work	
Drive through identified areas and determine typical use and construction types for each area; circle buildings that appear to be pre-1980 concrete (mark X on buildings that appear to be post-1980 concrete)	
Estimate percentage of buildings in each area that are pre-1980 concrete (and post-1980 concrete)	
Use Google Earth satellite image to count total number of buildings in identified areas; calculate numbers of concrete buildings in each area by multiplying total number of buildings by percentage concrete	
Estimate total number of buildings in uncounted areas (single-family residential) based on City of Burlingame web site data	
Sum totals	

Tips from Burlingame Survey

Areas and locations of possible concrete buildings
(based on scanning in Google Earth for non-single-family-home-looking roofs)

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Tips from Burlingame Survey

Data

Burlingame buildings			
	Pre-1980 concrete	Post-1980 concrete	Total
Area 1:	60 (45%)	20 (15%)	130
Area 2:	40 (30%)	13 (10%)	130
Area 3:	3 (12%)	1 (4%)	25
Area 4:	15(20%)	1 (1%)	75
Area 5:	0	0	calc'd with other res.
Area 6:	18 (45%)	2 (5%)	40
Area 7:	2 (2%)	0	120
Area 8:	80 (40%)	20 (10%)	200
Area 9:	1 (4%)	0	25
Area 10:	4 (45%)	1 (10%)	9
Area 11:	5 (60%)	0	8
Other areas: Single-family res.	12	2	6700
Total:	**240 (3%)**	**60 (1%)**	**7500**

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Entering Your Information Online

- Once you have compiled basic information, you are ready to enter it online.
- Go to http://www.concretecoalition.org/?page_id=260&page=login (Or www.concretecoalition.org and then click on CA Inventory Project and volunteer log-in page)
- User ID is name of city, all one word, lowercase
- Password is eeri123
- Once you are logged in, select Create New Report
- TO NEXT PAGE--

You should read the Introduction tab, and fill out three other tabs:

- Your information (contact information for the report authors)
- The Community Risk Profile Summary for your jurisdiction (same questions as on other side of this sheet)
- Contacts in the jurisdiction
- All other tabs are meant only to provide suggestions for how you might think about the problem in your community. [Our pilot cities used these questions and we decided through that process that most of these questions should be made supplemental only.]

Dave McCormick of SGH and SEAONC is the volunteer coordinator for Northern California.

California Inventory Project

Thank you for agreeing to volunteer with our inventory project. This project is developing ESTIMATES of the numbers of pre-1980 concrete buildings in California. Volunteers are being asked to provide estimates for the following questions:

Community Risk Profile Summary

County: Alameda

City/Town: Alameda

Drop-down menu of counties and cities

Population: will be provided

Year of Incorporation: will be provided

Population Density: will be provided

Data Sources (select all that apply)

Counts & Surveys: Discussion with Building official

Other (describe):

Plans and Histories: Zoning maps

Field Work: Selected sample areas

Google Earth: Google Earth (if possible, attach kml/z file)

These answers will help us understand how you arrived at your estimates.

Total number of buildings

Single Family Residences:

Multi-Family Residences:

Other Private Buildings:

City Buildings:

Concrete Coalition will provide counts for public schools, CSUs, UC campuses, OSHPD-regulated hospitals and State of CA buildings

AND / OR

Total number of pre-1980 buildings:

Total Square Footage:

Total Number of Pre-1980 Concrete Buildings:

Total Square Footage of Pre-1980 Concrete Buildings:

Estimates can be one number or a range of numbers

Attach File(s):

1.

Please attach files that will help us understand how you derived your estimates, and could be helpful if more detailed analyses are needed. Could include scanned notes, KMZ files, maps, etc.

What the community risk profile summary page looks like online

Range of techniques used by volunteers, as of August 2009

	Sanborn Maps	Zoning Maps	Google Earth	Street Surveying	Building Officials	Tax Assessor's Data	Internet	Library Research	Engineering Firm Archives	Other Online Databases	Other
Alameda	X	X	X	X	X			X			
Albany	X		X	X	X						
Berkeley	X			X	X	X				X	
Burlingame			X	X			X				
Calabasas				X							X (familiarity with city)
Daly City	X		X	X			X				X (US Census; city-data.com; Daly City History Guild)
El Cerrito	X		X	X	X						
Emeryville	X			X							
Eureka		X		X	X						
Fairfax		X		X	X						
Fullerton		X	X	X	X				X		X (loss estimates)
Glendale	X	X	X	X	X						X (building permits)
Long Beach		X	X	X	X						
Mill Valley	X		X		X				X		
Millbrae			X	X	X						
Napa	X		X	X							
Navato		X	X	X			X				
Oakland	X		X								
Piedmont			X	X	X		X				
San Bernadino				X	X						
San Francisco	X		X	X							
San Leandro	X	X		X	X						
San Rafael	X		X		X						
Santa Monica		X	X	X	X	X					
Santa Rosa	X	X	X	X							
Solana Beach		X		X			X				X (local inquiries)

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Summary Data from Northern California Volunteer Cities as of Oct 09

CITY	REPORTED PRE-80 CONCRETE BUILDINGS
Alameda	140-160
Albany	36
Berkeley	275
Burlingame	240
Daly City	30
El Cerrito	22
Emeryville	44
Eureka	10
Fairfax	18
Mill Valley	13
Millbrae	52
Milpitas	0
Napa	14
Novato	18
Oakland	1300
Piedmont	8
Richmond	35-45
San Francisco	3000
San Jose	363
San Leandro	57
San Rafael	53
San Ramon	0
Santa Rosa	55

Our Northern CA Volunteers to Date

CITY	VOLUNTEERS
Alameda	Dave McCormick, Marguerite Bello
Albany	Afshar Jalalian, Ayse Celikbas
Berkeley	Joan McQuarrie, Heidi Faison
Burlingame	Karl Telleen, Kurt Lindorfer
Daly City	Eric Borchers, Nick Alexander
El Cerrito	Afshar Jalalian, Ayse Celikbas
Emeryville	Afshar Jalalian, Ayse Celikbas
Eureka	Randy Girouard
Fairfax	Jason Powers
Fremont	Carlos Sempere
Millbrae	Heinz Kuo
Mill Valley	Dennis Fagent
Milpitas	Azlan Ezaddin
Napa	Chris Jonas

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Our Northern CA Volunteers to Date

CITY	VOLUNTEERS
Novato	Jared Barrilleaux
Oakland	Meghann Rand; Mark Gilligan; Dmitry Ozeryansky; Ayse Celikbas; and Lawrence Burkett
Piedmont	Mohamed Talaat
Redwood City	Mehri Ansari
Richmond	Mark Moore, Janette Mae Gonzales
San Francisco	Stephen Kadysiewski; Marguerite Bello; David Bonowitz; Ayse Celikbas; Valerie Martin; Simin Naaseh; Meghann Rand; Refugio Rochin; Karl Telleen
San Jose	Carlos Sempere, Daniel Espino
San Leandro	Janise Rodgers
San Rafael	Luke Wilson
San Ramon	Jeff Williams
Santa Rosa	Chris Warner, Mark Moore

If you have questions, any of the following folks can help:

Craig Comartin, Project Director: ccomartin@comartin.net

Dave McCormick, volunteer coordinator: DLMcCormick@sgh.com

David Bonowitz, data curator (integrating our data with the statewide databases): dbonowitz@att.net

Marjorie Greene, EERI staff: mgreene@eeri.org

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Appendix D: What to Count Guidance

What Concrete Coalition Volunteers Need to Count

- Prepared by Dave McCormick and David Bonowitz

If in doubt, count it and note that you have counted it.

Concrete Building Types	Count Data	Optional – Other Databases Available[1]	Do Not Count Data
City Buildings	X		
County Buildings	X		
State Buildings		X	
Post Offices	X		
County and State Courthouses		X	
Federal Office Buildings and Courthouses		X	
Hospitals Regulated by OSHPD		X	
Utility-owned Bldgs. including Substations	X		
Grade K-12 Public Schools		X	
UC and CSU	X		
Community Colleges	X		
Private Schools and Colleges	X		
Military Bases and Facilities	X		

[1] Volunteers must indicate if they counted these building types.

Concrete Building Types	Count Data	Optional – Other Databases Available[1]	Do Not Count Data
Prisons	X		
Special Districts including Pump Stations and Buildings at Treatment Plants	X		
Churches	X		
Port Buildings	X		
Regional, County and City Parks	X		

[1] Volunteers must indicate if they counted these building types.

Concrete Building Types	Count Data	Optional – Other Databases Available	Do Not Count Data
Concrete Frame with Masonry Infill	X		
Wood-frame Residential on Conc. Podium	X		
1-story Cast-in-Place Concrete with Wood Roof (including walls with pilasters)	X		
Concrete Shear Wall with Steel Gravity Frame	X		
Mixed Construction[2]	X		
Tilt-ups			X
Dual System with Concrete Shear Wall[3]			X
Parking Garages	X		
Buildings Whose Concrete Elements are Limited to Fire Walls Between Sections			X
Buildings Whose Concrete Elements are Limited to Basement or Retaining Walls			X

[2] Includes horizontal additions of concrete as well as buildings with concrete lateral load systems in one direction only.

[3] Do not need to make exceptional efforts to verify whether a building has a dual system or not, but if you know, don't count it.

Concrete Building Types	Count Data	Optional – Other Databases Available	Do Not Count Data
Retrofitted Buildings[4]	X		
Abandoned Buildings	X		
Buildings in Areas Scheduled for Redevelopment	X		
Building-like Nonbuilding Structures[5]	X		
Nonbuilding-like Nonbuilding Structures[6]			X
Concrete Structures Supported on Piers or Wharfs over Water	X		
Buildings used for Storage – No Occupancy	X		

Do not include concrete block buildings without concrete walls.

[4] Obtain approximate retrofit date is possible.
[5] Includes campanile, substation and pumping stations.
[6] Includes silos, tanks, bridges, canopies, covered walkways and monuments.

Reminder - Ultimate Goal

Your City	
Category	ESTIMATE
Total Number of Buildings	Possible Source: Assessors' Data
Total Number of Concrete Buildings	+ or - 10 –20 %
Pre-1980 Buildings	Possible Source: Assessors' Data
Pre-1980 Concrete Buildings	+ or - 10 –20 %

A range is ok—Also provide some documentation on how you arrived at your estimate—you can write a few sentences on the same page where you enter your contact information (see below for how to enter information online)

Appendix E: FAQ from San Francisco Walk-Around Day

San Francisco Concrete Building Survey, February 27, 2010

What are we doing?
We are collecting data related to certain concrete buildings. A survey of this type is one of the first steps toward understanding and reducing risks to the public and to the city's ability to respond effectively after an earthquake. We are *not* making engineering judgments about the safety or legality of any building.

Who are we?
We are volunteers interested in earthquakes and public safety; mostly building design professionals, earthquake scientists, or university students in those fields; mostly from two organizations: SEAONC and EERI-NC. As volunteers, we are not working for the city or for any business venture.

What are we looking for?
Our survey concerns concrete structures designed and built before building codes were significantly revised around 1980. We already know roughly how many of these buildings there are in San Francisco. The purpose of our survey is to enhance that data with information about building size, use, and approximate age.

What will happen to the data we collect?
The data will be used by researchers, engineers, and planners to help estimate the city's earthquake risk. We will make the data available to the San Francisco Department of Building Inspection for its use in planning and earthquake preparedness.

Is my building safe?
We are not making that judgment with this survey. If you are concerned about the safety of your building, the best thing to do is to call an engineer or the Department of Building Inspection.

Will I have to retrofit my building?
We are not making that judgment with this survey. Mandatory safety improvements generally require legislation. For more information, the best thing to do is to call your Supervisor, your state Assembly member, or the Department of Building Inspection.

Where can I learn more?
- San Francisco Department of Building Inspection: 558-6088, http://www.sfgov.org/site/dbi_index.asp
- Concrete Coalition, http://www.concretecoalition.org/
- Structural Engineers Association of Northern California (SEAONC), www.seaonc.org, http://www.celebratingeqsafety.com/
- Earthquake Engineering Research Institute – Northern California Chapter (EERI-NC), http://www.eerinc.org/
- Earthquake preparedness:
  - Association of Bay Area Governments, http://quake.abag.ca.gov/
  - California Seismic Safety Commission, http://www.seismic.ca.gov/
  - U.S. Geological Survey, http://pubs.usgs.gov/gip/2005/15/

Appendix F: Counts by County

CITY	% OF HOUSING UNITS IN STRUCTURES WITH 20+ UNITS	# HOUSING UNITS	% BUILT BEFORE 1939	# PRE-1980 CONCRETE BUILDINGS: VOLUNTEER ESTIMATE	# PRE-1980 CONCRETE BUILDINGS: REGRESSION MODEL PREDICTION
Alameda	16.2	31,801	37.1	140-150	161
Albany	16.4	7,248	41.9	36	53
Berkeley	13.4	46,602	55.8	275	253
Dublin	10.9	13,125	0.1		1
Emeryville	69.0	4,274	14.0	44	46
Fremont	14.7	71,237	1.7	10	36
Hayward	20.5	47,255	3.5		53
Livermore	4.4	28,792	4.1		13
Newark	8.2	13,408	2.7		8
Oakland	16.9	163,341	42.5	1300	683
Piedmont	0.0	3,859	70.5	8	0
Pleasanton	7.6	25,698	1.3		8
San Leandro	14.6	32,183	9.9	57	62
Union City	8.3	20,036	1.2		7

COUNTY DATA	State Court Facilities	State owned/leased buildings	K-12 Public Schools	UC Campus	CSU Campuses	Federally-owned Buildings	
# pre-1980 concrete bldgs	5	2	161	25(UC Berkeley)	3 (Cal State East Bay)		TOTAL = 196

SOURCES

Census data (% of housing units in structures with 20+ units, # of housing units, % built before 1939): U.S. Census Bureau, American FactFinder, 2005-2009 American Community Survey
volunteer estimates: EERI volunteers
regression model prediction: from model developed by Concrete Coalition steering committee member Professor Peter May, University of Washington
state court facilities: AOC, 2004. Superior Courts of California, Seismic Assessment Program: Summary Report of Preliminary Findings. Prepared by Rutherford & Chekene Consulting Engineers for Administrative Office of the Courts, Office of Court Construction and Management, January
state owned or leased buildings: DGS, 2008. "Concrete Types Jan 2009." Unpublished spreadsheet prepared for the Concrete Coalition by Department of General Services, Real Estate Services Division. Obtained by the Concrete Coalition December 31, 2008.
K-12 public schools: DGS, 2002. "Seismic Safety Inventory of California Public Schools (A Report to the Governor of California and California State Legislature)." Department of General Services, November 15. Available online: http://www.documents.dgs.ca.gov/Legi/Publications/2002Reports/FinalAB300Report.pdf

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UC campus:Luckle, M. and E. Perez. 2010. MAP: Seismically Hazardous Buildings in the UC System. California Watch. March 17. (http://californiawatch.org/higher-ed/map-seismically-hazardous-buildings-uc-system); University of California Berkeley. Seismic Action Plan for Facilities Enhancement and Renewal- SAFER (http://berkeley.edu/administration/facilities/safer/). Comerio, M; S. Tobriner, A. Fehrenkamp. 2006. Bracing Berkeley: A Guide to Seismic Safety on the UC Berkeley Campus. January. Pacific Earthquake Engineering Research Center. (http://peer.berkeley.edu/publications/peer_reports/reports_2006/webR_PEER-601_BracingBerkeley_3rdEd.pdf)

CSU campus: Space and Facilities Database Management System Facility Report 2009; Luckle and Perez, 2010, seismic safety studies conducted in 1993 by various engineering firms for DSA
federally owned buildings: GSA, 2009. "Concrete Buildings." Unpublished spreadsheet prepared for the Concrete Coalition by General Services Administration Region IX. Obtained by the Concrete Coalition March 2, 2009.

Contra Costa

CITY OR TOWN	% OF HOUSING UNITS IN STRUCTURES WITH 20+ UNITS	# HOUSING UNITS	% BUILT BEFORE 1939	# PRE-1980 CONCRETE BUILDINGS	
				VOLUNTEER ESTIMATE	REGRESSION MODEL PREDICTION
Antioch	7.2	34,873	3.2		19
Brentwood	2.9	15,055	1.0		2
Clayton	0.4	3,976	1.5		0
Concord	15.4	46,978	1.7		27
Danville	1.9	15,840	0.3		1
El Cerrito	6.3	10,708	10.8	22	15
Hercules	0.0	8,192	0.3		0
Lafayette	5.9	9,584	2.4		5
Martinez	5.9	14,740	9.8		17
Moraga	3.6	5,827	0.5		1
Oakley	0.7	9,407	4.0		1
Orinda	3.1	6,753	8.1		5
Pinole	5.5	6,888	3.7		5
Pittsburg	6.8	21,071	3.8		13
Pleasant Hill	11.2	14,437	0.9		5
Richmond	7.9	39,108	14.2	35-45	60
San Pablo	13.4	10,066	8.1		20
San Ramon	5.2	22,217	0.5	0	3
Walnut Creek	15.4	32,362	1.1		15

COUNTY DATA	State Court Facilities	State owned/leased buildings	K-12 Public Schools	UC Campus	CSU Campuses	Federally-owned Buildings	
# pre-1980 concrete bldgs	2	5	61	0	0	0	Total = 68

SOURCES

Census data (% of housing units in structures with 20+ units, # of housing units, % built before 1939): U.S. Census Bureau, American FactFinder, 2005-2009 American Community Survey
volunteer estimates: EERI volunteers
regression model prediction: from model developed by Concrete Coalition steering committee member Professor Peter May, University of Washington
state court facilities: AOC, 2004. Superior Courts of California, Seismic Assessment Program: Summary Report of Preliminary Findings. Prepared by Rutherford & Chekene Consulting Engineers for Administrative Office of the Courts, Office of Court Construction and Management, January
state owned or leased buildings: DGS, 2008. "Concrete Types Jan 2009." Unpublished spreadsheet prepared for the Concrete Coalition by Department of General Services, Real Estate Services Division. Obtained by the Concrete Coalition December 31, 2008.
K-12 public schools: DGS, 2002. "Seismic Safety Inventory of California Public Schools (A Report to the Governor of California and California State Legislature)." Department of General Services, November 15. Available online: http://www.documents.dgs.ca.gov/Legi/Publications/2002Reports/FinalAB300Report.pdf

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UC campus:Luckle, M. and E. Perez. 2010. MAP: Seismically Hazardous Buildings in the UC System. California Watch. March 17. (http://californiawatch.org/higher-ed/map-seismically-hazardous-buildings-uc-system)
CSU campus: Space and Facilities Database Management System Facility Report 2009; Luckle and Perez, 2010, seismic safety studies conducted in 1993 by various engineering firms for DSA
federally owned buildings: GSA, 2009. "Concrete Buildings." Unpublished spreadsheet prepared for the Concrete Coalition by General Services Administration Region IX. Obtained by the Concrete Coalition March 2, 2009.

Fresno

CITY OR TOWN	% OF HOUSING UNITS IN STRUCTURES WITH 20+ UNITS	# HOUSING UNITS	% BUILT BEFORE 1939	# PRE-1980 CONCRETE BUILDINGS VOLUNTEER ESTIMATE	# PRE-1980 CONCRETE BUILDINGS REGRESSION MODEL PREDICTION
Fresno	6.4	162,374	7.0		101

COUNTY DATA	State Court Facilities	State owned/leased buildings	K-12 Public Schools	UC Campus	CSU Campuses	Federally-owned Buildings	
# pre-1980 concrete bldgs	0	0	0	0	0	0	0

SOURCES

Census data (% of housing units in structures with 20+ units, # of housing units, % built before 1939): U.S. Census Bureau, American FactFinder, 2005-2009 American Community Survey

volunteer estimates: EERI volunteers

regression model prediction: from model developed by Concrete Coalition steering committee member Professor Peter May, University of Washington

state court facilities: AOC, 2004. Superior Courts of California, Seismic Assessment Program: Summary Report of Preliminary Findings. Prepared by Rutherford & Chekene Consulting Engineers for Administrative Office of the Courts, Office of Court Construction and Management, January

state owned or leased buildings: DGS, 2008. "Concrete Types Jan 2009." Unpublished spreadsheet prepared for the Concrete Coalition by Department of General Services, Real Estate Services Division. Obtained by the Concrete Coalition December 31, 2008.

K-12 public schools: DGS, 2002. "Seismic Safety Inventory of California Public Schools (A Report to the Governor of California and California State Legislature)." Department of General Services, November 15. Available online: http://www.documents.dgs.ca.gov/Legi/Publications/2002Reports/FinalAB300Report.pdf

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UC campus:Luckle, M. and E. Perez. 2010. MAP: Seismically Hazardous Buildings in the UC System. California Watch. March 17. (http://californiawatch.org/higher-ed/map-seismically-hazardous-buildings-uc-system)

CSU campus: Space and Facilities Database Management System Facility Report 2009; Luckle and Perez, 2010, seismic safety studies conducted in 1993 by various engineering firms for DSA

federally owned buildings: GSA, 2009. "Concrete Buildings." Unpublished spreadsheet prepared for the Concrete Coalition by General Services Administration Region IX. Obtained by the Concrete Coalition March 2, 2009.

Humboldt

CITY OR TOWN	% OF HOUSING UNITS IN STRUCTURES WITH 20+ UNITS	# HOUSING UNITS	% BUILT BEFORE 1939	# PRE-1980 CONCRETE BUILDINGS	
				VOLUNTEER ESTIMATE	REGRESSION MODEL PREDICTION
Arcata	8.6	7,261	10.7		13
Blue Lake	0.0	547	27.8		0
Eureka	3.8	12,077	35.5	10	26
Ferndale	0.0	664	49.2		0
Fortuna	2.0	4,417	11.1		3
Rio Dell	0.4	1,447	13.5		0
Trinidad	0.1	225	9.8		0

COUNTY DATA	State Court Facilities	State owned/leased buildings	K-12 Public Schools	UC Campus	CSU Campuses	Federally-owned Buildings	
# pre-1980 concrete bldgs	0	0	0	0	6	0	Total = 6

SOURCES

Census data (% of housing units in structures with 20+ units, # of housing units, % built before 1939): U.S. Census Bureau, American FactFinder, 2005-2009 American Community Survey

volunteer estimates: EERI volunteers

regression model prediction: from model developed by Concrete Coalition steering committee member Professor Peter May, University of Washington

state court facilities: AOC, 2004. Superior Courts of California, Seismic Assessment Program: Summary Report of Preliminary Findings. Prepared by Rutherford & Chekene Consulting Engineers for Administrative Office of the Courts, Office of Court Construction and Management, January

state owned or leased buildings: DGS, 2008. “Concrete Types Jan 2009.” Unpublished spreadsheet prepared for the Concrete Coalition by Department of General Services, Real Estate Services Division. Obtained by the Concrete Coalition December 31, 2008.

K-12 public schools: DGS, 2002. “Seismic Safety Inventory of California Public Schools (A Report to the Governor of California and California State Legislature).” Department of General Services, November 15. Available online: http://www.documents.dgs.ca.gov/Legi/Publications/2002Reports/FinalAB300Report.pdf

DGS, 2008. “Concrete Types Jan 2009.” Unpublished spreadsheet prepared for the Concrete Coalition by Department of General Services, Real Estate Services Division. Obtained by the Concrete Coalition December 31, 2008.

UC campus:Luckle, M. and E. Perez. 2010. MAP: Seismically Hazardous Buildings in the UC System. California Watch. March 17. (http://californiawatch.org/higher-ed/map-seismically-hazardous-buildings-uc-system)

CSU campus: Space and Facilities Database Management System Facility Report 2009; Luckle and Perez, 2010, seismic safety studies conducted in 1993 by various engineering firms for DSA

federally owned buildings: GSA, 2009. “Concrete Buildings.” Unpublished spreadsheet prepared for the Concrete Coalition by General Services Administration Region IX. Obtained by the Concrete Coalition March 2, 2009.

Kern

CITY OR TOWN	% OF HOUSING UNITS IN STRUCTURES WITH 20+ UNITS	# HOUSING UNITS	% BUILT BEFORE 1939	# PRE-1980 CONCRETE BUILDINGS: VOLUNTEER ESTIMATE	# PRE-1980 CONCRETE BUILDINGS: REGRESSION MODEL PREDICTION
Bakersfield	5.3	107,964	4.7		50

COUNTY DATA	State Court Facilities	State owned/leased buildings	K-12 Public Schools	UC Campus	CSU Campuses	Federally-owned Buildings	
# pre-1980 concrete bldgs	3	1	25	0	unknown	0	Total = 29

SOURCES

Census data (% of housing units in structures with 20+ units, # of housing units, % built before 1939): U.S. Census Bureau, American FactFinder, 2005-2009 American Community Survey

volunteer estimates: EERI volunteers

regression model prediction: from model developed by Concrete Coalition steering committee member Professor Peter May, University of Washington

state court facilities: AOC, 2004. Superior Courts of California, Seismic Assessment Program: Summary Report of Preliminary Findings. Prepared by Rutherford & Chekene Consulting Engineers for Administrative Office of the Courts, Office of Court Construction and Management, January

state owned or leased buildings: DGS, 2008. "Concrete Types Jan 2009." Unpublished spreadsheet prepared for the Concrete Coalition by Department of General Services, Real Estate Services Division. Obtained by the Concrete Coalition December 31, 2008.

K-12 public schools: DGS, 2002. "Seismic Safety Inventory of California Public Schools (A Report to the Governor of California and California State Legislature)." Department of General Services, November 15. Available online: http://www.documents.dgs.ca.gov/Legi/Publications/2002Reports/FinalAB300Report.pdf

DGS, 2008. "Concrete Types Jan 2009." Unpublished spreadsheet prepared for the Concrete Coalition by Department of General Services, Real Estate Services Division. Obtained by the Concrete Coalition December 31, 2008.

UC campus:Luckle, M. and E. Perez. 2010. MAP: Seismically Hazardous Buildings in the UC System. California Watch. March 17. (http://californiawatch.org/higher-ed/map-seismically-hazardous-buildings-uc-system)

CSU campus: Space and Facilities Database Management System Facility Report 2009; Luckle and Perez, 2010, seismic safety studies conducted in 1993 by various engineering firms for DSA

federally owned buildings: GSA, 2009. "Concrete Buildings." Unpublished spreadsheet prepared for the Concrete Coalition by General Services Administration Region IX. Obtained by the Concrete Coalition March 2, 2009.

Los Angeles

CITY	% 20+ UNITS	# HOUSING UNITS	% BUILT BEFORE 1939	# PRE-1980 CONCRETE BUILDINGS	
				VOLUNTEER ESTIMATE	REGRESSION MODEL PREDICTION
Agoura Hills	5.8	7,319	0.7		2
Alhambra	8.4	30,052	29.1		82
Arcadia	10.9	19,962	5.7		24
Artesia	9.7	4,598	5.1		6
Avalon	0.0	1,853	45.5		0
Azusa	18.7	13,466	6.3		27
Baldwin Park	8.3	17,876	3.1		12
Bell	4.1	9,271	13.8		12
Bell Gardens	1.2	9,938	5.8		3
Bellflower	19.7	25,007	7.9		54
Beverly Hills	18.8	15,936	35.4		99
Bradbury	0.0	311	2.3		0
Burbank	19.2	43,265	16.0		132
Calabasas	6.0	8,262	0.6	2	2
Carson	4.7	25,818	2.6		9
Cerritos	3.0	16,088	0.6		2
Claremont	7.8	11,568	6.5		13
Commerce	10.3	3,380	9.9		8
Compton	3.9	24,319	12.5		23
Covina	11.5	16,839	4.5		18
Cudahy	9.1	5,826	3.8		6
Culver City	24.3	17,182	12.1		61
Diamond Bar	1.8	18,425	0.1		0
Downey	16.3	35,556	3.2		34
Duarte	11.0	7,011	4.2		8
El Monte	8.7	28,437	7.5		32
El Segundo	11.4	7,228	11.8		17
Gardena	13.1	21,557	5.7		29
Glendale	19.9	74,665	19.8	160	243
Glendora	4.5	17,474	4.0		9
Hawaiian Gardens	12.3	3,624	4.3		5
Hawthorne	28.6	30,379	3.0		42
Hermosa Beach	11.7	9,476	16.0		27
Hidden Hills	0.0	592	0.3		0
Huntington Park	13.4	15,928	33.4		75
Industry	0.0	119	7.6		0
Inglewood	12.4	39,627	13.5		81
Irwindale	0.0	417	10.1		0
La Cañada Flintridge	0.1	7,088	13.3		1
La Habra Heights	0.0	1,895	7.8		0
La Mirada	4.9	15,290	0.6		2
La Puente	15.0	10,056	3.1		11
La Verne	2.0	11,514	5.7		5
Lakewood	6.7	27,619	2.4		12
Lancaster	6.3	47,120	1.7		14
Lawndale	11.4	10,086	2.7		8
Lomita	16.0	8,326	11.5		24
Long Beach	15.0	174,113	19.9		396
Los Angeles	25.4	1,356,808	20.5	1500	3088
Lynwood	5.1	15,535	15.0		22
Malibu	8.3	6,188	3.5		5
Manhattan Beach	2.3	14,984	5.9		6
Maywood	3.4	6,903	17.3		9
Monrovia	11.4	14,211	19.5		42
Montebello	19.0	19,978	7.4		42
Monterey Park	10.0	20,691	6.8		26
Norwalk	9.7	28,611	3.5		21
Palmdale	4.9	41,841	0.4		4
Palos Verdes Estates	2.9	5,202	5.6		3
Paramount	13.6	14,991	10.4		33
Pasadena	19.2	56,060	29.4	12--16	245
Pico Rivera	11.4	17,673	5.5		22

Los Angeles

Pomona	7.5	40,860	10.1		48
Rancho Palos Verdes	11.5	16,345	1.4		8
Redondo Beach	16.1	30,227	6.4		47
Rolling Hills	0.1	682	11.6		0
Rolling Hills Estates	0.9	2,875	1.1		0
Rosemead	11.5	14,314	3.3		13
San Dimas	9.2	12,585	4.0		11
San Fernando	4.1	5,943	16.4		9
San Gabriel	9.5	12,852	18.2		33
San Marino	0.1	4,450	42.5		1
Santa Clarita	8.6	52,456	0.8		12
Santa Fe Springs	18.6	4,928	1.3		4
Santa Monica	22.8	48,911	17.2	70	173
Sierra Madre	2.1	4,923	26.1		7
Signal Hill	24.8	3,820	9.4		16
South El Monte	2.9	4,703	4.7		3
South Gate	5.0	24,277	13.9		29
South Pasadena	14.0	10,848	34.5		58
Temple City	1.8	11,706	11.9		7
Torrance	22.5	55,964	3.8		69
Vernon	19.2	26	19.2		0
Walnut	1.8	8,395	0.5		1
West Covina	15.7	32,011	2.2		24
West Hollywood	38.5	24,110	18.2		147
Westlake Village	0.7	3,423	0.2		0
Whittier	6.7	29,040	11.3		36

COUNTY DATA	**State Court Facilities**	**State owned/leased buildings**	**K-12 Public Schools**	**UC Campus**	**CSU Campuses**	**Federally-owned Buildings**	
# pre-1980 concrete bldgs	29	62	644	(UCLA) 12	(CSU Dominguez Hills, Long Beach, Los Angeles, Northridge, Pomona) 13	3	Total = 763

please note: these are estimates based on sources below and judgment of EERI volunteers. Please contact EERI if you have better numbers you could share.

SOURCES

Census data (% 20+units in a building, # of housing units, % built before 1939): U.S. Census Bureau, American FactFinder, 2005-2009 American Community Survey

volunteer estimates: EERI volunteers

regression model prediction: from model developed by Concrete Coalition steering committee member Professor Peter May, University of Washington

state court facilities: AOC, 2004. Superior Courts of California, Seismic Assessment Program: Summary Report of Preliminary Findings. Prepared by Rutherford & Chekene Consulting Engineers for Administrative Office of the Courts, Office of Court Construction and Management, January

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K-12 public schools: DGS, 2002. “Seismic Safety Inventory of California Public Schools (A Report to the Governor of California and California State Legislature).” Department of General Services, November 15. Available online: http://www.documents.dgs.ca.gov/Legi/Publications/2002Reports/FinalAB300Report.pdf

UC campus:Luckle, M. and E. Perez. 2010. MAP: Seismically Hazardous Buildings in the UC System. California Watch. March 17. (http://californiawatch.org/higher-ed/map-seismically-hazardous-buildings-uc-system)

CSU campus: Space and Facilities Database Management System Facility Report 2009; Luckle and Perez, 2010, seismic safety studies conducted in 1993 by various engineering firms for DSA

federally owned buildings: GSA, 2009. “Concrete Buildings.” Unpublished spreadsheet prepared for the Concrete Coalition by General Services Administration Region IX. Obtained by the Concrete Coalition March 2, 2009.

Marin

CITY OR TOWN	% OF HOUSING UNITS IN STRUCTURES WITH 20+ UNITS	# HOUSING UNITS	% BUILT BEFORE 1939	# PRE-1980 CONCRETE BUILDINGS: VOLUNTEER ESTIMATE	# PRE-1980 CONCRETE BUILDINGS: REGRESSION MODEL PREDICTION
Belvedere	0.5	1,060	16.6		1
Corte Madera	4.2	3,841	11.7		5
Fairfax	7.3	3,387	27.1	18	12
Larkspur	19.8	6,452	9.2		20
Mill Valley	7.9	6,281	26.5	13	21
Novato	7.4	18,975	2.9	18	11
Ross	0.1	820	51.8		0
San Anselmo	1.4	5,455	34.6		7
San Rafael	18.3	22,963	11.1	53	60
Sausalito	6.4	4,533	25.3		13
Tiburon	6.7	3,906	4.8		4

COUNTY DATA	State Court Facilities	State owned/leased buildings	K-12 Public Schools	UC Campus	CSU Campuses	Federally-owned Buildings	
# pre-1980 concrete bldgs	0	10	44	0	0	0	Total = 54

SOURCES

Census data (% of housing units in structures with 20+ units, # of housing units, % built before 1939): U.S. Census Bureau, American FactFinder, 2005-2009 American Community Survey

volunteer estimates: EERI volunteers

regression model prediction: from model developed by Concrete Coalition steering committee member Professor Peter May, University of Washington

state court facilities: AOC, 2004. Superior Courts of California, Seismic Assessment Program: Summary Report of Preliminary Findings. Prepared by Rutherford & Chekene Consulting Engineers for Administrative Office of the Courts, Office of Court Construction and Management, January

state owned or leased buildings: DGS, 2008. “Concrete Types Jan 2009.” Unpublished spreadsheet prepared for the Concrete Coalition by Department of General Services, Real Estate Services Division. Obtained by the Concrete Coalition December 31, 2008.

K-12 public schools: DGS, 2002. “Seismic Safety Inventory of California Public Schools (A Report to the Governor of California and California State Legislature).” Department of General Services, November 15. Available online: http://www.documents.dgs.ca.gov/Legi/Publications/2002Reports/FinalAB300Report.pdf

DGS, 2008. “Concrete Types Jan 2009.” Unpublished spreadsheet prepared for the Concrete Coalition by Department of General Services, Real Estate Services Division. Obtained by the Concrete Coalition December 31, 2008.

UC campus:Luckle, M. and E. Perez. 2010. MAP: Seismically Hazardous Buildings in the UC System. California Watch. March 17. (http://californiawatch.org/higher-ed/map-seismically-hazardous-buildings-uc-system)

CSU campus: Space and Facilities Database Management System Facility Report 2009; Luckle and Perez, 2010, seismic safety studies conducted in 1993 by various engineering firms for DSA

federally owned buildings: GSA, 2009. “Concrete Buildings.” Unpublished spreadsheet prepared for the Concrete Coalition by General Services Administration Region IX. Obtained by the Concrete Coalition March 2, 2009.

Mendocino

CITY OR TOWN	% OF HOUSING UNITS IN STRUCTURES WITH 20+ UNITS	# HOUSING UNITS	% BUILT BEFORE 1939	# PRE-1980 CONCRETE BUILDINGS: VOLUNTEER ESTIMATE	# PRE-1980 CONCRETE BUILDINGS: REGRESSION MODEL PREDICTION
Fort Bragg	6.2	3,069	25.2		9
Point Arena	4.4	227	21.1		1
Ukiah	7.4	6,071	12.9		12
Willits	9.0	2,053	15.8		7

COUNTY DATA	State Court Facilities	State owned/leased buildings	K-12 Public Schools	UC Campus	CSU Campuses	Federally-owned Buildings	
# pre-1980 concrete bldgs	2	0	0	0	0	0	Total = 2

SOURCES

Census data (% of housing units in structures with 20+ units, # of housing units, % built before 1939): U.S. Census Bureau, American FactFinder, 2005-2009 American Community Survey

volunteer estimates: EERI volunteers

regression model prediction: from model developed by Concrete Coalition steering committee member Professor Peter May, University of Washington

state court facilities: AOC, 2004. Superior Courts of California, Seismic Assessment Program: Summary Report of Preliminary Findings. Prepared by Rutherford & Chekene Consulting Engineers for Administrative Office of the Courts, Office of Court Construction and Management, January

state owned or leased buildings: DGS, 2008. “Concrete Types Jan 2009.” Unpublished spreadsheet prepared for the Concrete Coalition by Department of General Services, Real Estate Services Division. Obtained by the Concrete Coalition December 31, 2008.

K-12 public schools: DGS, 2002. “Seismic Safety Inventory of California Public Schools (A Report to the Governor of California and California State Legislature).” Department of General Services, November 15. Available online: http://www.documents.dgs.ca.gov/Legi/Publications/2002Reports/FinalAB300Report.pdf

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CSU campus: Space and Facilities Database Management System Facility Report 2009; Luckle and Perez, 2010, seismic safety studies conducted in 1993 by various engineering firms for DSA

federally owned buildings: GSA, 2009. “Concrete Buildings.” Unpublished spreadsheet prepared for the Concrete Coalition by General Services Administration Region IX. Obtained by the Concrete Coalition March 2, 2009.

Monterey

CITY OR TOWN	% OF HOUSING UNITS IN STRUCTURES WITH 20+ UNITS	# HOUSING UNITS	% BUILT BEFORE 1939	# PRE-1980 CONCRETE BUILDINGS: VOLUNTEER ESTIMATE	# PRE-1980 CONCRETE BUILDINGS: REGRESSION MODEL PREDICTION
Carmel-by-the Sea	1.2	3,331	29.9		4
Del Rey Oaks	4.7	727	1.5		0
Gonzales	4.8	1,738	6.2		2
Greenfield	5.2	2,727	3.9		2
King City	3.7	2,855	6.5		2
Marina	10.6	8,543	1.2		4
Monterey	15.0	13,420	12.9		37
Pacific Grove	7.5	7,998	25.5		24
Salinas	12.5	39,612	5.9		46
Sand City	0.1	92	17.4		0
Seaside	2.7	11,005	4.0		4
Soledad	5.9	2,543	2.2		2

COUNTY DATA	State Court Facilities	State owned/leased buildings	K-12 Public Schools	UC Campus	CSU Campuses	Federally-owned Buildings	
# pre-1980 concrete bldgs	2	27	22	0	CSU Monerey Bay (unknown)	0	51

SOURCES

Census data (% of housing units in structures with 20+ units, # of housing units, % built before 1939): U.S. Census Bureau, American FactFinder, 2005-2009 American Community Survey

volunteer estimates: EERI volunteers

regression model prediction: from model developed by Concrete Coalition steering committee member Professor Peter May, University of Washington

state court facilities: AOC, 2004. Superior Courts of California, Seismic Assessment Program: Summary Report of Preliminary Findings. Prepared by Rutherford & Chekene Consulting Engineers for Administrative Office of the Courts, Office of Court Construction and Management, January

state owned or leased buildings: DGS, 2008. "Concrete Types Jan 2009." Unpublished spreadsheet prepared for the Concrete Coalition by Department of General Services, Real Estate Services Division. Obtained by the Concrete Coalition December 31, 2008.

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CSU campus: Space and Facilities Database Management System Facility Report 2009; Luckle and Perez, 2010, seismic safety studies conducted in 1993 by various engineering firms for DSA

federally owned buildings: GSA, 2009. "Concrete Buildings." Unpublished spreadsheet prepared for the Concrete Coalition by General Services Administration Region IX. Obtained by the Concrete Coalition March 2, 2009.

Napa

CITY OR TOWN	% OF HOUSING UNITS IN STRUCTURES WITH 20+ UNITS	# HOUSING UNITS	% BUILT BEFORE 1939	# PRE-1980 CONCRETE BUILDINGS: VOLUNTEER ESTIMATE	# PRE-1980 CONCRETE BUILDINGS: REGRESSION MODEL PREDICTION
American Canyon	1.3	3,279	1.6		1
Calistoga	3.0	2,249	12.0		3
Napa	8.0	29,511	7.9	14	32
St. Helena	5.9	2,708	17.0		6
Yountville	1.1	1,565	10.2		2

COUNTY DATA	State Court Facilities	State owned/leased buildings	K-12 Public Schools	UC Campus	CSU Campuses	Federally-owned Buildings	
# pre-1980 concrete bldgs	0	31	4	0	0	0	Total = 35

SOURCES

Census data (% of housing units in structures with 20+ units, # of housing units, % built before 1939): U.S. Census Bureau, American FactFinder, 2005-2009 American Community Survey

volunteer estimates: EERI volunteers

regression model prediction: from model developed by Concrete Coalition steering committee member Professor Peter May, University of Washington

state court facilities: AOC, 2004. Superior Courts of California, Seismic Assessment Program: Summary Report of Preliminary Findings. Prepared by Rutherford & Chekene Consulting Engineers for Administrative Office of the Courts, Office of Court Construction and Management, January

state owned or leased buildings: DGS, 2008. "Concrete Types Jan 2009." Unpublished spreadsheet prepared for the Concrete Coalition by Department of General Services, Real Estate Services Division. Obtained by the Concrete Coalition December 31, 2008.

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CSU campus: Space and Facilities Database Management System Facility Report 2009; Luckle and Perez, 2010, seismic safety studies conducted in 1993 by various engineering firms for DSA

federally owned buildings: GSA, 2009. "Concrete Buildings." Unpublished spreadsheet prepared for the Concrete Coalition by General Services Administration Region IX. Obtained by the Concrete Coalition March 2, 2009.

Orange

CITY OR TOWN	% OF HOUSING UNITS IN STRUCTURES WITH 20+ UNITS	# HOUSING UNITS	% BUILT BEFORE 1939	# PRE-1980 CONCRETE BUILDINGS: VOLUNTEER ESTIMATE	# PRE-1980 CONCRETE BUILDINGS: REGRESSION MODEL PREDICTION
Aliso Viejo	12.6	16,602	0.1		1
Anaheim	21.1	99,592	2.4		77
Brea	18.0	13,274	1.8		11
Buena Park	15.1	23,885	1.9		16
Costa Mesa	19.9	40,399	1.4		25
Cypress	12.4	16,021	1.2		8
Dana Point	3.8	15,649	0.7		2
Fountain Valley	9.8	18,477	0.7		5
Fullerton	18.9	47,254	5.1	60	65
Garden Grove	11.8	46,825	2.1		25
Huntington Beach	12.0	75,793	1.3		27
Irvine	14.5	53,712	0.1		4
La Habra	17.1	19,542	3.2		22
La Palma	13.3	5,071	0.3		1
Laguna Beach	5.7	12,862	18.3		23
Laguna Hills	11.7	11,335	0.4		3
Laguna Niguel	6.9	23,893	0.2		2
Laguna Woods	16.4	12,657	1.8		10
Lake Forest	7.1	20,588	0.3		2
Los Alamitos	7.5	4,258	1.3		2
Mission Viejo	4.3	32,896	0.1		1
Newport Beach	15.6	37,336	4.9		46
Orange	9.0	41,776	5.5		37
Placentia	8.9	15,424	2.1		8
Rancho Santa Margarita	7.0	16,639	0.1		1
San Clemente	6.1	20,651	2.2		8
San Juan Capistrano	3.4	11,335	1.0		2
Santa Ana	17.2	74,475	6.2		100
Seal Beach	8.1	14,309	3.8		11
Stanton	24.8	10,948	2.3		14
Tustin	22.4	25,486	1.8		22
Villa Park	0.1	2,046	1.5		0
Westminster	11.3	26,934	1.4		12
Yorba Linda	3.4	19,534	0.8		3

COUNTY DATA	State Court Facilities	State owned/leased buildings	K-12 Public Schools	UC Campus	CSU Campuses	Federally-owned Buildings	
# pre-1980 concrete bldgs	6	18	103	unknown	4	1	Total = 132

SOURCES

Census data (% of housing units in structures with 20+ units, # of housing units, % built before 1939): U.S. Census Bureau, American FactFinder, 2005-2009 American Community Survey

volunteer estimates: EERI volunteers

regression model prediction: from model developed by Concrete Coalition steering committee member Professor Peter May, University of Washington

state court facilities: AOC, 2004. Superior Courts of California, Seismic Assessment Program: Summary Report of Preliminary Findings. Prepared by Rutherford & Chekene Consulting Engineers for Administrative Office of the Courts, Office of Court Construction and Management, January

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CSU campus: Space and Facilities Database Management System Facility Report 2009; Luckle and Perez, 2010, seismic safety studies conducted in 1993 by various engineering firms for DSA

federally owned buildings: GSA, 2009. “Concrete Buildings.” Unpublished spreadsheet prepared for the Concrete Coalition by General Services Administration Region IX. Obtained by the Concrete Coalition March 2, 2009.

CITY	% 20+ UNITS	# HOUSING UNITS	% BUILT BEFORE 1939	# PRE-1980 CONCRETE BUILDINGS: VOLUNTEER ESTIMATE	# PRE-1980 CONCRETE BUILDINGS: REGRESSION MODEL PREDICTION
Banning	2.5	9,739	6.3		5
Beaumont	7.1	4,258	5.8		5
Blythe	7.1	4,851	4.3		5
Calimesa	0.4	3,263	3.2		0
Canyon Lake	1.2	4,174	0.4		0
Cathedral City	3.1	17,813	1.0		3
Coachella	4.5	4,982	0.8		1
Corona	9.1	39,258	2.5		21
Desert Hot Springs	7.6	7,026	0.7		2
Hemet	8.2	29,464	1.8		12
Indian Wells	7.1	3,950	0.1		0
Indio	13.3	16,899	1.4		9
La Quinta	0.5	11,763	0.5		0
Lake Elsinore	2.9	13,243	4.1		5
Moreno Valley	3.3	50,790	0.4		4
Murrieta	5.3	31,753	0.1		1
Norco	0.1	7,210	3.1		0
Palm Desert	4.2	33,453	0.2		2
Palm Springs	8.7	32,924	2.1		15
Perris	5.6	15,082	1.5		5
Rancho Mirage	8.0	11,643	0.6		3
Riverside	14.2	97,436	8.1		130
San Jacinto	3.8	12,618	1.3		3
Temecula	5.1	30,747	0.1		1
Wildomar	0.1	7,232	0.5		0

COUNTY DATA	State Court Facilities	State owned/leased buildings	K-12 Public Schools	UC Campus	CSU Campuses	Federally-owned Buildings	
# pre-1980 concrete bldgs	1	4	25	(UC Riverside) unknown	0	0	Total = 30

please note: these are estimates based on sources below and judgment of EERI volunteers. Please contact EERI if you have better numbers you could share.

SOURCES

Census data (% 20+units in a building, # of housing units, % built before 1939): U.S. Census Bureau, American FactFinder, 2005-2009 American Community Survey
volunteer estimates: EERI volunteers
regression model prediction: from model developed by Concrete Coalition steering committee member Professor Peter May, University of Washington
state court facilities: AOC, 2004. Superior Courts of California, Seismic Assessment Program: Summary Report of Preliminary Findings. Prepared by Rutherford & Chekene Consulting Engineers for Administrative Office of the Courts, Office of Court Construction and Management, January
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CSU campus: Space and Facilities Database Management System Facility Report 2009; Luckle and Perez, 2010, seismic safety studies conducted in 1993 by various engineering firms for DSA
federally owned buildings: GSA, 2009. "Concrete Buildings." Unpublished spreadsheet prepared for the Concrete Coalition by General Services Administration Region IX. Obtained by the Concrete Coalition March 2, 2009.

CITY OR TOWN	% OF HOUSING UNITS IN STRUCTURES WITH 20+ UNITS	# HOUSING UNITS	% BUILT BEFORE 1939	# PRE-1980 CONCRETE BUILDINGS: VOLUNTEER ESTIMATE	# PRE-1980 CONCRETE BUILDINGS: REGRESSION MODEL PREDICTION
Citrus Heights	4.5	36,064	1.6		16
Elk Grove	1.9	46,908	0.4	0	4
Folsom	5.3	24,825	1.4		12
Galt	1.9	7,087	2.4		3
Isleton	0.1	391	33.2		0
Rancho Cordova	9.7	23,277	1.5		18
Sacramento	8.6	185,729	12.1		368

COUNTY DATA	State Court Facilities	State owned/leased buildings	K-12 Public Schools	UC Campus	CSU Campuses	Federally-owned Buildings	
# pre-1980 concrete bldgs	1	26	76	0	1	2	TOTAL = 106

SOURCES

Census data (% of housing units in structures with 20+ units, # of housing units, % built before 1939): U.S. Census Bureau, American FactFinder, 2005-2009 American Community Survey

volunteer estimates: EERI volunteers

regression model prediction: from model developed by Concrete Coalition steering committee member Professor Peter May, University of Washington

state court facilities: AOC, 2004. Superior Courts of California, Seismic Assessment Program: Summary Report of Preliminary Findings. Prepared by Rutherford & Chekene Consulting Engineers for Administrative Office of the Courts, Office of Court Construction and Management, January

state owned or leased buildings: DGS, 2008. "Concrete Types Jan 2009." Unpublished spreadsheet prepared for the Concrete Coalition by Department of General Services, Real Estate Services Division. Obtained by the Concrete Coalition December 31, 2008.

K-12 public schools: DGS, 2002. "Seismic Safety Inventory of California Public Schools (A Report to the Governor of California and California State Legislature)." Department of General Services, November 15. Available online: http://www.documents.dgs.ca.gov/Legi/Publications/2002Reports/FinalAB300Report.pdf

DGS, 2008. "Concrete Types Jan 2009." Unpublished spreadsheet prepared for the Concrete Coalition by Department of General Services, Real Estate Services Division. Obtained by the Concrete Coalition December 31, 2008.

UC campus:Luckle, M. and E. Perez. 2010. MAP: Seismically Hazardous Buildings in the UC System. California Watch. March 17. (http://californiawatch.org/higher-ed/map-seismically-hazardous-buildings-uc-system)

CSU campus: Space and Facilities Database Management System Facility Report 2009; Luckle and Perez, 2010, seismic safety studies conducted in 1993 by various engineering firms for DSA

federally owned buildings: GSA, 2009. "Concrete Buildings." Unpublished spreadsheet prepared for the Concrete Coalition by General Services Administration Region IX. Obtained by the Concrete Coalition March 2, 2009.

San Bernardino

CITY OR TOWN	% 20+ UNITS	# HOUSING UNITS	BEFORE 1939	# PRE-1980 CONCRETE BUILDINGS: VOLUNTEER ESTIMATE	# PRE-1980 CONCRETE BUILDINGS: REGRESSION MODEL PREDICTION
Adelanto	3.3	7,485	1.8		2
Apple Valley	1.6	24,353	0.3		1
Barstow	4.4	9,703	3.1		5
Big Bear Lake	1.4	8,696	3.3		2
Chino	8.1	20,107	2.4		11
Chino Hills	3.8	23,688	0.4		2
Colton	13.4	16,760	7.1		27
Fontana	6.2	48,454	1.6		14
Grand Terrace	11.2	4,401	2.3		4
Hesperia	3.7	26,220	0.3		2
Highland	6.7	16,511	4.6		12
Loma Linda	8.0	9,374	5.1		10
Montclair	2.9	9,664	0.4		1
Needles	6.2	2,556	17.3		6
Ontario	5.3	47,521	3.9		22
Rancho Cucamonga	9.8	53,701	0.5		9
Redlands	6.6	26,800	10.1		31
Rialto	6.0	27,034	2.0		10
San Bernardino	12.6	66,210	7.3		81
Twentynine Palms	0.6	8,796	4.5		1
Upland	8.6	27,229	3.9		20
Victorville	5.1	30,973	1.7		9
Yucaipa	0.4	19,093	2.3		1
Yucca Valley	1.0	9,292	0.5		0

COUNTY DATA	State Court Facilities	State owned/leased buildings	K-12 Public Schools	UC Campus	CSU Campuses	Federally-owned Buildings	
# pre-1980 concrete bldgs	2	31	74	0	(CSU San Bernardino) unknown	0	Total = 107

please note: these are estimates based on sources below and judgment of EERI volunteers. Please contact EERI if you have better numbers you could share.

SOURCES

Census data (% 20+units in a building, # of housing units, % built before 1939): U.S. Census Bureau, American FactFinder, 2005-2009 American Community Survey

volunteer estimates: EERI volunteers

regression model prediction: from model developed by Concrete Coalition steering committee member Professor Peter May, University of Washington

state court facilities: AOC, 2004. Superior Courts of California, Seismic Assessment Program: Summary Report of Preliminary Findings. Prepared by Rutherford & Chekene Consulting Engineers for Administrative Office of the Courts, Office of Court Construction and Management, January

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UC campus:Luckle, M. and E. Perez. 2010. MAP: Seismically Hazardous Buildings in the UC System. California Watch. March 17. (http://californiawatch.org/higher-ed/map-seismically-hazardous-buildings-uc-system)

CSU campus: Space and Facilities Database Management System Facility Report 2009; Luckle and Perez, 2010, seismic safety studies conducted in 1993 by various engineering firms for DSA

federally owned buildings: GSA, 2009. “Concrete Buildings.” Unpublished spreadsheet prepared for the Concrete Coalition by General Services Administration Region IX. Obtained by the Concrete Coalition March 2, 2009.

San Diego

CITY OR TOWN	% OF HOUSING UNITS IN STRUCTURES WITH 20+ UNITS	# HOUSING UNITS	% BUILT BEFORE 1939	# PRE-1980 CONCRETE BUILDINGS	
				VOLUNTEER ESTIMATE	REGRESSION MODEL PREDICTION
Carlsbad	8.1	41,441	0.8		9
Chula Vista	12.8	77,071	1.6		33
Coronado	24.5	9,436	16.2		46
Del Mar	14.5	2,557	4.8		5
El Cajon	21.6	35,433	2.2		32
Encinitas	5.9	25,002	2.4		10
Escondido	11.7	47,541	2.8		31
Imperial Beach	9.4	9,881	3.3		8
La Mesa	18.2	25,047	5.1		38
Lemon Grove	7.5	8,609	3.3		6
National City	17.2	15,928	10.5		41
Oceanside	11.4	64,199	1.6		27
Poway	6.9	16,539	0.1		1
San Diego	16.6	501,609	7.3		509
San Marcos	9.7	25,317	0.7		6
Santee	4.9	19,142	0.5		3
Solana Beach	16.4	6,449	3.5	3	9
Vista	11.8	30,612	0.8		9

COUNTY DATA	State Court Facilities	State owned/leased buildings	K-12 Public Schools	UC Campus	CSU Campuses	Federally-owned Buildings	
# pre-1980 concrete bldgs	7	1	45	unknown	unknown	0	Total = 53

SOURCES

Census data (% of housing units in structures with 20+ units, # of housing units, % built before 1939): U.S. Census Bureau, American FactFinder, 2005-2009 American Community Survey

volunteer estimates: EERI volunteers

regression model prediction: from model developed by Concrete Coalition steering committee member Professor Peter May, University of Washington

state court facilities: AOC, 2004. Superior Courts of California, Seismic Assessment Program: Summary Report of Preliminary Findings. Prepared by Rutherford & Chekene Consulting Engineers for Administrative Office of the Courts, Office of Court Construction and Management, January

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CSU campus: Space and Facilities Database Management System Facility Report 2009; Luckle and Perez, 2010, seismic safety studies conducted in 1993 by various engineering firms for DSA

federally owned buildings: GSA, 2009. “Concrete Buildings.” Unpublished spreadsheet prepared for the Concrete Coalition by General Services Administration Region IX. Obtained by the Concrete Coalition March 2, 2009.

CITY OR TOWN	% OF HOUSING UNITS IN STRUCTURES WITH 20+ UNITS	# HOUSING UNITS	% BUILT BEFORE 1939	# PRE-1980 CONCRETE BUILDINGS: VOLUNTEER ESTIMATE	# PRE-1980 CONCRETE BUILDINGS: REGRESSION MODEL PREDICTION
San Francisco	22.9	356,462	53.3	3,000	1855

COUNTY DATA	State Court Facilities	State owned/leased buildings	K-12 Public Schools	UC Campus	CSU Campuses	Federally-owned Buildings	
# pre-1980 concrete bldgs	1	2	51	1	unknown	0	Total = 55

SOURCES

Census data (% of housing units in structures with 20+ units, # of housing units, % built before 1939): U.S. Census Bureau, American FactFinder, 2005-2009 American Community Survey

volunteer estimates: EERI volunteers

regression model prediction: from model developed by Concrete Coalition steering committee member Professor Peter May, University of Washington

state court facilities: AOC, 2004. Superior Courts of California, Seismic Assessment Program: Summary Report of Preliminary Findings. Prepared by Rutherford & Chekene Consulting Engineers for Administrative Office of the Courts, Office of Court Construction and Management, January

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CITY OR TOWN	% OF HOUSING UNITS IN STRUCTURES WITH 20+ UNITS	# HOUSING UNITS	% BUILT BEFORE 1939	# PRE-1980 CONCRETE BUILDINGS: VOLUNTEER ESTIMATE	# PRE-1980 CONCRETE BUILDINGS: REGRESSION MODEL PREDICTION
Arroyo Grande	5.0	6,806	4.3		9
Atascadero	2.5	10,835	5.4		9
Grover Beach	2.4	5,368	3.0		3
Morro Bay	1.9	6,286	5.5		5
Paso Robles	4.8	11,218	5.9		15
Pismo Beach	2.4	5,493	4.5		4
San Luis Obispo	12.0	22,665	11.8	27	83

COUNTY DATA	State Court Facilities	State owned/leased buildings	K-12 Public Schools	UC Campus	CSU Campuses	Federally-owned Buildings	
# pre-1980 concrete bldgs	1	3	37	0	36	0	Total = 77

SOURCES

Census data (% of housing units in structures with 20+ units, # of housing units, % built before 1939): U.S. Census Bureau, American FactFinder, 2005-2009 American Community Survey

volunteer estimates: EERI volunteers

regression model prediction: from model developed by Concrete Coalition steering committee member Professor Peter May, University of Washington

state court facilities: AOC, 2004. Superior Courts of California, Seismic Assessment Program: Summary Report of Preliminary Findings. Prepared by Rutherford & Chekene Consulting Engineers for Administrative Office of the Courts, Office of Court Construction and Management, January

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CSU campus: Space and Facilities Database Management System Facility Report 2009; Luckle and Perez, 2010, seismic safety studies conducted in 1993 by various engineering firms for DSA

federally owned buildings: GSA, 2009. “Concrete Buildings.” Unpublished spreadsheet prepared for the Concrete Coalition by General Services Administration Region IX. Obtained by the Concrete Coalition March 2, 2009.

San Mateo

CITY OR TOWN	% OF HOUSING UNITS IN STRUCTURES WITH 20+ UNITS	# HOUSING UNITS	% BUILT BEFORE 1939	# PRE-1980 CONCRETE BUILDINGS	
				VOLUNTEER ESTIMATE	REGRESSION MODEL PREDICTION
Atherton	0.3	2,505	15.4		1
Belmont	22.1	10,811	4.2		19
Brisbane	2.8	1,818	17.1		3
Burlingame	18.4	12,776	30.9	240	74
Colma	0.1	353	75.1		0
Daly City	16.4	31,876	7.2	30	54
East Palo Alto	23.4	7,573	7.7		23
Foster City	21.4	12,454	0.5		5
Half Moon Bay	2.0	4,151	5.3		2
Hillsborough	0.0	3,804	17.2		0
Menlo Park	10.8	12,624	11.0		25
Millbrae	13.4	8,311	10.1	52	20
Pacifica	8.2	14,467	2.1		8
Portola Valley	4.6	1,809	8.4		2
Redwood City	12.4	29,194	8.9	150	47
San Bruno	22.6	16,403	7.7		41
San Carlos	4.7	11,794	8.1		11
San Mateo	21.7	38,672	10.6	150	100
South San Francisco	8.8	20,870	4.9		19
Woodside	0.0	1,989	17.0		0

COUNTY DATA	State Court Facilities	State owned/leased buildings	K-12 Public Schools	UC Campus	CSU Campuses	Federally-owned Buildings	
# pre-1980 concrete bldgs	1	5	30	0	0	2	Total = 38

SOURCES

Census data (% of housing units in structures with 20+ units, # of housing units, % built before 1939): U.S. Census Bureau, American FactFinder, 2005-2009 American Community Survey

volunteer estimates: EERI volunteers

regression model prediction: from model developed by Concrete Coalition steering committee member Professor Peter May, University of Washington

state court facilities: AOC, 2004. Superior Courts of California, Seismic Assessment Program: Summary Report of Preliminary Findings. Prepared by Rutherford & Chekene Consulting Engineers for Administrative Office of the Courts, Office of Court Construction and Management, January

state owned or leased buildings: DGS, 2008. "Concrete Types Jan 2009." Unpublished spreadsheet prepared for the Concrete Coalition by Department of General Services, Real Estate Services Division. Obtained by the Concrete Coalition December 31, 2008.

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CSU campus: Space and Facilities Database Management System Facility Report 2009; Luckle and Perez, 2010, seismic safety studies conducted in 1993 by various engineering firms for DSA

federally owned buildings: GSA, 2009. "Concrete Buildings." Unpublished spreadsheet prepared for the Concrete Coalition by General Services Administration Region IX. Obtained by the Concrete Coalition March 2, 2009.

Santa Barbara

CITY OR TOWN	% OF HOUSING UNITS IN STRUCTURES WITH 20+ UNITS	# HOUSING UNITS	% BUILT BEFORE 1939	# PRE-1980 CONCRETE BUILDINGS VOLUNTEER ESTIMATE	# PRE-1980 CONCRETE BUILDINGS REGRESSION MODEL PREDICTION
Buellton	1.0	1,488	1.7		0
Carpinteria	11.3	5,473	5.9		9
Goleta	7.5	11,155	2.6		7
Guadalupe	0.7	1,468	9.5		1
Lompoc	4.8	13,878	2.5		6
Santa Barbara	10.4	38,172	21.9		96
Santa Maria	6.8	26,430	5.2		20
Solvang	7.4	2,356	3.0		2

COUNTY DATA	State Court Facilities	State owned/leased buildings	K-12 Public Schools	UC Campus	CSU Campuses	Federally-owned Buildings	
# pre-1980 concrete bldgs	2	2	21	1	0	0	TOTAL = 26

SOURCES

Census data (% of housing units in structures with 20+ units, # of housing units, % built before 1939): U.S. Census Bureau, American FactFinder, 2005-2009 American Community Survey

volunteer estimates: EERI volunteers
regression model prediction: from model developed by Concrete Coalition steering committee member Professor Peter May, University of Washington
state court facilities: AOC, 2004. Superior Courts of California, Seismic Assessment Program: Summary Report of Preliminary Findings. Prepared by Rutherford & Chekene Consulting Engineers for Administrative Office of the Courts, Office of Court Construction and Management, January

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CSU campus: Space and Facilities Database Management System Facility Report 2009; Luckle and Perez, 2010, seismic safety studies conducted in 1993 by various engineering firms for DSA
federally owned buildings: GSA, 2009. “Concrete Buildings.” Unpublished spreadsheet prepared for the Concrete Coalition by General Services Administration Region IX. Obtained by the Concrete Coalition March 2, 2009.

CITY OR TOWN	% OF HOUSING UNITS IN STRUCTURES WITH 20+ UNITS	# HOUSING UNITS	% BUILT BEFORE 1939	# PRE-1980 CONCRETE BUILDINGS VOLUNTEER ESTIMATE	# PRE-1980 CONCRETE BUILDINGS REGRESSION MODEL PREDICTION
Campbell	15.3	16,465	2.6		15
Cupertino	13.1	20,004	0.7		7
Gilroy	3.9	14,219	4.9		8
Los Altos	6.3	11,111	5.7		10
Los Altos Hills	0.3	2,835	5.9		0
Los Gatos	10.9	12,722	9.4		23
Milpitas	6.6	18,699	0.2		2
Monte Sereno	0.1	1,237	12.4		0
Morgan Hill	1.8	12,105	1.3		2
Mountain View	27.2	33,184	3.5		49
Palo Alto	16.4	26,735	15.1		77
San Jose	11.2	299,218	5.3	363	205
Santa Clara	20.1	42,480	3.0		43
Saratoga	3.3	11,244	3.1		4
Sunnyvale	22.5	55,145	2.1		46

COUNTY DATA	State Court Facilities	State owned/leased buildings	K-12 Public Schools	UC Campus	CSU Campuses	Federally-owned Buildings	
# pre-1980 concrete bldgs	3	10	138	0	8	0	TOTAL = 159

SOURCES

Census data (% of housing units in structures with 20+ units, # of housing units, % built before 1939): U.S. Census Bureau, American FactFinder, 2005-2009 American Community Survey

volunteer estimates: EERI volunteers

regression model prediction: from model developed by Concrete Coalition steering committee member Professor Peter May, University of Washington

state court facilities: AOC, 2004. Superior Courts of California, Seismic Assessment Program: Summary Report of Preliminary Findings. Prepared by Rutherford & Chekene Consulting Engineers for Administrative Office of the Courts, Office of Court Construction and Management, January

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CSU campus: Space and Facilities Database Management System Facility Report 2009; Luckle and Perez, 2010, seismic safety studies conducted in 1993 by various engineering firms for DSA

federally owned buildings: GSA, 2009. "Concrete Buildings." Unpublished spreadsheet prepared for the Concrete Coalition by General Services Administration Region IX. Obtained by the Concrete Coalition March 2, 2009.

Santa Cruz

CITY OR TOWN	% OF HOUSING UNITS IN STRUCTURES WITH 20+ UNITS	# HOUSING UNITS	% BUILT BEFORE 1939	# PRE-1980 CONCRETE BUILDINGS: VOLUNTEER ESTIMATE	# PRE-1980 CONCRETE BUILDINGS: REGRESSION MODEL PREDICTION
Capitola	13.6	5,379	10.1		14
Santa Cruz	9.0	22,421	24.8		61
Scotts Valley	5.2	4,477	2.1		2
Watsonville	8.8	12,604	13.8		25

COUNTY DATA	State Court Facilities	State owned/leased buildings	K-12 Public Schools	UC Campus	CSU Campuses	Federally-owned Buildings	
# pre-1980 concrete bldgs	2	0	9	3	0	0	TOTAL = 14

SOURCES

Census data (% of housing units in structures with 20+ units, # of housing units, % built before 1939): U.S. Census Bureau, American FactFinder, 2005-2009 American Community Survey

volunteer estimates: EERI volunteers

regression model prediction: from model developed by Concrete Coalition steering committee member Professor Peter May, University of Washington

state court facilities: AOC, 2004. Superior Courts of California, Seismic Assessment Program: Summary Report of Preliminary Findings. Prepared by Rutherford & Chekene Consulting Engineers for Administrative Office of the Courts, Office of Court Construction and Management, January

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federally owned buildings: GSA, 2009. “Concrete Buildings.” Unpublished spreadsheet prepared for the Concrete Coalition by General Services Administration Region IX. Obtained by the Concrete Coalition March 2, 2009.

Solano

CITY OR TOWN	% OF HOUSING UNITS IN STRUCTURES WITH 20+ UNITS	# HOUSING UNITS	% BUILT BEFORE 1939	# PRE-1980 CONCRETE BUILDINGS: VOLUNTEER ESTIMATE	# PRE-1980 CONCRETE BUILDINGS: REGRESSION MODEL PREDICTION
Benicia	3.6	10,909	6.2		7
Dixon	1.2	5,147	0.1		0
Fairfield	7.9	31,867	1.3		10
Rio Vista	3.5	1,989	14.6		3
Suisun City	4.4	8,750	2.2		3
Vacaville	5.3	31,524	1.4		8
Vallejo	7.2	43,804	16.2		67

COUNTY DATA	State Court Facilities	State owned/leased buildings	K-12 Public Schools	UC Campus	CSU Campuses	Federally-owned Buildings	
# pre-1980 concrete bldgs	4	13	3	0	unknown	0	TOTAL = 20

SOURCES

Census data (% of housing units in structures with 20+ units, # of housing units, % built before 1939): U.S. Census Bureau, American FactFinder, 2005-2009 American Community Survey

volunteer estimates: EERI volunteers

regression model prediction: from model developed by Concrete Coalition steering committee member Professor Peter May, University of Washington

state court facilities: AOC, 2004. Superior Courts of California, Seismic Assessment Program: Summary Report of Preliminary Findings. Prepared by Rutherford & Chekene Consulting Engineers for Administrative Office of the Courts, Office of Court Construction and Management, January

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federally owned buildings: GSA, 2009. “Concrete Buildings.” Unpublished spreadsheet prepared for the Concrete Coalition by General Services Administration Region IX. Obtained by the Concrete Coalition March 2, 2009.

CITY OR TOWN	% OF HOUSING UNITS IN STRUCTURES WITH 20+ UNITS	# HOUSING UNITS	% BUILT BEFORE 1939	# PRE-1980 CONCRETE BUILDINGS	
				VOLUNTEER ESTIMATE	REGRESSION MODEL PREDICTION
Cloverdale	4.7	2,636	7.5		3
Cotati	2.7	2,545	3.2		1
Healdsburg	2.1	4,152	15.4		4
Petaluma	6.7	22,067	11.3		29
Rohnert Park	11.6	16,479	0.3		3
Santa Rosa	10.0	63,153	5.9	55	58
Sebastopol	4.8	3,328	15.6		6
Sonoma	5.5	4,632	6.5		5
Windsor	2.7	8,657	1.5		2

COUNTY DATA	State Court Facilities	State owned/leased buildings	K-12 Public Schools	UC Campus	CSU Campuses	Federally-owned Buildings	
# pre-1980 concrete bldgs	1	40	13	0	3	0	TOTAL = 57

SOURCES

Census data (% of housing units in structures with 20+ units, # of housing units, % built before 1939): U.S. Census Bureau, American FactFinder, 2005-2009 American Community Survey

volunteer estimates: EERI volunteers

regression model prediction: from model developed by Concrete Coalition steering committee member Professor Peter May, University of Washington

state court facilities: AOC, 2004. Superior Courts of California, Seismic Assessment Program: Summary Report of Preliminary Findings. Prepared by Rutherford & Chekene Consulting Engineers for Administrative Office of the Courts, Office of Court Construction and Management, January

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federally owned buildings: GSA, 2009. “Concrete Buildings.” Unpublished spreadsheet prepared for the Concrete Coalition by General Services Administration Region IX. Obtained by the Concrete Coalition March 2, 2009.

Ventura

CITY OR TOWN	% OF HOUSING UNITS IN STRUCTURES WITH 20+ UNITS	# HOUSING UNITS	% BUILT BEFORE 1939	# PRE-1980 CONCRETE BUILDINGS: VOLUNTEER ESTIMATE	# PRE-1980 CONCRETE BUILDINGS: REGRESSION MODEL PREDICTION
Camarillo	6.1	24,036	0.9		5
Fillmore	3.1	3,778	11.4		4
Moorpark	3.4	9,728	0.8		2
Ojai	2.9	3,197	13.0		4
Oxnard	7.7	50,262	2.2		20
Port Hueneme	15.0	8,122	0.6		3
Santa Paula	4.5	8,882	7.6		8
Simi Valley	3.9	40,270	0.4		3
Thousand Oaks	7.3	45,639	0.3		5
Ventura	8.7	41,483	7.9		45

COUNTY DATA	State Court Facilities	State owned/leased buildings	K-12 Public Schools	UC Campus	CSU Campuses	Federally-owned Buildings	
# pre-1980 concrete bldgs	0	6	23	0	2	0	TOTAL = 31

SOURCES

Census data (% of housing units in structures with 20+ units, # of housing units, % built before 1939): U.S. Census Bureau, American FactFinder, 2005-2009 American Community Survey

volunteer estimates: EERI volunteers
regression model prediction: from model developed by Concrete Coalition steering committee member Professor Peter May, University of Washington
state court facilities: AOC, 2004. Superior Courts of California, Seismic Assessment Program: Summary Report of Preliminary Findings. Prepared by Rutherford & Chekene Consulting Engineers for Administrative Office of the Courts, Office of Court Construction and Management, January

state owned or leased buildings: DGS, 2008. "Concrete Types Jan 2009." Unpublished spreadsheet prepared for the Concrete Coalition by Department of General Services, Real Estate Services Division. Obtained by the Concrete Coalition December 31, 2008.

K-12 public schools: DGS, 2002. "Seismic Safety Inventory of California Public Schools (A Report to the Governor of California and California State Legislature)." Department of General Services, November 15. Available online: http://www.documents.dgs.ca.gov/Legi/Publications/2002Reports/FinalAB300Report.pdf

DGS, 2008. "Concrete Types Jan 2009." Unpublished spreadsheet prepared for the Concrete Coalition by Department of General Services, Real Estate Services Division. Obtained by the Concrete Coalition December 31, 2008.

UC campus:Luckle, M. and E. Perez. 2010. MAP: Seismically Hazardous Buildings in the UC System. California Watch. March 17. (http://californiawatch.org/higher-ed/map-seismically-hazardous-buildings-uc-system)

CSU campus: Space and Facilities Database Management System Facility Report 2009; Luckle and Perez, 2010, seismic safety studies conducted in 1993 by various engineering firms for DSA

federally owned buildings: GSA, 2009. "Concrete Buildings." Unpublished spreadsheet prepared for the Concrete Coalition by General Services Administration Region IX. Obtained by the Concrete Coalition March 2, 2009.

Yolo

CITY OR TOWN	% OF HOUSING UNITS IN STRUCTURES WITH 20+ UNITS	# HOUSING UNITS	% BUILT BEFORE 1939	# PRE-1980 CONCRETE BUILDINGS	
				VOLUNTEER ESTIMATE	REGRESSION MODEL PREDICTION
Davis	16.8	23,942	2.4		21
West Sacramento	5.6	17,545	4.8		12
Winters	3.1	2,197	10.3		2
Woodland	9.2	19,430	9.0		28

COUNTY DATA	State Court Facilities	State owned/leased buildings	K-12 Public Schools	UC Campus	CSU Campuses	Federally-owned Buildings	
# pre-1980 concrete bldgs	2	5	13	2	0	0	TOTAL = 22

SOURCES

Census data (% of housing units in structures with 20+ units, # of housing units, % built before 1939): U.S. Census Bureau, American FactFinder, 2005-2009 American Community Survey

volunteer estimates: EERI volunteers

regression model prediction: from model developed by Concrete Coalition steering committee member Professor Peter May, University of Washington

state court facilities: AOC, 2004. Superior Courts of California, Seismic Assessment Program: Summary Report of Preliminary Findings. Prepared by Rutherford & Chekene Consulting Engineers for Administrative Office of the Courts, Office of Court Construction and Management, January

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K-12 public schools: DGS, 2002. “Seismic Safety Inventory of California Public Schools (A Report to the Governor of California and California State Legislature).” Department of General Services, November 15. Available online: http://www.documents.dgs.ca.gov/Legi/Publications/2002Reports/FinalAB300Report.pdf

DGS, 2008. “Concrete Types Jan 2009.” Unpublished spreadsheet prepared for the Concrete Coalition by Department of General Services, Real Estate Services Division. Obtained by the Concrete Coalition December 31, 2008.

UC campus:Luckle, M. and E. Perez. 2010. MAP: Seismically Hazardous Buildings in the UC System. California Watch. March 17. (http://californiawatch.org/higher-ed/map-seismically-hazardous-buildings-uc-system)

CSU campus: Space and Facilities Database Management System Facility Report 2009; Luckle and Perez, 2010, seismic safety studies conducted in 1993 by various engineering firms for DSA

federally owned buildings: GSA, 2009. “Concrete Buildings.” Unpublished spreadsheet prepared for the Concrete Coalition by General Services Administration Region IX. Obtained by the Concrete Coalition March 2, 2009.