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PUBLIC SUPPORT AND PRIORITIES FOR SEISMIC REHABILITATION IN THE EAST BAY REGION OF NORTHERN CALIFORNIA

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Public Support and Priorities for Seismic Rehabilitation in the East Bay Region of Northern California

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Abstract

A mail survey was conducted on a sample of 727 residents of Alameda County, CA. The goals of the study were to obtain data on public perceptions of likely damage and disruption following a Bay Area earthquake, judgments concerning the criticality of various elements in the built environment, and willingness to pay for programs to strengthen structures and lifelines. Alameda County residents expect significant damage in the event of a major earthquake, and they have clear priorities regarding which structures and systems must remain operational should an earthquake occur. Most residents are willing to invest additional funds in seismic safety programs, particularly programs targeting health- and safety-related structures, such as major hospitals, fire stations, and critical government buildings. Logistic regression analyses identified a number of predictors of support for seismic safety programs. The most significant predictors of overall willingness to pay for seismic upgrading were education, age (which was negatively associated with willingness to pay), trust in California state government, household preparedness, and earthquake risk perception.

1. INTRODUCTION

Despite the growing emphasis on performance-based design and on developing seismic loss-reduction policies that are consistent with public conceptions of acceptable risk, we currently lack detailed information on how the public expects critical elements in the urban built environment to perform when an earthquake occurs or on what standards of performance residents of vulnerable areas consider acceptable. Both past research and experience in the U. S. present a somewhat contradictory picture of the strength and scope of public support for hazard-reduction measures. On the one hand, there is a substantial body of work in the social sciences suggesting that both the general public and opinion leaders assign a low priority to earthquake and other disaster-related loss-reduction programs (Rossi, Wright, and Weber-Burdin 1982; Drabek, Mushkatel, and Kilijanek 1983; Mittler 1989; Federal Emergency Management Agency 1993). Stallings (1995) has argued that earthquake safety has not yet been defined as a significant social problem by the broader public, even in high-risk areas like Southern California, and that seismic loss reduction lacks a public constituency outside the small group of experts he calls the "earthquake establishment." On the other hand, some studies have shown that significant public support does exist for stronger seismic safety measures. For example, Palm and Carroll (1998), focusing on a sample of Northern and Southern California homeowners, found that a majority of their survey respondents favored stricter building codes, mandatory strengthening of public buildings, and improvements in emergency communications systems, even if such measures would have to be paid for with higher taxes. At the same time, however, while survey respondents believed that government should be involved in promoting higher levels of earthquake safety, they tended to see protection against earthquake losses as fundamentally an individual rather than a governmental responsibility.

While some communities have been successful in implementing stronger seismic safety ordinances for existing buildings, such policies have a greater likelihood of being judged acceptable in the wake of damaging earthquakes (Alesch and Petak 1986). Following the 1994 Northridge earthquake, for example, the City of Los Angeles adopted an impressive set of mandatory and voluntary seismic safety ordinances and standards, including a mandatory ordinance for pre-1976 tilt-up concrete buildings and voluntary measures to reduce losses in existing hillside buildings, reinforced concrete buildings, and concrete frame buildings with masonry infills. While earthquake disasters are clearly important factors encouraging the adoption of loss-reduction measures, little research exists on what factors influence support for more stringent seismic safety measures in the absence of such events (National Academy of Sciences/National Research Council 1997).

Recent earthquakes have highlighted the need for a better understanding of public and stakeholder expectations concerning disaster impacts, as well as their loss-reduction policy preferences for both buildings and lifelines. More information is needed on the significance community residents and leaders attach to seismic damage-reduction measures and to maintaining the functionality of elements in the built environment following earthquakes. Similarly, it is important to learn whether there are infrastructural elements and structures that are considered so essential by community residents that they would be willing—both attitudinally and financially—to support measures to ensure higher levels of performance. To address these kinds of questions, in 1998 the Disaster Research Center initiated a study in the San Francisco Bay Area's East Bay Region, an area in the U. S. that was selected because of its vulnerability to earthquakes and its similarity to some vulnerable regions in Japan. The project is being carried out as part of the Japan-U. S. cooperative research program on urban earthquake hazards. The general goals of the study are to better understand what levels of seismic performance residents of a high-risk area judge to be acceptable and what factors affect willingness to support stronger seismic rehabilitation measures. More specifically, the study seeks to obtain data on (1) the expectations that the general public and various stakeholder groups have concerning likely earthquake impacts on the built environment; (2) the importance they attach to the survivability and performance of various elements within the built environment, including lifeline systems (e.g., bridges, highways, utility lifelines) and various types of structures (e.g., residential units, schools, community buildings, hospitals); and (3) seismic mitigation policy preferences, with a particular emphasis on understanding both what East Bay residents consider acceptable levels of performance for different structures and systems and the degree to which they support rehabilitation and retrofit programs that would improve performance. The project employs two methodological approaches: a mail questionnaire designed to obtain information from East Bay residents, and focus group interviews with representatives of selected stakeholder groups. This paper, which reports findings from the East Bay survey, focuses on what kinds of damage the public expects in the next major earthquake, importance ratings and rankings for different elements in the built environment, and the factors that predict support for the seismic rehabilitation of structures and systems.

2. STUDY METHODOLOGY

2.1 Study Sample and Survey Strategy

The mail survey was administered using an approach based on Dillman's total design method (1978), which emphasizes the importance of systematic follow-up and remailings to achieve optimal response rates. In early July, 1999, questionnaires were mailed to 1750 randomly-selected households in Alameda County communities; that sample included an oversample of 250 households in the city of Oakland. Approximately two weeks after the initial mailing, postcard reminders were mailed to those who had not responded. A few days after that mailing, telephone calls were made to non-responders for whom phone numbers were available (1,068 households, a substantial proportion of the non-responders) to encourage them to complete the survey. Approximately two months after the initial mailing, a second mailing was sent to households that had still not returned their questionnaires.

A total of 727 surveys were returned. Taking into account cases that were removed from the original sample for various reasons, the response rate for the study, including both the Alameda county regular sample and the Oakland over-sample, was 42.9%. For the former, the response rate was 43.9% (N=638), while for the latter, it was 36.9% (N=89). Those who completed the survey were not entirely representative of study area residents. Compared with the population of Alameda County, survey respondents were more likely to be older, white, earning more than the median income for the county, more highly educated, and more likely to be homeowners. Groups that were under-represented in the survey include adults under age 24, African Americans, households earning less than the median income (approximately $35,000), those who have not attended college, and renters.

2.2 Topics Addressed in the Questionnaire

The mail questionnaire used for the East Bay survey sought information on a range of topics, including the following: respondents' sociodemographic characteristics, including age, race/ethnicity, education and income, as well as other information, such as whether respondents own or rent their homes; general perceptions of the severity of the earthquake risk, both compared to other problems facing East Bay residents, such as crime, and compared to other natural and technological hazards; respondents' previous experiences with earthquakes and other disasters, including losses they may have experienced in the 1989 Loma Prieta earthquake; perceptions of the likelihood of a major earthquake within five, ten, and twenty years; expectations about the harm and disruption such an earthquake would cause, both to their households and to the community more generally; household earthquake mitigation and preparedness measures respondents have adopted; and the extent to which they have confidence in the ability of both government and building owners to provide protection from earthquake losses.

To address issues of acceptable levels of risk and support for seismic rehabilitation measures, the questionnaire also contained a series of detailed questions designed to obtain data on the levels of damage and disruption respondents anticipate to twenty different elements in the built environment, including bridges over the Bay, utility systems, and various types of structures, if an earthquake on the scale of the 1989 Loma Prieta event were to occur closer to the East Bay Region. The questionnaire also required respondents to rate the criticality of each of those twenty systems and building types and to select the five that they consider most critical. Other questions focused on respondents' willingness to pay for seismic upgrading of different categories of lifelines and structures.

The section below presents descriptive data on the severity of damage that respondents expect different elements in the built environment to sustain in the next major earthquake, as well as their judgments concerning how critical it is that these elements continue to remain functional. Following a discussion of those findings, results of preliminary analyses on factors influencing willingness to pay for seismic upgrading are presented.

3. STUDY FINDINGS

3.1 Expected Levels of Damage

To provide a reference point for their answers, survey respondents were asked "If an earthquake as large as the 1989 earthquake were to strike near the East Bay, what level of damage to the following types of buildings or facilities and what level of disruption to the community do you think would actually occur?" They were then given a list of twenty different types of lifelines and structures and asked to rate expected damage and disruption on a five-point scale, ranging from "No damage or disruption" to "Severe damage and widespread disruption;" thus, the higher the score, the more earthquake damage is anticipated. As indicated in Table 1, respondents expect all twenty types of structures and systems to sustain at least moderate levels of damage should a major

Table 1.

Expected Levels of Damage and Disruption to Elements in the Built Environment

Rank		Mean
1	Electric power lines	3.96
2	Natural gas pipelines	3.94
3	Water pipelines	3.92
3	Highways and overpasses	3.92
4	Major bridges	3.82
5	Telephone lines	3.81
6	BART lines and stations	3.77
7	Apartment building and condos	3.65
8	Office buildings and retail stores	3.55
9	Public schools	3.47
10	Private schools	3.42
11	Major hospitals	3.40
12	Airport facilities	3.39
13	Public arenas and stadiums	3.37
14	Universities and colleges	3.34
15	Single-family houses	3.30
16	Day care centers	3.29
17	Key government buildings	3.28
18	Public safety buildings	3.17
19	Seaport facilities	3.12

earthquake occur near the East Bay. However, they are most concerned about the risk of damage to lifeline systems, rating the potential for damage to be most severe for electrical power, natural gas, and water lifelines, as well as for highways and overpasses, major bridges, and telephone lines. In relative terms, they are least concerned about the vulnerability of seaports, public safety and governmental buildings, day-care centers, and single-family houses. Falling between these two extremes are a range of different types of structures and facilities, including the BART subway system, apartment and office buildings, schools, hospitals, and the airport. Again, however, it should be noted that residents expect all twenty types of facilities and systems to sustain relatively high levels of damage in the event of a major earthquake.

3.2 Importance of Structures and Systems

Respondents were asked to assess the criticality of elements in the built environment in two ways. First, using the same list of twenty types of structures and systems, they were asked to provide assessments of "how important it is for that building or facility to have minimal damage and continue to operate immediately after an earthquake," again on a scale of five, with 1 indicating "Not important at all" and 5 indicating "Very important." As shown in Table 2, respondents give extremely high importance ratings to major hospitals, natural gas, electric, and water pipelines, as well as public safety buildings. Rated lowest in importance are public arenas and stadiums, office buildings and retail stores, universities and colleges, private schools, and ports.

Table 2.

Importance of Elements in the Built Environment

Rank		Mean
1	Major hospitals	4.76
2	Natural gas pipelines	4.75
3	Electric power lines	4.74
3	Water pipelines	4.74
4	Public safety buildings	4.66
5	Telephone lines	4.64
5	Highways and overpasses	4.64
6	Major bridges	4.61
7	BART lines and stations	4.25
8	Airport facilities	4.01
8	Single-family houses	3.89
9	Apartment buildings and condos	3.83
10	Public schools	3.64
11	Key government buildings	3.62
12	Day care centers	3.44
13	Seaport facilities	3.42
14	Private schools	3.39
15	Universities and colleges	3.28
16	Office buildings and retail stores	3.20
17	Public arenas and stadiums	2.57

Second, respondents were asked to review the entire list and to select the five types of structures and facilities that they believe must remain functional and continue to operate in a major earthquake. Priority rankings were assigned based on the number of times different elements in the built environment were selected by respondents. As indicated in Table 3, using this measure, water pipelines, major hospitals, and electrical power lines had the highest ratings, having been selected as critical by approximately three-fourths of all respondents. Structures and systems singled out as critical by more than 40% of respondents include telephone lines, public safety buildings, highways and overpasses, natural gas pipelines, and major bridges. Public consensus appears to crystallize around the importance of these types of buildings and lifelines, and then drop off rather rapidly, with fewer than 10% of respondents believing that the other structures and systems must remain operational in a major earthquake. For example, an extremely small number of respondents identified universities and colleges, public arenas and stadiums, office buildings and retail stores, private schools, and seaport facilities as critical.

These data suggest that East Bay residents expect moderate to severe damage to virtually all elements in the built environment should a major earthquake occur in their area and that they are particularly concerned about the vulnerability of the region's lifelines. They assign the greatest functional importance to major hospitals and to gas, electric, and water lifeline systems.

Table 3.

Prioritization of Elements

in the Built Environment

Rank		% of cases
1	Water pipelines	76.3
2	Major hospitals	76.0
3	Electrical power lines	73.9
4	Telephone lines	47.7
5	Public safety buildings	47.4
6	Highways and overpasses	45.8
7	Natural gas pipelines	44.3
8	Major bridges	43.3
9	Airport facilities	8.7
10	BART lines and stations	8.3
11	Single-family houses	7.0
12	Public schools	0.7
13	Apartment buildings and condos	3.2
14	Key government buildings	2.9
15	Day care centers	2.7
16	Seaport facilities	1.4
17	Private schools	1.2
18	Office buildings and retail stores	0.2
18	Public arenas and stadiums	0.2
19	Universities and colleges	0.1

3.3 Willingness to Pay for Seismic Upgrading

One approach to measuring support for loss-reduction policies is to attempt to determine willingness to pay for higher levels of safety. To the extent that reluctance to make that investment signals an acceptance of the status quo, willingness to pay can also be considered an indirect measure of the extent to which current levels of risk and vulnerability are acceptable. Because pilot tests indicated that respondents would have great difficulty making willingness-to-pay judgments about twenty different elements in the built environment, the question concerning willingness to pay asked not about specific types of structures and systems, but rather about six general groupings of elements in the built environment—public safety buildings, utility systems, transportation systems, schools, residential buildings, and commercial buildings—under which those elements were subsumed. The willingness-to-pay question was phrased in the following manner: "Given what you know about the chances of a damaging earthquake in the East Bay, how much would you be willing to pay each year for ten years in extra taxes, fees, or charges to strengthen the following sets of buildings and facilities so they would continue to operate following an earthquake?" Respondents were also asked to take into account their household resources and to assume that their contributions would go directly to keeping those structures and systems operational.

In asking respondents to specify the amount of dollars they would be willing to pay for enhancing the seismic resistance of the built environment, the original intention was to derive measures of willingness to pay that could be used as dependent variables in OLS regression models. However, because such a large number of respondents were unwilling to pay any amount of money for seismic strengthening, the willingness-to-pay variable was treated as dichotomous for analytic purposes; that is, respondents were categorized as either "not willing to pay anything" or "willing to pay something" for seismic rehabilitation.

As indicated in Table 4, overall 85% of respondents were willing to pay at least a minimal amount of money over a ten-year period to strengthen at least some structures and systems in the East Bay. Respondents showed the greatest willingness to invest in strategies to enhance the seismic resistance of public safety buildings, a category that includes fire stations, police departments, other key governmental buildings, and major hospitals. Over 80% were willing to pay at least something to obtain higher levels of seismic resistance for those structures. A large proportion of respondents also showed a willingness to commit funds for the seismic strengthening of utility systems (80% willing to pay), transportation systems (79% willing to pay), and schools (66% willing to pay). In contrast, relatively few people were willing to use their money to upgrade residential and commercial structures. Approximately 46% of the respondents would pay to upgrade residential structures, and only 29% were willing to pay for the upgrading of commercial buildings.

Table 4.

Percent Willing to Pay to Strengthen

Elements in the Built Environment

Rank		% of cases
1	Public safety buildings	82.3
2	Utility systems	80.0
3	Transportation systems	79.5
4	Schools	65.9
5	Residential buildings	45.6
6	Commercial buildings	28.9
	Any element	85.0

In deciding on whether and where to invest their funds, respondents appear to be making two kinds of distinctions. First, they seem to be more willing to pay to upgrade buildings and systems that they believe must remain operational for the good of the entire community (e.g., health- and safety-related building, lifelines), as contrasted with those that are less critical from the point of view of the community. Second, they appear to be distinguishing between elements in the built environment that they believe should be strengthened using funds raised from the general public, such as public safety buildings, and those that owners themselves, rather than the public, should pay to make more seismically resistant. For example, of the six categories, respondents show the least willingness to pay for upgrading commercial buildings, perhaps because they see such measures as the sole responsibility of building owners.

3.4 Factors Predicting Willingness to Pay for Loss-Reduction Measures

A series of logistic regression analyses were conducted to identify factors that are associated with East Bay residents' willingness to pay for seismic upgrading. Table 5 contains a listing of survey variables that were employed in those models.

Table 5.
List of Logistic Regression
Model Variables

Type	Variable	Description
Demographics	Age	In years
	Gender	Male v. Female
	Race	White v. Non-white
	Education	Bachelor's degree v. <Degree
Family Composition	Child	Number of children under 18
	Own Home	Own v. Rent
Earthquake Preparedness	Prepared	Completed preparedness activities v. Done nothing
Disaster Experience	Experience	Experienced disaster other than Loma Prieta in past 10 years v. None
Trust	California	Trust in state government
	Businesses	Trust in business owners
	Landlords	Trust in landlords
Risk Perception	Quake Risk	Likelihood of another damaging earthquake
Functional Importance (By Category)	Residential	Mean composite
	Commercial	Mean composite
	Public Safety	Mean composite
	Schools	Mean composite
	Utility	Mean composite
	Transportation	Mean composite
Functional Importance (All Elements)	Overall Importance	Sum of importance ratings for all elements (20-100)

The majority of those variables were selected for inclusion in the survey because previous research suggests that they influence a broad range of hazard-related behaviors. For example, in various U. S. studies, income, education, prior disaster experience, gender, perceived risk, minority status, home ownership, and presence of children in the home have been found to be associated with higher levels of disaster preparedness, as well as with risk perception, willingness to take self-protective actions when disasters strike, and support for governmental programs to reduce disaster losses (Turner, Nigg, and Heller-Paz 1986; Lindell and Perry 1992; Edwards 1993; Palm and Carroll 1998; Tierney, Lindell, and Perry 2001). We thus reasoned that those factors might also affect willingness to commit financially to enhancing earthquake safety. Also included in the models were a variable measuring the degree of trust respondents place in the ability of various public- and private-sector entities to provide protection against earthquake damage, as well as two composite importance measures, one assessing importance for the six categories of structures and systems, and the other summarizing respondents' assessments of the importance of all twenty types of facilities and systems in the built environment. It seems reasonable to assume that members of the public will not be willing to invest in programs unless they place at least some degree of trust in the entities that would be administering and implementing those programs. Similarly, we expected that support for strengthening elements in the built environment would be associated with views on the importance of maintaining the functionality of those structures and systems.

Table 6 presents the results of the logistic regression analysis that was conducted to identify predictors of overall willingness to pay for seismic upgrading. In this model, the focus was on identifying factors that were associated with support for enhancing the seismic safety of *any of the six categories of structures and systems.* As indicated in the table, willingness to commit funds for loss reduction over a ten-year period is associated with higher levels of education—in this case, education beyond the college level. Age is negatively associated with willingness to support loss-reduction programs. Older residents are less willing to commit funds, perhaps because they have less discretionary income, or conceivably because they do not expect to live long enough to reap the benefits of investing in seismic loss reduction. The degree of trust residents have in the ability of the State of California to provide protection of communities is a positive predictor of willingness to invest in programs to

Table 6.
Logistic Regression Model for
Total Willingness to Pay

Variables	+/-	Wald
Education*	+	10.051
Age*	-	9.093
Trust State*	+	7.776
Prepared*	+	6.150
Quake Risk*	+	5.668
Gender	-	2.210
Race	+	0.303
Functional Importance (All Elements)	+	0.142
		*p<= .05

strengthen elements in the built environment, suggesting that the public sees the state as an important supporter of earthquake safety. Levels of household preparedness are also associated with support for seismic upgrading. Evidently households that have been willing to invest the time, effort, and expense involved in undertaking seismic protection measures at home are also more willing to invest in measures that would afford higher levels of community protection. Finally, and not unexpectedly, risk perception influences support for seismic loss-reduction measures. Residents who believe that a damaging earthquake is more probable in the relatively near future are more willing to pay for community-wide seismic upgrading than those who do not believe that a major earthquake is likely to strike the East Bay. Model variables that are not significantly associated with willingness to pay for any type of loss-reduction measures include gender, race, and the composite measure of functional importance respondents assign to the twenty built environment elements focused on in the survey.

Because other survey results indicated that members of the public place a higher priority on some elements in the built environment than on others, analyses were also undertaken to identify factors associated with support for enhancing the earthquake resistance of each of the six categories of structures and systems—residential structures, commercial structures, public safety buildings, schools, utility lifelines, and transportation lifelines.

Table 7 presents the results of logistic regression analyses focusing on those categories of built environment elements. The variables in bold type in the table are factors that are significant predictors in three or more models. Those variables include the functional importance respondents assign to different categories of structures and lifeline systems, trust in state government, education, age, and household earthquake preparedness. Intuitively, we would expect that individuals who consider it very important that some types of structures and lifelines remain operational following an earthquake would also be willing to pay to upgrade those structures, and this did turn out to be the case for residential and commercial buildings, public safety buildings, and schools.

As in the overall willingness-to-pay model, trust in California state government again emerged as a significant predictor of willingness to pay for the rehabilitation of virtually all categories of structures and systems, with the exception of schools. This last result is difficult to understand, since state policies have a major impact on school seismic safety. Again paralleling the overall model, age is negatively associated with support for enhancing the earthquake safety of public safety buildings, as well as utility and transportation lifelines. Higher levels of education are associated with support for seismic mitigation for public safety buildings, schools, and utility and transportation lifelines, and higher levels of household earthquake preparedness predict willingness to invest in upgrading public safety buildings, schools, and utility and transportation systems.

Some variables achieve only occasional significance as predictors of support for upgrading specific categories of structures and systems. For example, female respondents are more likely than males to be willing to invest in loss-reduction measures for schools and utilities; the former result seems to make intuitive sense, while the latter is more puzzling. Trust in the ability of businesses to provide earthquake protection is associated with willingness to invest in enhancing seismic safety for commercial structures. Home ownership is also associated with willingness to pay for strengthening commercial structures. However, neither variable is an important predictor of support for strengthening other types of buildings and systems.

Table 7.
Significant* Predictors of Willingness
To Pay by Functional Category

Category	Significant Variables	+/-	Wald
Residential	**Functional Importance (Residential)**	+	18.182
	Trust State	+	4.803
Commercial	**Functional Importance (Commercial)**	+	18.326
	Trust State	+	9.573
	Trust Businesses	+	7.549
	Own Home	-	7.492
Public Safety	**Education**	+	12.760
	Trust State	+	9.390
	Age	-	6.230
	Prepared	+	5.675
	Functional Importance (Public Safety)	+	5.441
Schools	**Functional Importance (Schools)**	+	26.500
	Gender	-	4.575
	Prepared	+	4.332
	Education	+	4.115
Utility	**Education**	+	21.094
	Trust State	+	11.883
	Gender	-	6.874
	Quake Risk	+	5.427
	Prepared	+	4.317
	Age	-	2.594
Transportation	**Education**	+	15.223
	Trust State	+	10.604
	Age	-	4.251
	Quake Risk	+	4.238
			*p<= .05

It is interesting that home ownership is not associated with willingness to pay for programs to strengthen residential structures. Perhaps homeowners believe the cost of such measures should be borne by homeowners themselves, rather than the public at large. Risk perception, while important as an overall predictor of willingness to pay for seismic upgrading, is only associated with support for strengthening utility and transportation lifelines.

4. CONCLUSIONS

Survey findings indicate that residents of Alameda County are quite concerned about the earthquake threat and that they expect structures and lifelines to sustain moderate to severe damage in the event of an earthquake. Members of the public identify several types of structures and systems, including major hospitals, natural gas, electric, and water pipelines, and public safety buildings as elements in the built environment that they believe must remain functional in the event of an earthquake. Put another way, their standards of performance are higher for these structures and systems than for other elements in the built environment.

These performance expectations translate into willingness to pay for additional seismic upgrading for some types of buildings and infrastructural systems. Alameda County residents are most willing to pay for health- and public-safety-related structures, such as hospitals and fire and police stations. Support is also high for programs that would strengthen critical lifeline systems such as electrical power, gas, and water lifelines. In contrast, respondents show little interest in financially supporting programs to strengthen private buildings such as businesses and residential structures.

Willingness to invest in higher levels of seismic safety is higher among certain segments of the population, including those with higher levels of education, younger community residents, those who have themselves engaged in household preparedness activities, and those who think that a damaging earthquake is likely in the near future. Other significant predictors of support for seismic loss-reduction programs include trust in state government (but not in other levels of government or in the private sector). Some factors appear to be important determinants of willingness to pay for some seismic safety programs, but not for others. For example, gender affects support for school seismic safety measures and for the strengthening of lifeline systems, but does not appear to be a significant factor affecting willingness to pay for other types of seismic upgrading.

It is interesting to note that in some cases survey respondents' views on the need for seismically upgrading elements in the built environment do not appear to be correlated directly with their expectations concerning potential damage severity. Rather, those attitudes seem to be driven more by the importance they attach to the survival and continued functionality of those structures. For example, even though respondents believe that public safety buildings and hospitals are currently less vulnerable than many other types of structures and systems, they are still willing to invest further in order to make those facilities more earthquake resistant.

The findings presented here are very preliminary. More extensive analyses will be needed to explore more fully relationships among variables in the data set. Promising avenues for future work include the development of profiles describing typical supporters of stronger seismic safety measures and analyses aims at determining whether residents of Oakland, the County's largest city, differ from other county residents in views on seismic hazards.

Additionally, to supplement this quantitative, survey-based approach, the next phase of the study will explore similar issues using a qualitative, focus group approach. Separate focus group discussions will be held with public officials, engineers, business owners, and members of the general public in an effort to gain a better understanding of such topics as the extent to which group participants consider current seismic safety programs adequate, where they think improvements are needed and why, and what funding sources should be used to pay for those programs.

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