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# Barriers to Mitigation: A Pilot Study

James Lee

*San Jose State University*, james.lee@sjsu.edu

Crystal Paul

*San Jose State University*

Guna Selvaduray

*San Jose State University*

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# **BARRIERS TO MITIGATION: A PILOT STUDY**

Submitted to

The Office of Emergency Services

City of San José

Report prepared by

James Lee,\* Ph.D., Crystal Paul\* and Guna Selvaduray, \*\* Ph.D.

Collaborative for Disaster Mitigation

San José State University

*\*Department of Sociology, San Jose State University*

*\*\*College of Engineering, San Jose State University*

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# **BARRIERS TO MITIGATION: A PILOT STUDY**

James Lee, Crystal Paul and Guna Selvaduray  
San Jose State University  
April, 2009

## **Executive Summary**

This pilot research was undertaken to discover barriers that prevent homeowners from mitigating earthquake hazards in their homes. There is a relatively significant body of literature on disaster mitigation, which is reviewed and summarized in this report. However, no studies address how these barriers may be overcome so that homeowners would be more proactive in mitigation. If the barriers can be identified, then future communications and policy actions that address these barriers can be taken, resulting in more widespread mitigation implementation that reduces the injury and damage potential that communities face, leading to a reduction in the post-disaster response requirement, and the time required to achieve recovery.

Data came from an online survey of San José State University employees; the survey took approximately 15 minutes for respondents to complete. Questions addressed home characteristics, demographic characteristics, perceptions of earthquake risk, levels of mitigation, past experience with earthquake injury or damage, social influences on hazard and damage prevention, and reactions to various incentives. Statistical analyses were done using SPSS version 16.0.

Of the total 331 respondents, 215 were homeowners and consequently used for data analysis. Of these homeowners, 79 % owned single-family homes. The sample overwhelmingly expects a major earthquake to occur within the next 10 years, and most expect to suffer earthquake-caused injuries and damage within their homes in the near future.

The findings indicate the importance of earthquake expectations and the social network for influencing mitigation. Physical proximity to others who experienced earthquake damage and relational closeness to those who have taken mitigation actions were found to have a positive effect on mitigation implementation by individuals. Homeowners assumed responsibility for mitigation, and cost is generally not a concern. The most prevalent obstacles to mitigation were the feeling that the mitigation is not necessary or that it is inconvenient. Home structures and systems mitigation is far more commonplace than home contents mitigation. Mitigation of home contents was perceived as not being very important, and this perception prevents individuals from taking mitigation actions.

All incentive types that were presented to respondents, which were primarily financial in nature, were reported as likely to increase mitigation. Providing advice and information was also reported to likely result in higher levels of mitigation. The development of mitigation approaches that are low-cost and simple is expected to have a positive effect on mitigation actions. In addition, codes were found to be effective at prompting mitigation – most respondents had mitigated for items that have code requirements. One outcome of this is that mitigation of structures is more widely reported than mitigation of home contents.

More research is needed to explore non-financial incentives for mitigation, including incentives provided by personal relationships and how social relationships may be leveraged. There is also a need to explore whether different types of incentives (such as free labor or education) would be more or less effective at prompting particular mitigation actions (such as securing the foundation or strapping down appliances). It would be helpful to take a “bottom up” approach by conducting focus groups on these topics.

Demographic effects on mitigation and barriers to mitigation also need to be explored further. There were suggestions that demography mattered, but the sample size for this survey was not sufficiently large to draw statistically valid conclusions. There is also a need to revise the survey instrument to remove some ambiguities and inadequacies that currently exist. It would be useful to explore why persons might have taken particular mitigation actions and how social networks affect their mitigation action, among other things.

Heightened perceptions of earthquake threats, experience with earthquake injuries and damage, and social relationships are critical predictors of mitigation. Individuals who know others who have mitigated are more likely to mitigate; therefore improved communications, on the personal level, on the topic of mitigation can be effective. Given the perceptions of mitigating home contents, the public also needs to be made more aware of the threats posed by home contents during an earthquake.

## **I. Introduction**

The purpose of the research reported here was to identify barriers or impediments that prevent homeowners from implementing earthquake hazard or damage reduction measures, frequently referred to as mitigation. Practically all earthquake mitigation measures that can be implemented in the home are relatively straightforward and can be very effective (Multihazard Mitigation Council 2005; U.S. Geological Survey 2005). They are also not prohibitively expensive, especially damage prevention measures that can be used to protect the contents of homes. Despite the relative simplicity of earthquake mitigation techniques, they have not been as widely adopted by the general population as they could be (U.S. Geological Survey 2005).

At the present time, significant amounts of educational and instructional materials on earthquake hazard or damage reduction, targeted at homeowners, already exist. These have typically been designed and prepared by government agencies and non-profits. Despite the availability of such materials that include “how-to” instructions in many cases, implementation of earthquake hazard reduction is still not sufficiently widespread.

This research was predicated on the hypothesis that there are barriers or obstacles to mitigation that exist and that these need to be understood so that they can be overcome, and new and more effective approaches to reach out to homeowners can be identified and developed to overcome them.

Another objective of this project was to develop a survey instrument that could be used to discover and understand the barriers to mitigation, test it on a small sample, and, based on the findings, make the necessary revisions so that the survey instrument could be used on a broader and more general population. A key goal for the questionnaire was for it to be “user friendly,”



meaning that average persons would not be discouraged from completing it because of its length (goal: under 15 minutes to complete) or complexity. It should also be pointed out that the target group of this survey was *homeowners*. This was based on the assumption that homeowners have the most to lose, should they suffer damage to their homes as the result of an earthquake. This approach is consistent with the approach of the California Seismic Safety Commission that has targeted homeowners for their hazard reduction outreach.

This was a pilot project that used San José State University faculty and staff as its sample. This group was chosen because it was thought that there would be a sufficient proportion of them who would be homeowners, and, living in an earthquake affected area, it is a good target group to develop a better understanding of the barriers to mitigation.

As a part of this research, the relevant literature was reviewed and is summarized in Section II. The methods employed for the research are described in Section III.

The results, which are described in Section IV, include: (a) description of the sample, including expected earthquake activity, experiences with earthquakes in the past, and experiences with earthquakes of others in respondents' social networks, (b) levels of mitigation behaviors across a spectrum of mitigation activities, (c) perceived obstacles to mitigation, and (d) variations in mitigation by demographic groups. Suggestions for improving levels of mitigation are made.

In Section V, discussion, the important descriptive findings, including what the barriers appear to be, and recommendations for potentially removing the barriers, are presented. Recommendations for changes to the survey instrument are also included in this section.

The Conclusions are contained in Section VI. The survey instrument used for this research is included in Appendix A.

## **II. Barriers to Hazard Mitigation – Review of the Literature**

Studies have shown that both disaster preparedness and disaster mitigation are extremely important steps in the emergency preparation process. However, relatively little research that directly concerns earthquake hazard mitigation among individuals has been done (Lindell and Perry 2000; Mileti and Gottslitch 2001; Perrings 2003). Disaster preparedness involves several steps in which a family may gather and store items as well as prepare evacuation plans and meeting spots to ensure safety in the event of a disaster. Mitigation, on the other hand, requires individuals to take a different approach specifically towards reducing vulnerability, for example, in the home. There are various actions individuals can take to mitigate their homes against disasters. Examples would include securing water heaters and large furniture items into place as well as anchoring one's house to its foundation (U.S. Geological Survey 2005).

While there is a solid and growing body of research assessing disaster preparedness (Russel, Goltz, & Bourque 1995), there has been little focus solely on earthquake hazard mitigation among individuals. Extensive research assessing the importance of mitigation from a technical and financial perspective, particularly focusing on mitigation from an insurance and civil engineering aspect, has been widely documented (Settle 1985; Kunreuther 1998; Multihazard Mitigation Council 2005). Much of this research is focused on the public administration aspect of disaster preparedness or commercial risk management. Mitigation research has often revolved around what city planners and governments can do to reduce both property damage and the injury of residents in various natural disasters (Bolt 1991; Lamarre 1998; Meltsner 1977; Nelson & French 2002; Palm and Hodgson 1992).

Numerous organizations, businesses and governments are exploring ways to ready communities against both the physical and financial effects of disasters. Yet, research has found

that often homeowners themselves do not take the proper precautions against disasters (Lindell and Perry 2000; U.S. Geological Survey 2005). In fact, Edwards (1993) shows that when asked about disaster preparedness in an area where earthquakes are a potential hazard, over 70% of individuals responded that they had taken actions toward personal preparedness. However less than 4% of individuals had participated in actual mitigation practices (Edwards 1993).

Noted studies have shown that individuals tend to increase disaster preparedness and/or mitigation efforts either directly after a major disaster has occurred or when there has been a large increase in awareness about the threat of a disaster (Duval and Mulilis 1999; Kreps 1984; Garcia 1989; Showalter 1993). A survey of 955 Californians conducted by the Survey and Policy Research Institute (SPRI) at San José State University (2006) found that those respondents who understood the potential threat of an earthquake had higher preparedness ratings than those who did not. The National Council for Excellence in Government (2008) found that 19% of over 1,000 national respondents claimed to have taken steps toward preparedness after observing recent flooding in the Midwest and wildfires in California. Still, the majority of the population remains unprepared at all times (Council for Excellence in Government 2007; National Center for Disaster Preparedness 2007; Department of Homeland Security 2007).

Past studies have shown that often individuals do not participate in disaster preparedness or disaster mitigation for several reasons. It may be that the individual is unaware of the imposed risk of disaster or does not perceive the threat of a disaster to be imminent (Clarke 2008). Turner, Niggs, Paz, and Young (1980, as cited in Kreps 1984), presented research based on individual and group responses of southern California residents to earthquake prediction announcements over the time period of three years. The threat of an earthquake was not a frequent worry of most respondents. However, when a potential threat was communicated to them, these individuals

became very interested in obtaining more information and inquired about ways to be prepared (Kreps 1984). Also, Lindell and Perry (2000) cite Turner, Nigg, and Paz (1986) who claim that those individuals who were better informed about disasters and understood that the threat of a disaster was real, were more likely to practice preparedness. Additionally, it has been found that not only do individuals not recognize the threat of a disaster, but they also do not personalize that threat (Lindell and Perry 2000; Weber 2003). This inability to personalize a threat causes these individuals to be less likely to participate in preparedness or mitigation activities.

In an extensive literature review, Lindell and Perry (2000) offered an inventory of other barriers to disaster preparedness. For example, studies have found that individuals are more preoccupied with daily life than they are concerned about preparing for a natural disaster (Lindell and Perry 2000; Clarke 2008). Other studies have found that many individuals do not mitigate because they do not feel it is their responsibility (Garcia 1998; Lindell and Perry 2000; City of Roseville 2004). In fact many individuals reported that they believed the government to be responsible for disaster preparedness and mitigation for the general public. Other individuals did not feel as though mitigation was financially viable (Lindell and Perry 2000; Weber 2003). Individuals may feel that purchasing emergency goods are too costly or that having their house assessed for mitigation adjustments is not an investment they are willing to make.

The disaster preparedness findings above are further verified by a study conducted by the San Diego County Department of Emergency Services. In this study, 55% of the 600 houses surveyed in San Diego County were most concerned about the threat of an Earthquake in their area and approximately 50% of the total respondents were prepared for a disaster with a family emergency plan (Rea & Parker Research 2006). Further, this study showed that those with families and those who had previously experienced a disaster were more likely to be prepared.

However, 50% of households that were not prepared reported the following as reasons for not doing so: they have not taken the time to prepare (approximately 35%), they planned to prepare sometime in the future (approximately 18%), they did not believe anything serious was going to happen (18%), and they felt that they were too busy to take steps toward preparedness (15%) (Rea & Parker Research 2006). Among these responses, another 12% of households claimed that one of the following issues prevented them from being prepared: they simply had not thought about preparedness, they lived in an apartment, they did not have enough space in their home for storage of preparedness items, they did not have children, and/or could not afford certain types of preparedness supplies (Rea & Parker Research 2006).

Stemming from the findings that individuals do not participate in disaster preparedness to a full extent, it is in the interest of earthquake mitigation research to understand what incentives can be used to encourage individuals to help themselves reduce their vulnerability in the event of a disaster. Considering that it has previously been found that individuals do not participate in disaster preparedness or mitigation due to the lack of feelings of personal responsibility, and other factors such as cost, time lost, and inconvenience as listed above, researchers must find incentives that will appeal effectively so that these particular barriers can be overcome. Although incentive research is scarce, there has been some governmental and community based organizations that have conducted community and national surveys to better understand barriers to disaster preparedness. For example, the Texas Colorado River Floodplain Coalition found that out of 39 respondents, only one individual mentioned that enforcing government mandates, such as building codes, would be useful as an encouragement toward disaster preparedness (H2O Partners, Inc 2004). In addition, the Council for Excellence in Government (2006) offered a unique insight to preparedness by citing reasons that individuals *do* prepare. Specifically, among

the 1,000 respondents in this study, about 80% of the individuals who had taken at least one preparedness step did so due to the need for self-sufficiency and to reduce their reliance on others during a disaster (Council for Excellence in Government 2006). Additionally, 49% of respondents who had taken preparedness steps claim to have done so because they are responsible for children. When focusing on specific areas of the county, it was found that 62% of individuals who reside in Miami and 61% of individuals who reside in San Francisco claim to be prepared because they know they live in a high risk area (Council for Excellence in Government 2006).

In a survey conducted by the National Center for Disaster Preparedness in 2007, it was found that many individuals did not feel a disaster threat was imminent and that over 60% would still need to gather items if a disaster were to happen (National Center for Disaster Preparedness 2007). This may imply that an incentive to encourage preparedness and mitigation would be one that helped individuals understand the realistic urgency of a threat in their area. This same survey found that only 28% of 1,352 adult respondents felt that financial incentives such as a tax credit or other economic strategies would affect their decision to prepare (National Center for Disaster Preparedness 2007). Logic would imply that financial incentives would be effective or relevant only when the threat of disaster is acknowledged. It has been mentioned in previous studies that individuals felt that better education and more information about disasters and disaster preparedness would provide incentives (Lindell & Perry 2000). For example, it was found in a national survey, that if information and preparedness recommendations were given by police or fire officials, 64% of 1,006 respondents claimed that they would be very or somewhat more likely to prepare (having a greater effect than any other source); friends and family are also compelling sources as 63% of respondents claimed that encouragement from friends and family

would increase their preparedness level (Council for Excellence In Government 2006). However, information may not always encourage individuals to protect themselves from disasters. One study showed that when prospective homeowners in the Berkeley, CA and Contra Costa County, CA areas were provided with information on potential disasters in their region, they ranked the house's location to an earthquake fault line as one of the least important factors to consider when choosing which new home to purchase (Palm 1981). Moreover, only about 20% of homeowners said that the house's location in an earthquake hazard zone made any difference in their choice to purchase the house (Palm 1981).

Aside from general incentives for individuals to prepare, demographic characteristics have also been studied to understand their relationship with disaster preparedness. Characteristics such as job status, age, race, education and the presence of children in the home all have an effect on preparedness levels. For example, individuals who have a full time job are more likely to participate in disaster preparedness than those who work part time or less (Council for Excellence in Government 2006). In terms of age, it has been found that individuals between the ages of 45 and 55 have the highest preparedness rating among all adult age categories, followed by the 55-64 and 35-44 categories ranked as the second and third most prepared. The 18- 24 adult age category was the least prepared category (Department of Homeland Security 2007). In a general disaster preparedness study conducted in 2006, African Americans were rated the most prepared of all ethnic categories and in a follow-up study in 2008, Non-Hispanic Whites were ranked as the least prepared (Council for Excellence in Government 2008). In terms of education, individuals with less education, specifically those who have only a high school diploma or less are significantly less prepared than those who have obtained higher education (Council for Excellence in Government 2006; 2008). Additionally, having one or more school-

aged child in the home has a positive effect on the household's preparedness levels (Council for Excellence in Government 2006).

Particular theories concerning an individual's lack of preparedness or actions towards mitigation have been developed in both the psychological and sociological fields. For example Duval and Mulilis (1999) assessed earthquake preparedness using a social psychological theory called a person-relative-to-event (PrE) approach. Grounded in the concept of negative threat appeals, as well as the association of both personal attributes (i.e. self-efficacy) and actual event characteristics (i.e. probability, severity), this theory is focused on an individual's preparedness activities in direct response to threat perception (Duval & Mulilis 1999). The PrE approach additionally hypothesizes that "problem focused coping" will be greater when resources are considered to be sufficient in relation to the size of the expected disaster (Duval & Mulilis 1999). Duval and Mulilis (1999) used the negative threat appeal of an impending disaster to study the response and disaster preparedness activity of a group of 328 homeowners in Long Beach, CA. PrE theory was supported when the results of the study showed that those with high personal resources tended to increase their readiness activities as the potential magnitude of the disaster increased (Duval & Mulilis 1999). However, for those with low personal resources, as the potential magnitude of the disaster increased, preparedness efforts decreased (Duval & Mulilis 1999). The explanation for this finding is that when a disaster is anticipated as potentially more intense, and individuals have low coping resources, preparedness activities are perceived as more difficult and that actual preparation is impossible; therefore, individuals with low personal resources are not willing to commit to a level of disaster preparation that they feel they can not attain (Duval & Mulilis 1999). One possible lesson stemming from this work is that advocates for mitigation need to emphasize the low cost and simplicity of many mitigation techniques. This



emphasis could encourage persons with low personal resources to mitigate more than otherwise. There is also a need to review the mitigation techniques that are advocated currently and evaluate whether simpler and/or lower cost approaches can be developed.

Expanding off of their previous work done on tornado preparedness, Mulilis, Duval, and Rombach (2001) discussed disaster preparedness in the social psychological terms of not only personal responsibility but also of personal choice and commitment. To the extent that individuals feel that they have a choice *to be involved* in a particular situation relates to how much control they feel that they have *in* that situation (Mulilis et al 2001). This control in turn affects the amount of responsibility individuals feel that they have *over* that situation (Mulilis et al 2001). Mulilis et al. (2001) continue on to state that when individuals feel that they are responsible for a decision, the more commitment to the decision they will have. The findings of a study on tornado preparedness done on 52 undergraduate psychology students at Pennsylvania State University found that only under conditions of high choice and high commitment did individuals feel highly responsible for tornado preparedness activity (Mulilis et al 2001).

The concept of choice as related to personal responsibility in disaster preparedness is important. It may be concluded that it is when individuals understand that they have a choice to mitigate or to not mitigate against disasters, in order to protect themselves and their families, that they take control of and follow through with mitigation activities. In this same vein, it can be further stated that as an individual is likely to have the power to choose to mitigate against disasters, if they believe that they are responsible for that decision, they will be more committed to following through on it. These conclusions are consistent with Mulilis and Duval's (1999) research on the PrE approach to disaster preparedness. Just as individuals need to feel as though

they are in control of their choices and are in turn committed to those choices, individuals need and use personal attributes and resources also to react to and prepare for the threat of disaster.

Predating the social psychological approaches presented above, Bogard (1988) takes a more sociologically rooted look at disaster preparedness. Appealing to rational action theory and Giddens' concept of stratification to explain the relationship between the action of mitigation and its unanticipated consequences, Bogard (1988) discusses the intentional, purposeful and feedback oriented nature of human action. Essentially, this theory maintains, as Giddens asserts, that humans are naturally able to monitor and reflect upon their actions based on stocks of knowledge shared by individuals in society. Bogard then compares this nature of human action to the perpetually uncertain threat and outcome of a disaster (Bogard 1988). Bogard concludes that mitigation must always operate against this perception of the unknown. Bogard further discusses mitigation as a collection of strategic actions taken by individuals or society to reduce the impact of hazards. However, due to the fact that mitigation is not always guaranteed to work perfectly as planned, some precautions can have negative effects; Bogard claims that the potential harms of mitigation must also be considered. Bogard points out that very rarely an increase toward vulnerability in a disaster has been connected to mitigation. Specifically, Bogard uses work by White (1974) which shows that attempted flood hazard mitigation by the federal government actually increased property loss and damage (Bogard 1988). Such examples, inadvertent and unintended as they may be, can make mitigation look suspect and are important for understanding possible reasons why individuals may not participate in mitigation activities. For example, as Bogard illustrates, humans are constantly acting in relation to previous actions and shared social knowledge. If individuals do not conceptualize their actions directly in relation to the threat of a disaster, specifically in choosing to act in ways that support disaster mitigation,

then individuals will continue to be unprepared for disaster. Similarly, because individuals are able to reflect on actions, if they were to perceive previous mitigation actions, whether their own or that of others, as unhelpful, ineffective, or dangerous, then they will not be likely to mitigate, initially or repeatedly.

Lindell and Perry (1992) discuss another theoretical model called Protective Action Decision Model (PADM). This model states that the awareness of a threat arises through the individuals' exposure to incidences of environmental observation, through communication with others or through official governmental and media campaigns. After this exposure, individuals attempt to find the appropriate response for protection without interrupting everyday activities. Often individuals will then appeal to friends and other sources for clarification of appropriate responses (Lindell & Perry 1992). This may lead to the conclusion that if those friends and family members are responding to the situation by participating in disaster preparedness and mitigation, so too, will the individual respond with the same actions. The PADM model demonstrates that a large and direct social influence may be largely responsible for why individuals do or do not participate in preparedness or mitigation activities. It may be seen that this theory can be linked to the PrE theory in that once individuals perceive threat internally, they will then turn outward toward society, friends, and the media to gather information and understand appropriate reactions.

In line with a sociological approach, Kreps (1984) discusses the need to assess disaster preparedness in terms of responses by social units. Kreps states that while social units can range in size and organization, depending on location and the nature of the disaster, and that mitigation efforts vary, social units uniformly are more likely to increase mitigation efforts as the knowledge of a potential disaster increases. In fact, research has found that often persons'

preparedness activities are associated with the same preparedness activities that have been taken by others in their social networks (Mileti and Darlington 1997).

Overall, the research preceding this report points to some common barriers that may prevent mitigation—although research focused on barriers to earthquake injury and damage prevention is atypical. In particular, research on barriers to specific mitigation techniques is lacking. In addition, research on incentives to mitigate is also not common. Again, in particular, research relating incentives to specific mitigation techniques is lacking.

Barriers that previous research highlights include such things as not feeling responsible for mitigation, perceptions of costs and/or lack of benefits, and not feeling that mitigation is important (such as distraction, time, too busy). Some factors said to increase mitigation are the presence of children in the home, previous experience with disasters, and an attitude of self-reliance. Some incentives to mitigate that have been studied, such as information on codes and financial help, appear to be ineffective. On the other hand, social incentives such as lessons about risk from trusted persons appear promising.

The most important barriers to mitigation, and perhaps key to effective incentives, are lacking perception of personal risk to heightened threats of natural disasters and lacking social networks that confirm the assessment of risk and provide examples of persons who have taken steps to prevent injuries and damages. If persons do not feel threatened and do not perceive that mitigation activities are useful or that they do not have the personal power to make effective mitigation, they will be less likely to mitigate. Finally, those who do not see others in their networks taking mitigation seriously may not work to mitigate against injuries or damage from earthquakes.

Given the fact that social networks may influence mitigation, it is wise to ask whether various demographic groups have differing levels of mitigation. Such information is not commonly found in mitigation research, but there is some evidence that different groups have differing levels of mitigation.

The objectives of this research are to determine levels of mitigation for various earthquake mitigation techniques, obstacles to mitigation, and variations in mitigation by demographic groups. This report also suggests ways to improve levels of mitigation, including incentives and other means that can be utilized to reduce or eliminate barriers. Finally, the report makes suggestions for improvements in mitigation research, and in particular ways to improve the survey instrument for future applications.

### **III. Research Methods**

#### **III.1 Sample**

This research was a pilot study intended to (1) collect preliminary data on barriers to earthquake mitigation, and (2) to obtain information to refine the survey instrument for broader use. To gather the pilot data, the faculty and staff of San José State University (SJSU) were surveyed online. These persons were recruited via email, using a distribution list supplied by SJSU. The email explained the purpose of the project and asked for volunteers. This target population contains a variety of ethnic, class, gender, and educational groups. Recruitment and survey data collection was managed by the Survey & Policy Research Institute at SJSU, and the data were collected via the on-line platform, surveymonkey.com. 331 persons opted to respond to the survey.

#### **III.2 Questionnaire**

In this study, we measured home characteristics, self-reports of mitigation behaviors and experiences, perceptions of others' mitigation behaviors and experiences, attitudes about mitigation, and demographic variables. The questions were asked in groups that are discussed below. Actual questionnaire items are in the appendix.

***Home Characteristics*** This set of questions was used to measure the respondent's living arrangements (Questionnaire Sections II - IV). The purpose of this study was specifically focused on the barriers to mitigation on behalf of homeowners. The answers to these questions were used to better understand if the respondent owns a home or rents and what type of home the respondent owns or rents. Different types of homes may provide different opportunities for hazard prevention and mitigation and may lead to varying barriers to hazard mitigation.

Additionally, this set of questions included measures of the length of time the respondent has lived in his/her home and the age of the home. These data may be important to better understand what hazard mitigation steps may have already been required by law as well as to understand the length of time the respondent has had to begin the hazard mitigation process. This study was particularly interested in responses from those individuals who reside in the San José, CA area; a question used to measure the location of the residence of the respondent by asking them to report their zip code was also included.

***Perceptions of Earthquake Risk*** This set of questions was used to measure the effect of potential risk on the respondent's level of mitigation (Questionnaire Section V). It has been shown in the review of the literature that individuals who consider an earthquake to be a more likely occurrence will be more likely to mitigate. This set of questions first measures the respondent's perception of the likelihood of an earthquake occurrence. Additional questions measure the potential damage or injury the respondent may anticipate will occur.

***Level of Mitigation*** This set of questions was used to measure the respondents' level of mitigation (Questionnaire Sections 6 – 31). Several different categories of mitigation are referred to here including: research done on earthquake damage prevention, assessment of the home's earthquake resistance by an engineer, secured home to its foundation, strapped down water heater, fitted gas and other appliances with flexible connections, bolted large furniture items into place, placed safety straps on large appliances, placed security latches on cabinets, secured heavy wall hangings, secured table tops items into place, braced or replaced masonry chimney into place, braced masonry or concrete walls, and placed plastic film over windows.

It is assumed that those who have a “done” response to each question will be more likely to have participated in or plan to participate in hazard mitigation. A “not done” response

indicates neglect to mitigate, however, it does not necessarily mean that the respondent does not plan to take steps toward hazard mitigation. A response of “others did before I moved in” allows researchers to understand that the respondent may not have taken this hazard prevention step him/herself but that others previously have and that he/she is aware of it. A response of “don’t know” indicates that the respondent does not know if other individuals have taken this hazard prevention step or if they themselves have taken this step. In many ways, this response represents a neglect to mitigate as well.

For those who responded to questions in this section with a “not done” response, additional questions were asked to explore why they had not taken the cited step towards hazard mitigation. While there is an “other” space for respondents to explain themselves, a list of choices are provided for them to check why they have not participated in mitigation. Those choices include: not enough information, too expensive, unnecessary, requires too much time, not useful/effective, inconvenient, and not my responsibility. A response of “other” indicates that the respondent did not feel that any of the other responses provided reflected his/her experience. The respondent then filled in the “other” space with his/her own words to explain his/her answer. Based on the various answers provided by the respondents, this study will be better able to reveal what barriers exist that may prevent the respondents from taking more active roles in a particular form of hazard or damage reduction.

***Experience with Earthquake Injury or Damage*** This set of questions was used to understand the personal experience of the respondent (Questionnaire Sections 33 – 37). As was illustrated in the literature review, many individuals do not mitigate because they do not personalize the risk involved. A “Yes” response to these questions implies that the individual may be more likely to personalize the risk of an earthquake. Further, if the respondent or



someone the respondent knows had experienced earthquake damage or injury, then the relationship to the person affected was measured. It was assumed that the closer the relationship to the respondent of the person affected, the more likely the respondent would be to personalize the risk of damage or injury in the event of an earthquake; therefore the respondent will be more likely to participate in hazard mitigation. This assumption was also tested.

***Social Influence on Hazard and Damage Prevention*** This set of questions was used to measure the effect that social structure and social connections have on the respondent's mitigation efforts (Questionnaire Sections 38 – 40). It was assumed that respondents who have an immediate relationship with friends, family or community groups who have taken steps to mitigate against injury or damage will also be likely to mitigate. This assumption was also tested.

***Incentives*** The question in this portion of the survey (Questionnaire Section 41) was used to measure the potential effect(s) that offering of financial and/or other incentives could have on motivating hazard or damage reduction activities. Each incentive listed, with the exception of “Other” has been offered or suggested in previous studies on this topic. These are: an insurance discount, a tax break, free items to prevent damage, free advice, free service or labor, and more information on regulations and codes.

***Demographic Characteristics*** This set of questions was used to measure the diversity of the respondents in such terms as gender, race or ethnicity, level of education, family size, immigrant status, age, income and disposable income (Questionnaire Sections 42 – 51). As has been stated previously in this study, it is important to identify the demographic compilation of the sample in order to better understand possible barriers to mitigation as well as possible demographic influences over those barriers. Since the San José area has a large population that

has immigrated into the region from other parts of the state, country and the world, there was particular interest in discerning whether there were differences in awareness of earthquake mitigation as a result of this factor.

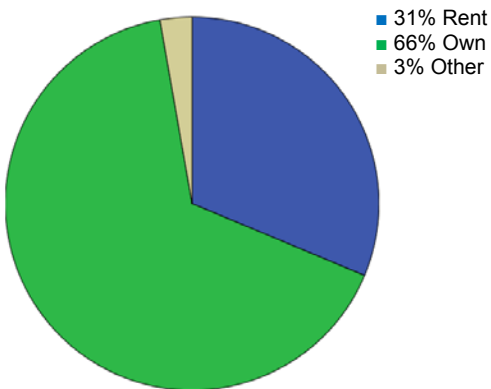
### **III.3 Analysis**

The results below contain descriptions of the sample used here. Many conclusions may be made about the mitigation behaviors of this group using descriptive statistics such as simple percentages. More sophisticated analyses were conducted using multinomial logistic regression to test models of mitigation behaviors. All analyses were conducted using the SPSS 16.0 for Windows software program.

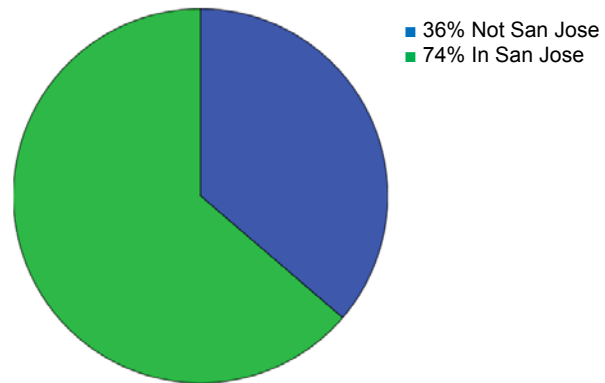
## IV. Results

### IV.1 Description of the Sample

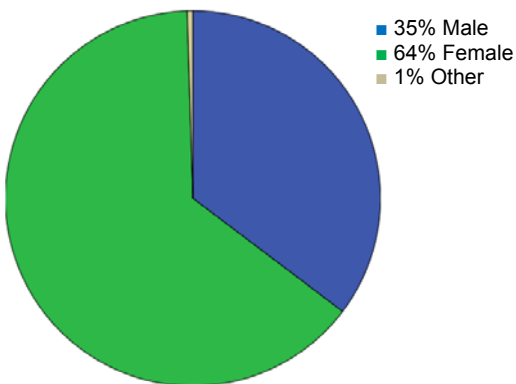
The pilot sample shows variation on many demographic characteristics, as explained below. The total number of respondents was 331. However, analysis is restricted to persons who were homeowners. This reduced the sample size by over 1/3 (see Chart 1) to 215. Of those, 137 live within the City of San José (Chart 2). Typical of surveys in general, women are overrepresented—64 percent in the sample (Chart 3) compared with 48 percent in the City of San José (U.S. Census Bureau 2007). Out of the 215 homeowners, 79 percent (see Chart 4)



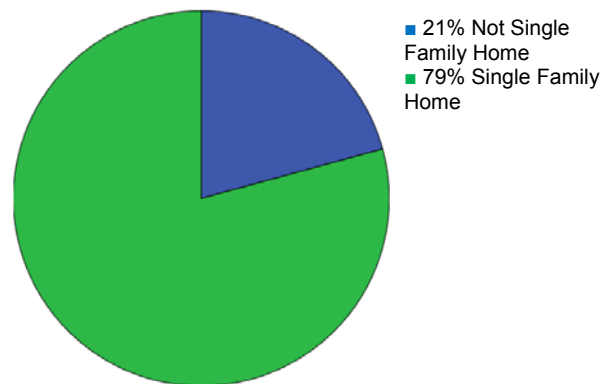
**Chart 1.** Home Ownership of Persons Responding to the Survey.



**Chart 2.** Respondents Reporting a Zip Code within vs. outside San José.

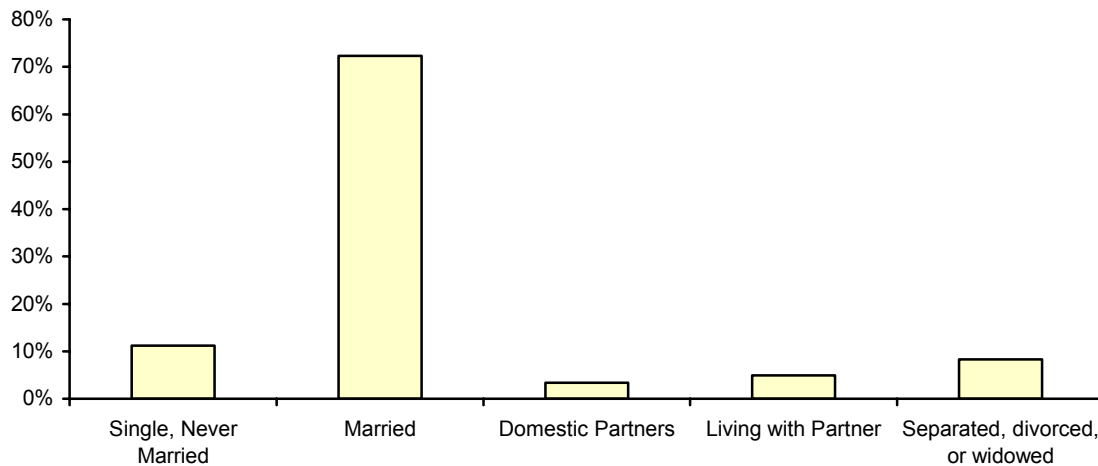


**Chart 3.** Gender of Respondents.

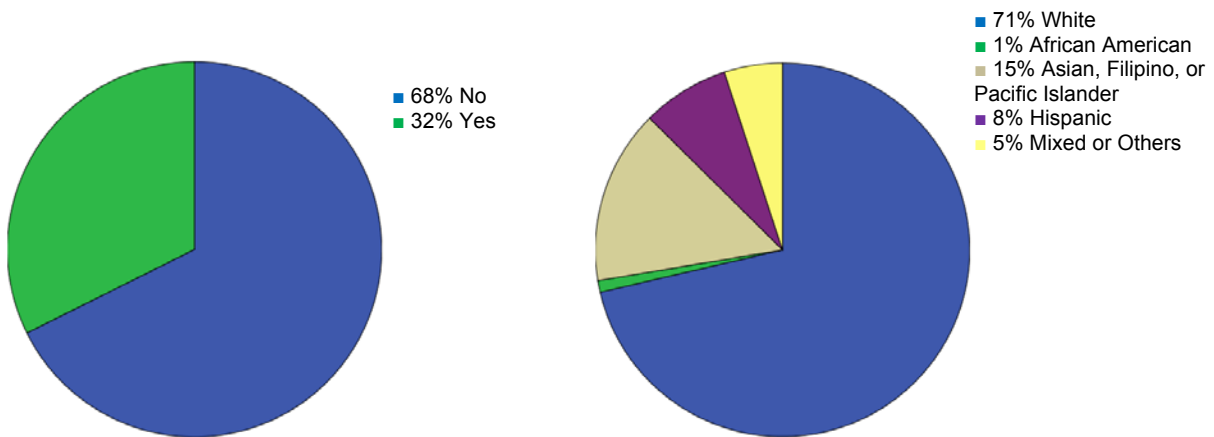


**Chart 4.** Type of Home Owned.

owned single-family homes as opposed to townhouses and so forth. Eighty-four percent of the respondents were married (Chart 5), and 68 percent did not have children under 18 living with them (Chart 6).



**Chart 5.** Marital Status of Respondents.



**Chart 6.** Children Under 18 Living at Home?

**Chart 7.** Race/Ethnicity of Respondents.

The nature of the sampling frame, university employees, made the sample somewhat different from the population of the City of San José. As Chart 7 shows, the sample has more white persons (71 percent) and fewer Asian (15 percent) and Latino persons (eight percent) than the City of San José; San José's population is 57 percent white, 30 percent Asian, and 32 percent

Latino (U.S. Census Bureau 2007). The sample is also, on average, older (median is 51 to 55, Table 1), more educated (85 percent have a college degree or more, Chart 8), and has a higher median household income (median is \$110,000 to \$129,999, Chart 9) than the City of San José. In San José, the median age is 34.6 (a figure that includes persons under 18, but the SJSU sample does not), 36 percent have a college degree or more, and median household income is just over \$70,000 (U.S. Census Bureau 2007). Finally, while there is no way to compare it with the San José population, the sample reported disposable income; 37 percent had less than \$1,000, 50 percent had between \$1,000 and \$5,000, and 13 percent had over \$5,000 left over after all expenses each month (Chart10).

**Table 1.** Age of Respondents by Age Categories.

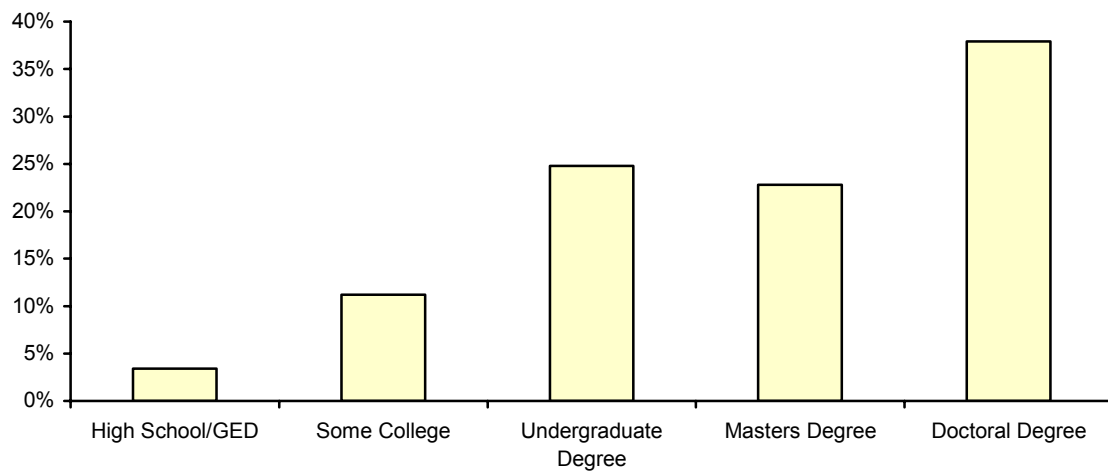
<b>Category</b>	<b>Frequency</b>	<b>Percent</b>
18 to 25	4	1.97
26 to 30	6	2.96
31 to 35	16	7.88
36 to 40	12	5.91
41 to 45	27	13.30
46 to 50	25	12.32
51 to 55	48	23.65
56 to 60	33	16.26
61 to 65	18	8.87
66 to 70	10	4.93
71 or Above	4	1.97
Total	203	100.02*

\*Total is greater than 100 due to rounding.

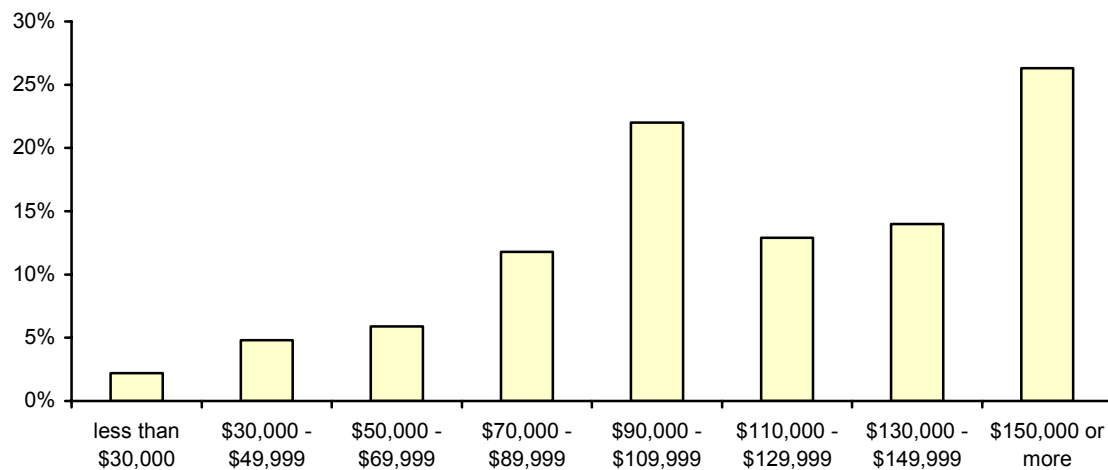
## **IV.2 Earthquake Expectations and Experiences**

Charts 11 – 12 show the respondents’ expectations of a major earthquake occurring within the next year and the next 10 years. A large majority believe a major earthquake is somewhat likely (73 percent) or very likely (11 percent) to occur within the next year. Far more

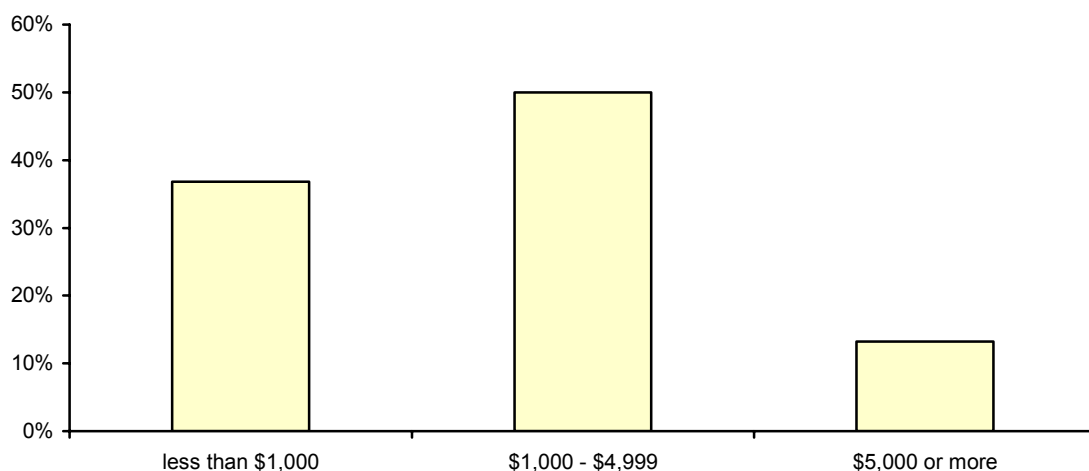
individuals believe a major earthquake is very likely (60 percent) in the next 10 years than do in the next year. Thirty-eight percent say such an event is somewhat likely, and only a slim minority (less than 2 percent) say that a major earthquake is not likely in 10 years. Therefore, this sample generally sees a major earthquake as a possibility in the next year, but also strongly expects that a major earthquake is likely within 10 years.



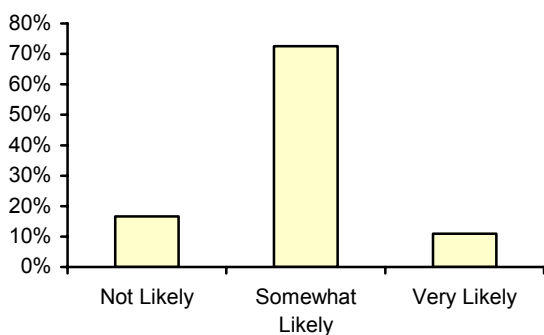
**Chart 8.** Highest Level of Education.



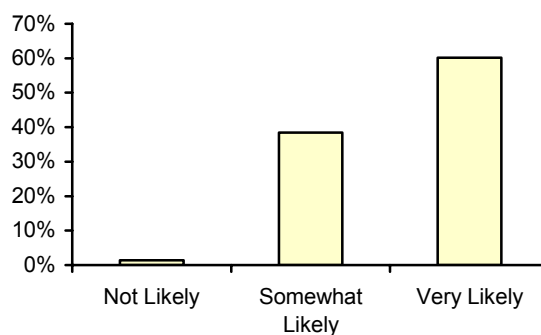
**Chart 9.** Median Household Income.



**Chart 10.** Monthly Disposable Income.



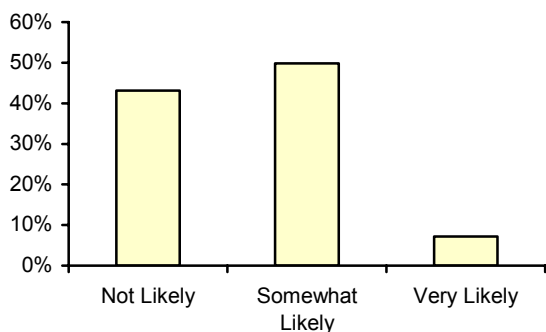
**Chart 11:** Reported Expected Likelihood that a Major Earthquake Will Occur in the San José Area in the next Year.



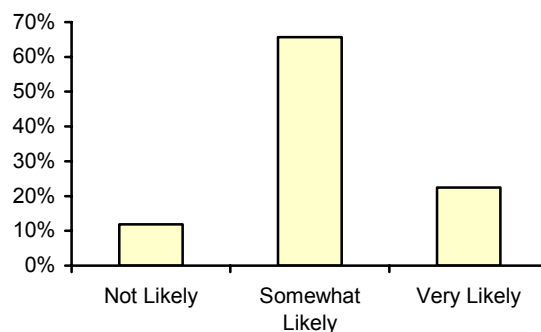
**Chart 12.** Reported Expected Likelihood that a Major Earthquake Will Occur in the San José Area in the next 10 Years.

Most respondents acknowledge that a major earthquake is a possibility, if not a probability, during the time that they are living in their current home. When asked whether they expected injuries or damage caused by an earthquake in their own homes in the near future, over half (57 percent) thought that injuries were somewhat or very likely to occur (Chart 13), and even more (88 percent) felt the same about damages occurring in their homes (Chart 14). Overall, then, most respondents not only expect a major earthquake to occur within the next 10 years, but they also expect to suffer losses in the near future. The severity of expected injuries or

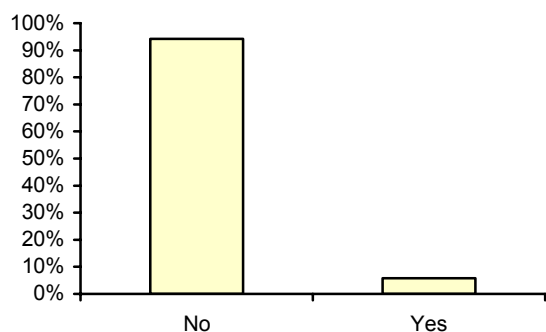
damages was not explored, so no comment can be made as to whether respondents see a dire future scenario or something that should be taken in stride.



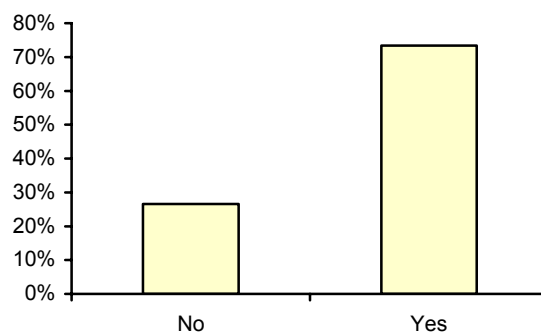
**Chart 13.** Expected Likelihood that an Earthquake Will Cause Injuries to Persons in Respondents' Homes.



**Chart 14.** Expected Likelihood that an Earthquake Will Cause Damage in Respondents' Homes.



**Chart 15.** Knows Someone or Self Had Earthquake Caused Injury in their Home.



**Chart 16.** Knows Someone or Self Had Earthquake Caused Damage in their Home.

Respondents also reported experiences with earthquake injuries and damage in the past, both in terms of personal experiences and whether they knew anyone else suffering harm. Charts 15 – 16 display the results of these questions. In the area of injuries, there were very few (only 12) persons who reported that they or anyone they knew had been injured (Chart 15). Not shown is that 10 of those 12 reported that the injury prompted them to mitigate, or take steps to prevent injuries that may be caused by future earthquakes. Far more commonly reported was damage to



property caused by earthquakes. Over 70 percent of respondents knew someone who had or had experienced damage themselves (Chart 16). When asked whether the damage experience caused them to mitigate, over half reported that it did.

**Table 2.** Relationship to Respondent of Persons Reported to have had Earthquake Caused Damage in their Home Compared with Those Reporting that the Experience Caused them to Mitigate against Future Damage, N = 151.

Relationship	Percent this Relationship	N	Percent Who Mitigated	Comparing Mitigation with those Not Reporting the Relationship		
				$\chi^2$	df	p-value
Myself	46.4	70	70.0	8.20	1	.004
Spouse	19.2	29	62.1	0.30	1	.589
Parent	21.2	32	46.9	1.92	1	.166
Sibling	10.6	16	56.2	0.01	1	.907
Child	4.6	7	71.4	*		
Other Family	9.3	14	57.1	0.00	1	.970
Friend	48.3	73	58.9	0.10	1	.757
Acquaintance	29.1	44	52.3	0.73	1	.394
Neighbor	23.2	35	74.3	5.18	1	.023

\*Number is too small to produce a valid Chi-squared Statistic.

Respondents were also asked who, among their friends and family, had experienced the damage from earthquakes in the past. Table 2 provides the relationships to respondents of those experiencing damage. It also shows the percentage of individuals reporting mitigation as a result of damages. The majority of persons who experienced damage themselves or knew someone

who did reported that they mitigated. The most common relationships were “myself” and “friend.” Chi-squared tests were run to discover whether particular relationships with damage experience led people to mitigate any more than other relationships. The only relationships that prompted more mitigation in such comparisons were “myself” and “neighbor.” This indicates that the closer the damage is to one’s own home, the more urgent mitigation acts seem to become. (Similarly high mitigation rates were seen among those reporting damage in their child’s home, but because there were too few cases, valid statistics could not be produced.) Closer relationships with those experiencing damage do not appear to make mitigation more urgent; physical proximity to self is more important.

### **IV.3 Mitigation Activity**

The respondents were asked if they had taken particular mitigation actions. These may be grouped into modifications to the home structures and systems or modification to the home’s contents. The findings can be seen in Charts 17 – 29. On most mitigation items, the majority of respondents said that they had not taken the step to prevent earthquake damage or injury.

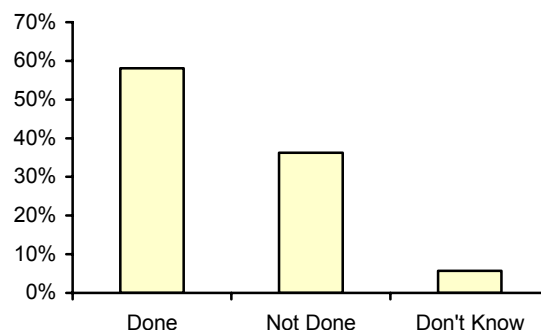
Highlighting the importance of building codes, the mitigation items that were most commonly done were also those that are required, such as strapping water heaters. Indeed, not only were water heaters reported as strapped down by the majority of respondents (88 percent), but very few individuals reported not knowing whether this had been done (four percent, see Chart 17).

Other home structures and systems mitigation items included securing the home to its foundation, fitting appliances with flexible connections, mitigating chimneys, bracing masonry or concrete walls, and placing plastic film over window glass. With the exception of the last item, each had a majority who reported that they had done it to the home or that others had done it to the home before they moved in. Combining these two sources of mitigation, rates of

mitigation for each item were 63 percent for securing the home to its foundation, 70 percent for flexible connections, 62 percent for chimneys (for those who had one), 73 percent for concrete walls (for those who had one), and 4 percent for window film.

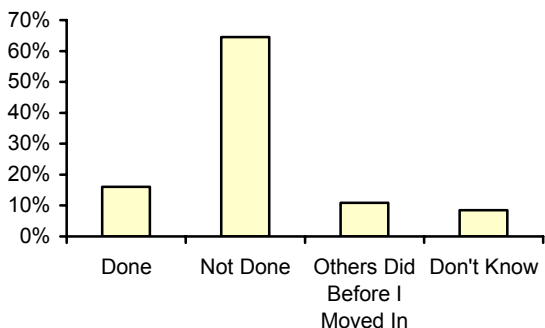
Also reported was extensive neglect to prevent damage and injury by securing household belongings such as furniture and table top items. Indeed, over 80 percent of respondents had not placed safety straps on large appliances (Chart 27), and a similar rate was found for table top items (Chart 29). Generally, there is more mitigation of home structures and systems than there is for contents of the home. This indicates that any existing efforts to increase mitigation for those items have not affected this sample much.

From a policy standpoint, one concern is that many respondents appear to not know whether certain mitigation actions have been taken. The rates are especially high for mitigation items involving the home structures and systems, as opposed to its contents. Reported rates of “don’t know” included: 24 percent for securing the home to its foundation and 25 percent for flexible connections, 18.6 percent for chimneys, and 25.6 percent for concrete walls. The exception is that only 6 percent “don’t know” for window film. It would be difficult to help persons mitigate if they are unaware of the status of their homes. From another perspective,

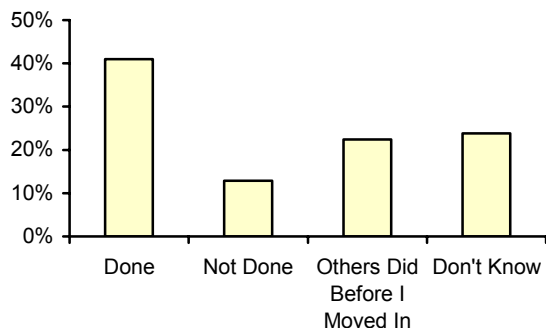


**Chart 17.** Mitigation Activities:  
Researched Damage Prevention.

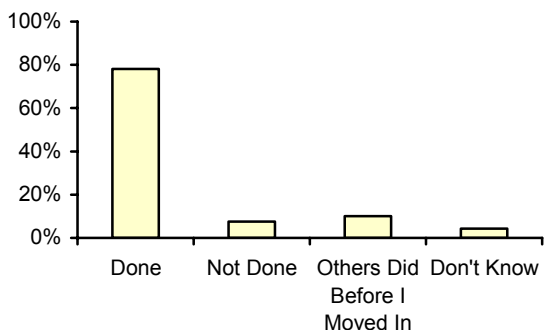
some persons may have declared “don’t know” to some mitigation items because they did not know to what the questionnaire was referring.



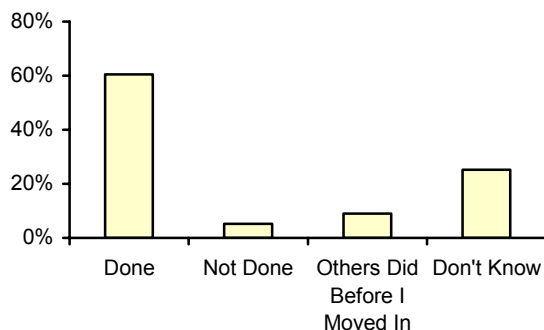
**Chart 18.** Mitigation Activities: Had an Engineer Evaluate Home.



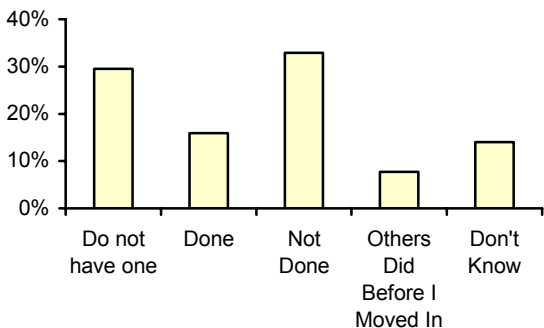
**Chart 19.** Mitigation Activities: Secured Home to Its Foundation.



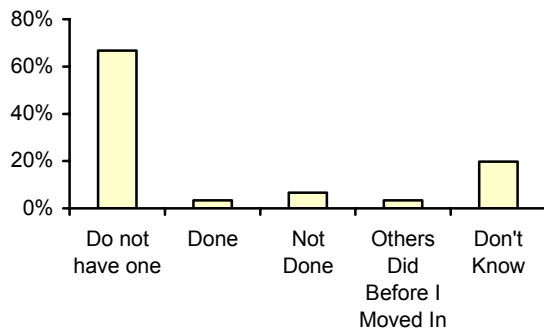
**Chart 20.** Mitigation Activities: Strapped Down Water Heater.



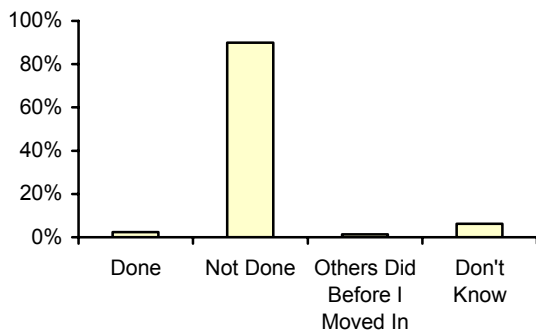
**Chart 21.** Mitigation Activities: Fitted Gas and Other Appliances with Flexible Connectors.



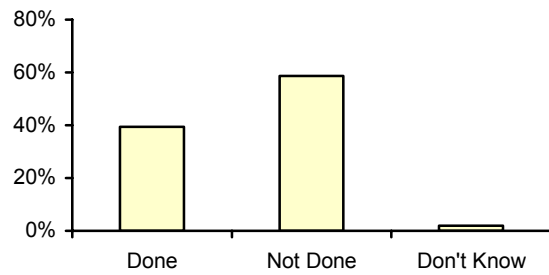
**Chart 22.** Mitigation Activities: Braced, Reinforced, Replaced, or Removed Masonry Chimney.



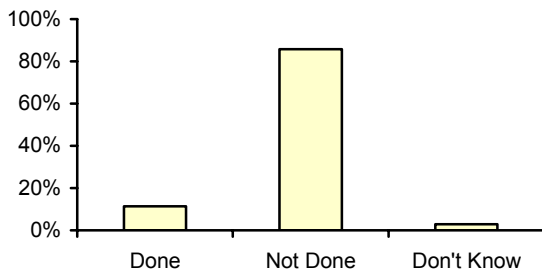
**Chart 23.** Mitigation Activities: Braced Masonry and Concrete Walls.



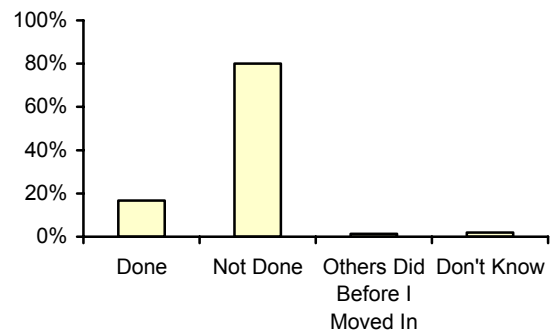
**Chart 24.** Mitigation Activities: Placed Plastic Film over Window Glass.



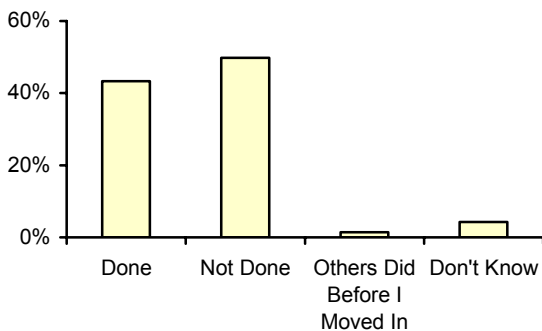
**Chart 25.** Mitigation Activities: Bolted Large Furniture Items into Place.



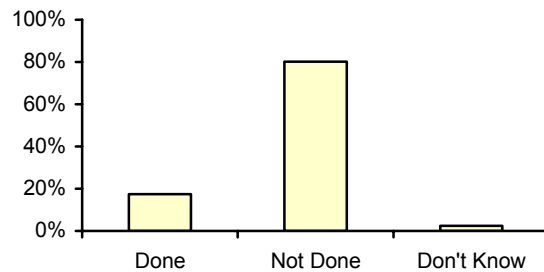
**Chart 26.** Mitigation Activities: Safety Straps on Large Appliances.



**Chart 27.** Mitigation Activities: Safety Latches Placed on Cabinets.



**Chart 28.** Mitigation Activities: Secured Heavy Wall Hangings.



**Chart 29.** Mitigation Activities: Secured Decorative or Other Table Top Items.

#### IV.4 Reasons for Not Mitigating

Respondents who had *not* mitigated were asked to choose reasons for not having done so (e.g, not enough information, too expensive, etc.). Table 3 shows the percent of respondents choosing each reason. The most prevalent reason is highlighted in each row. It is important to note that four of the items had very few respondents who had *not* mitigated in that area. These were “foundation,” “water heater,” “flexible connectors,” and “masonry or concrete walls.” These mitigation items are also aimed at preparing the home structures and systems for an earthquake, and many of them are called for by codes that regulate contractors.

The first two mitigation items in Table 3, research and hiring an engineer—not actually mitigation changes to the home, but rather, steps toward mitigation—have patterns that were different from the rest. Respondents reported that doing research on earthquake mitigation would take too much time and would be inconvenient, whereas hiring an engineer was considered too expensive. In contrast, all of the mitigation items (except research, engineer, foundation, and chimney) were not considered too expensive by the vast majority of those who had not mitigated.

Focusing on home structures and systems, there is some consistency among these items for why they were not done. They were considered too expensive (foundation and chimney), unnecessary (water heater) or the respondents did not have enough information (flexible connectors, walls, and film on windows). It can be said that barriers to mitigating home structures and systems are knowledge and perceived costs for those. However, it is important to recognize that most of these mitigation steps are more commonly reported than the others.

Mitigation involving household items or home contents was generally considered inconvenient (top choice for bolted furniture, strapped appliances, and latches on cabinets) and

unnecessary (top choice for wall hangings and table top items). Another popular response for these was that the mitigation step would take too much time to implement.

**Table 3.** Percent Who Indicated Reason for Not Mitigating for Each Mitigation Item.

<b>Mitigation Item</b>	<b>Not Enough Information</b>	<b>Too Expensive</b>	<b>Un-necessary</b>	<b>Too Much Time</b>	<b>Not Useful</b>	<b>Incon-venient</b>	<b>Not Responsible</b>	<b>N</b>
Research	19.7	15.8	7.9	28.9	10.5	22.4	3.9	76
Engineer	19.9	38.2	15.4	9.6	6.6	12.5	3.7	136
Foundation	25.9	51.9	7.4	11.1	11.1	11.1	7.4	27
Water Heater	12.5	0.0	25.0	0.0	0.0	18.8	6.2	16
Flexible Connectors	45.5	0.0	0.0	0.0	0.0	9.1	0.0	11
Chimney	17.6	50.0	8.8	8.8	7.4	8.8	2.9	68
Walls	42.9	35.7	7.1	0.0	7.1	14.3	7.1	14
Film on Windows	35.8	7.0	18.7	5.9	8.6	21.4	0.5	187
Bolted Furniture	6.6	5.7	16.4	20.5	3.3	29.5	0.8	122
Strap Appliances	18.9	1.7	22.2	9.4	8.3	24.4	2.2	180
Latches on Cabinets	11.3	1.8	17.9	13.1	13.1	36.9	0.6	168
Secured Wall Hangings	15.0	1.9	24.3	16.8	4.7	15.9	0.0	107
Table Top Items	7.8	0.0	26.5	13.3	11.4	21.7	0.0	166

The mitigation item, placing film on windows, was the least performed. The primary reason for not placing film on windows was not having enough information. For this mitigation item to become more commonplace, it appears that the public would need more education about

this technique. Other common responses were like those for household items: unnecessary and inconvenient.

An important finding that Table 3 shows is that homeowners in this sample assume responsibility for mitigation. For the two items where this option was chosen most frequently, bolting the house to the foundation and walls, only 7.4 and 7.1 percent, respectively, claimed that they were not responsible. This result should provide encouragement for those who promote mitigation to the public. Another finding is that cost is generally not a concern for most mitigation items. Indeed, among those things that were largely not done, cost only appeared to be a prominent reason for not hiring an engineer. The most prevalent obstacles to mitigation are the feeling that the mitigation is not necessary and that it is inconvenient. Respondents also indicated that with several items, they needed more information. (These include research, engineer, foundation, walls, flexible connections, window film, strap appliances, and wall hangings.)

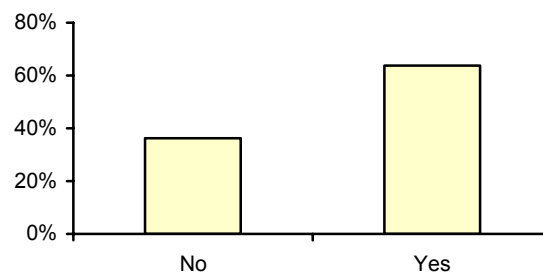
Finally, it appears that home structures and systems mitigation is far more commonplace than home contents mitigation. The patterns for reasons that mitigation was not done across these two types implies that mitigating home structures and systems is perceived as necessary, but persons may be lacking information or may be deterred by cost. However, mitigating home contents is perceived as not necessary so that this perception (*not* cost, lack of information, and so forth) is what prevents persons from taking these measures.

#### **IV.5 Effects of Mitigation by Others**

Respondents also reported whether they knew others who had mitigated, and they named the relationship type (such as “spouse” or “sibling”). Two-thirds of those responding said that they knew someone who had mitigated (Chart 30). Just over one-third of those persons reported



mitigating in response to the efforts by others. The relationships to those who had mitigated are presented in Table 4. Also included is the percent claiming they mitigated in response to others among those reporting knowing someone who mitigated in each relationship type measured. Chi-squared tests were conducted to compare those who knew someone who mitigated with those who did not for each relationship type on the amount of reported mitigation in response to knowing someone who had mitigated. These tests showed that a mitigating “spouse” and “other family” were the only categories that made mitigation more likely. Similarly high levels of mitigation were seen among persons reporting that a child mitigated, but the low number of persons reporting this relationship type prevents valid statistics from being produced. It appears that mitigation is more likely when family members have mitigated. Therefore, relationship closeness to others (family versus not family) who have mitigated may affect mitigation behaviors. However, while mitigation is influenced by family, there is not enough evidence to declare that closeness within the familial realm affects mitigation.



**Chart 30.** Reports of Knowing Persons who have Mitigated Against Damage or Injury.

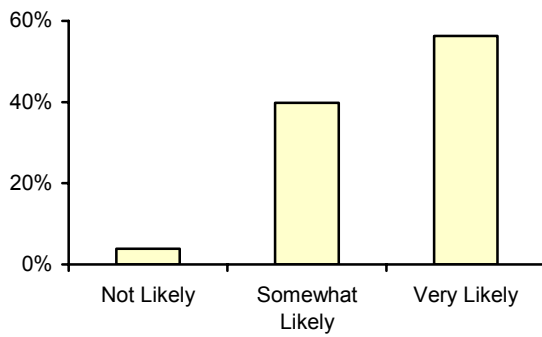
**Table 4.** Relationship to Persons who have Mitigated against Damage or Injury Compared with Those Reporting that the Experience Caused them to Mitigate, N=122.

Relationship	Percent this Relationship	N	Percent Who Mitigated	Comparing Mitigation with those Not Reporting the Relationship		
				$\chi^2$	df	p-value
Spouse	13.1	16	68.8	8.03	1	.005
Parent	23.8	29	48.3	2.12	1	.145
Sibling	17.2	21	42.9	0.39	1	.533
Child	6.6	8	62.5	*		
Other Family	20.5	25	56.0	4.94	1	.026
Friend	66.4	81	35.8	0.12	1	.728
Acquaintance	32.0	39	46.2	2.12	1	.146
Neighbor	37.7	46	43.5	1.38	1	.240

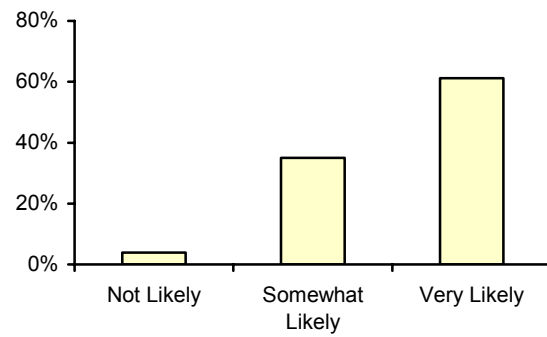
\*Number is too small to produce a valid Chi-squared Statistic

#### IV.6 Incentives

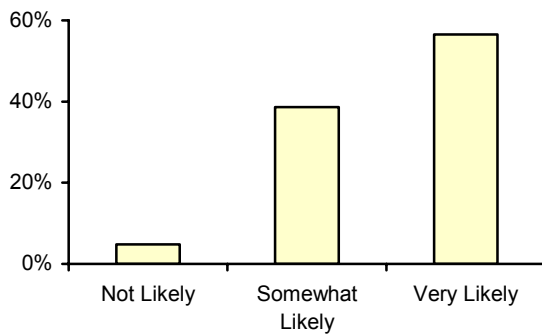
Respondents were presented with a list of potential incentives that might make mitigation more likely. For each one, respondents reported the likelihood that such an incentive would lead to greater mitigation. Charts 31 – 36 show the results of the incentive questions. Generally, all incentive types were reported as likely to increase mitigation. Indeed, for all items but two, the majority of respondents said that the incentive would be “very likely” to increase their efforts to prevent earthquake injuries and damage in their homes. The two less popular items were free advice and more information on regulations and codes. Nonetheless, a sizeable majority indicate that advice and information would make them somewhat or very likely to mitigate more.



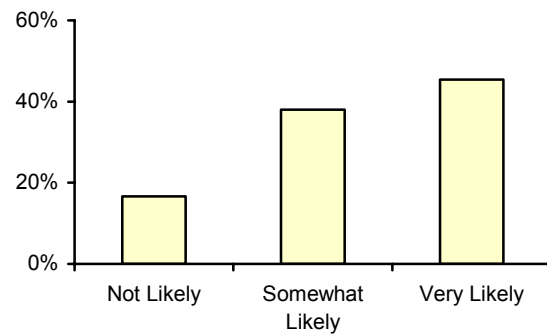
**Chart 31.** Incentive Insurance Discount: Reported Likelihood of Increasing Mitigation.



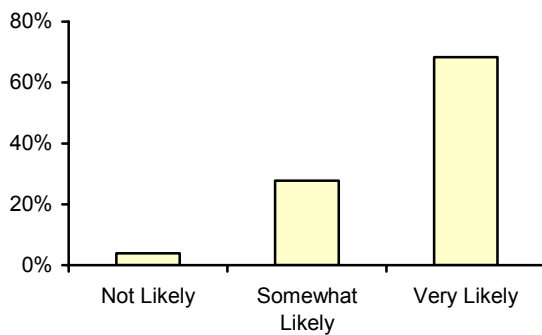
**Chart 32.** Incentive Tax Break: Reported Likelihood of Increasing Mitigation.



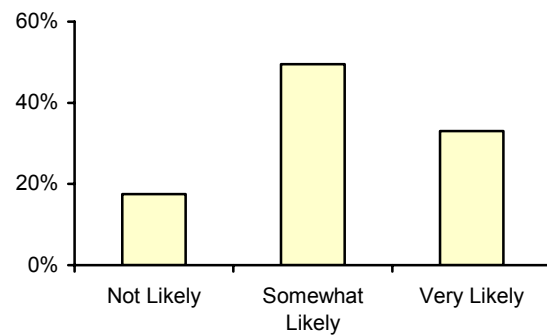
**Chart 33.** Incentive Free Mitigation Supplies: Reported Likelihood of Increasing Mitigation.



**Chart 34.** Incentive Free Advice: Reported Likelihood of Increasing Mitigation.



**Chart 35.** Incentive Free Labor: Reported Likelihood of Increasing Mitigation.



**Chart 36.** Incentive, More Information on Regulations and Codes: Reported Likelihood of Increasing Mitigation.

#### **IV.7 Predictors of Mitigation**

The final objective was to determine whether there are variations in mitigation by demographic and cultural groups. In addition, other factors that may affect whether respondents mitigated were explored. The following respondent characteristics were examined to determine their relationship to all the mitigation items: Single family home, Expect a Major Earthquake in one or 10 years, expect an earthquake that causes injury or damages in the near future, experience with earthquake damage, experience with friends mitigating, sex, marital status, children under 18 at home, born in the USA, born in California, disposable income, income, race, age, education, years in the home, and the age of the home. The results indicate that there are only a few discernible patterns in predictors of mitigation.

In Table 5 one can see the characteristics that have a significant relationship to mitigation items in bivariate tests (cross tabulations and correlations where appropriate). In these tests, mitigation responses were grouped into two categories: (1) “done” and “others did before I moved in”—certainty that mitigation steps were taken or (2) “not done” and “don’t know”—neglect of mitigation. Therefore, analyses were conducted to determine factors that are related to certainty that mitigation steps were taken versus neglect of mitigation. There are few predictors for most mitigation items (none for water heater, masonry or concrete walls, and window film). The mitigation items that have the most factors related to them are “research,” “foundation,” and “flexible connectors.” The respondent characteristics that are most related to mitigation appear to be “know a person who has had damage,” “know a person who mitigated,” and “age of home.” In fact, the item most related to mitigation behaviors appears to be having known a person who mitigated their own home. This finding points again to the social nature of mitigation behavior.

A few respondent characteristics were not related to any mitigation items. The characteristics not influencing certainty of mitigation were “expect a major earthquake in one year,” “expect an earthquake that causes injury in the near future,” and “children under 18 at home.”

In order to test models of mitigation which take into account the likely simultaneous effects of respondent characteristics, multivariate models (binary logistic regression) were run for respondents’ certainty of mitigation versus neglect of mitigation for each mitigation item. Included in the models are only those factors that were predictive of two or more mitigation items in Table 5. The value of these analyses is to determine whether some characteristics, apparently related to mitigation, are actually just spuriously related, meaning that one or more respondent characteristics are interrelated with others and are not actually related to levels of mitigation when the interrelationships are taken into account. Table 6 shows the results of respondent characteristics that were predictors for each mitigation item when controlling for other characteristics.

The findings are fairly simple. Knowing a person who has mitigated is the best predictor of mitigation. This variable had a high probability of affecting mitigation for research, engineer, flexible connections, bolt furniture, strap appliances, and secure wall items. The second most important predictor was expecting an earthquake to cause damage in the near future. Two other factors affecting mitigation in the multivariate models were “born in USA” and “age of home.” Those born outside the US were less likely to have researched or to have mitigated their chimney. The older respondents’ homes, the less likely they were to bolt furniture or to strap appliances. Finally, sex and years in home played a role in one mitigation item each.

**Table 5.** Relationships between Respondent Characteristics and Mitigation Items where Chi-Squared Tests Indicated Significant Relationships.

	Research	Engineer	Foundation	Flexible Connections	Chimney	Bolt Furniture	Strap Appliances	Cabinet Latches	Secure Wall Items	Table Top Items
Single Family Home			+	+						
Earthquake 10 Years				+						
Damage Near Future	+			+						
Know Person Damage	+			+						+
Know Person Mitigated	+	+	+	+		+	+		+	
Male			+	+						
Married/Partnered	+									
Born in USA	+				+					
Disposable Income			+							
White			+	+						
Asian/Pacific Islander	—									
Age	+									
Income	+		+							
Education		+	+							
Years in Home	+							+		
Age of Home						—	—		—	

**Table 6.** Relationships between Respondent Characteristics and Mitigation Items where Binary Logistic Regression Indicated Significant Relationships.

	Research	Engineer	Foundation	Water Heater	Flexible Connections	Chimney	Masonry/Concrete Walls	Bolt Furniture	Strap Appliances	Cabinet Latches	Secure Wall Items	Table Top Items
Single Family Home												
Damage Near Future	+			+	+				+			
Know Person Damage												
Know Person Mitigated		+			+			+	+		+	
Male					+							
Born in USA	+					+						
White												
Income												
Education												
Years in Home	+											
Age of Home								-	-			

Overall, these multivariate findings indicate the importance of earthquake expectations and the social network for influencing mitigation across a variety of mitigation types. It appears that a way to increase mitigation would be to raise the public's expectation that a damaging earthquake is likely to occur while also making mitigation behavior appear socially popular, akin to "word of mouth" advertising. When focused on household contents, the least mitigated items, knowing someone else who mitigated is clearly the most important predictor. So in the most

troubling area of neglect, mitigation may be best enhanced by social processes. Mitigation advocates should note, too, the fact that persons in older homes are less likely to mitigate by securing large items. These persons may need greater attention in mitigation campaigns.



## **V. Discussion**

The primary intent of this study was to explore factors or barriers that might be inhibiting homeowners from taking mitigation actions so that potential injuries and damage from future earthquakes can be reduced. The perceived effectiveness, or lack thereof, of specific mitigation actions was not part of our objective. We also did not differentiate between structural and non-structural mitigation and there is no implication that one is more effective or important than the other. The mitigation actions included in this study and the potential incentives were adopted from those proposed in the literature, including the Homeowner's Guide to Earthquake Safety (California Seismic Safety Commission 2005).

Overall, levels of mitigation were higher for home structures and systems than for home contents. "High enough" levels of mitigation cannot be defined here, so there is an open question about whether the low level of mitigation of home contents is more of a threat than the mitigation of home structures and systems left undone by many respondents. In other words, this report cannot make a recommendation about where to focus improvement in mitigation because the potential for savings in terms of lives and money with such improvements are not estimated here. However, it is certain that there is greater neglect of mitigation of home contents than of home systems and structures.

The findings do not support the idea that there are demographic patterns in mitigation behaviors. For example, we cannot point to one racial or ethnic group and declare that it is lacking in mitigation activities. It appears that, overall, differing groups are similar in preventing injuries and damage that could result from an earthquake. With that said, there is an indicator that further research may find differences by background. In our pilot sample, persons who were born outside the US had lower mitigation on two items in the multivariate models. In addition,

sporadically, demographic groups were associated with differing levels of mitigation in bivariate analysis.

Respondents generally do not complain about the costs of mitigation, especially for home contents, nor do they believe that mitigation is someone else's responsibility. Cost is a factor, however, for some among the minority not mitigating home structures and systems. The largest barrier to mitigation appears to be lack of prioritizing the mitigation of home contents. This is not to say that respondents think that mitigation in their homes is someone else's responsibility. Contrary to others' findings, few denied that they were responsible. Taken in light of Mulilis et al. (2001) who find that choice and responsibility lead to greater commitment to act, this group's high responsibility but low mitigation in home contents implies that mitigation of home contents is just not perceived as important or effective by them. Perhaps cost would be a concern for some once the barrier of perceived importance were removed, but cost should not be the primary focus for home contents at this point.

This sample reports that information about codes and financial incentives would be more effective than reported in previous work. The results of the incentives analysis, however, might mislead the reader into believing that homeowners are only worried about costs. When asked about financial incentives, most indicated that such incentives would work. When considered in the light of the previous findings about barriers, three conclusions may be made. First, financial incentives may work to increase mitigation for home structures and systems. Second, mitigating home contents is not a high priority to respondents, but if someone else were willing to pay for it, then respondents may go along with a plan to prevent damage or injury from household items. Third, financial incentives may be more effective if respondents had first perceived that mitigation of home contents was an important thing to do. All incentives listed received

favorable ratings. Once again, they were: an insurance discount, a tax break, free items to prevent damage, free advice, free service or labor, and more information on regulations and codes.

It should be noted that the incentives questions, based on those used in other research, largely assumed that nature of incentives would need to be financial. They also did not address specific mitigation items, so we do not know whether financial incentives would work equally well for home structures and systems mitigation (such as foundations or walls) and for home contents (such as wall items or large appliances). Therefore, as discussed below, more work needs to be done to uncover non-financial incentives that would likely work for various mitigation items.

One area researchers and others may want to explore is incentives provided by personal relationships. There was evidence that knowing someone who was injured or who had damage to their home prompted mitigation in response. There is also evidence that knowing someone who mitigated increases mitigation. Indeed, having a family member who mitigated seems to make certainty of mitigation even more likely (and negligence of mitigation less likely). Social relationships may be leveraged somehow to make mitigation more likely. For example, prompting persons who have experienced damage, or persons who mitigated, to share their experiences may influence persons they know to take steps to prevent injury and damage.

In all, a few things can be said about what incentives might work. First, codes are apparently effective at prompting mitigation. Most respondents had mitigated for items that have codes that affect them. Second, financial incentives may work for some, but more important is getting the public to believe that various mitigation techniques are important, effective, simple, and of low cost. Third, campaigns to raise the expectation that a damaging earthquake may occur

have promise. Indeed, it may be especially helpful to demonstrate ways that household contents may harm persons and to raise the expectation that for many homes a major earthquake is more likely to toss objects around than to damage the home's structure and systems. Finally, social relationships matter. Therefore, incentives that leverage knowledge of others' experiences and campaigns that normalize mitigation of home structures and systems and contents are likely to increase levels of mitigation.

## **VI Recommendations for Future Research**

Here, recommendations for future research are made. These can be classified into topics of research and research methods. Already addressed above is the need to produce much more detailed inquiry into the incentives that might work to increase mitigation. As the relevant literature did, this research asked general questions about likely effects of financial incentives. The results here imply that mitigation for home structures and systems and for home contents (and specific items within each category) may require different types of incentives. Therefore, questions about incentives should be specific to types of mitigation. In addition, incentives questions need to be moved beyond the narrow focus of financial incentives. For example, it appears that better perceptions of the probability of major earthquakes occurring, or that the impression that other persons are mitigating, would prompt more mitigation. Following this knowledge, incentives questions should, among other things, study the likely effects of better estimates of earthquakes and changed perceptions of others' earthquake-related behaviors and attitudes. The suggestion here is not to scare persons because that would likely increase their feelings of helplessness, thus reducing mitigation. Rather, the first suggestion is to inform persons of the likelihood of damage and to give some mental picture of that damage while also providing a mental picture of safety that mitigation provides while emphasizing the simplicity and low cost of that mitigation. The second suggestion is to make earthquake concern and mitigation activities appear normative. As these data indicate, the more a person knows others who mitigate, especially if that person is in close relationship, the more they themselves are likely to mitigate.

More research needs to be done to discover other types of incentives that should be included in future surveys. It would be helpful to take a “bottom up” approach to determining

likely incentives. One way to find out from the general public ways to encourage mitigation would be to conduct focus groups on the topic. Discussions may center on incentives that have worked for them for other purposes and on whether they can generate ideas for ways to prompt them to mitigate for earthquakes.

Demographic effects on mitigation and barriers to mitigation should be explored further too. Here there were no clear patterns in mitigation behaviors. However, there were suggestions at times that for some mitigation items demography mattered. We did not have fine distinctions for demographic categories, such as nationality or cultural group, so future work should consider employing these. Furthermore, we do not know whether differing demographic groups face different barriers to mitigation either. For example, cost appears important to home structures and systems mitigation, and knowing someone who mitigated is important across the board. Because of the limitation of using a small sample (discussed below) we did not pursue results that link demographic groups to reported barriers here.

Sample size is a concern for these analyses. Most mitigation items had four response options: “done,” “not done,” “others did before I moved in,” and “don’t know.” These are categorical and are appropriately analyzed using particular statistical procedures. When predictor variables had numerous categories as well, the sample size was too small to produce valid statistics using the four categories—that is in part why they were collapsed to the dichotomous outcome of certainty or neglect. The multivariate statistical procedures faced sample size limitations as well. With only 215 cases, one cannot include very many predictor variables before creating essentially unstable models.

Of particular concern are response categories that get few respondents. Our small sample restricted analysis on those responses (e.g., only 11 respondents had “not done” mitigation on

flexible connectors). Future research in this area should have a sample size that will be large enough to permit more complex analyses.

## **VII Recommended Survey Changes**

Our results and research discussions held by survey team members prompted several ideas about subsequent mitigation surveys. The first set of ideas center on the questionnaire. First, better explanation and more accessible phrasing of mitigation techniques must be available for respondents. It appears that respondents may not have had a clear understanding of what the hazard prevention step in the question they were asked actually was. Researchers may need to provide a glossary of each hazard prevention step for the lay audience.

Second, the response option, “don’t know,” introduces challenges. It is not clear whether the respondent may have selected the “don’t know” response because they did not know whether that action had been taken or whether the respondent did not know what the activity actually was. The intent for the “don’t know” option was to provide an option for those who did not know whether a hazard prevention step had been taken.

Third, a better response option should be added for those individuals who do not have the target of mitigation in their homes. For example, individuals who do not have large appliances to strap in their homes will not be able to participate in hazard prevention in reference to those. Therefore, a response option must be included for respondents who may not have targeted items.

Fourth, it may be useful to explore why persons actually have mitigated when referencing a particular target. In the survey reported here, respondents were only asked about things they have not mitigated. Of particular interest is whether law or other regulations prompted persons to mitigate. Indeed, those mitigation targets that are currently regulated by codes tended to have higher levels of mitigation. This will better help researchers understand the role laws and enforced regulations have in hazard prevention as well as the level of participation of individuals in hazard prevention. A potential response set for why persons mitigated may look like the



following: “Check all that apply: regulation requires it; to prevent damage; to prevent injury; it was recommended by someone; it seemed like a good idea.”

Fifth, as discussed previously, the incentives questions are limited. They should be expanded in order to provide more non-financial options for persons to respond to and to address particular mitigation activities. In addition, incentives generated by the public in focus groups should be included for testing on a larger sample.

Given the importance of social networks for mitigation, a sixth change should include adding new questions that gather information on whether others in respondents’ social networks have performed particular mitigation techniques. Such questions would allow analysis on whether persons copy those in their networks. If they do, policy would be improved by targeting the sharing of particular techniques rather than sharing positive attitudes about mitigation in general.

Expecting damages from an earthquake in the near future is also positively related to mitigation. However, this research did not measure perceived severity of expected injuries or damages in the near future. Therefore, a seventh change should include adding a measure of the severity of harm that is expected to come from an earthquake in the near future. It is likely, but could not be scrutinized here, that those expecting more harm in the near future would mitigate more often.

Finally, future surveys on mitigation for earthquake harm should be conducted using a different platform than surveymonkey.com. While this service provider has a useful place, it does not convey a serious attitude toward research. The team members experienced a few negative comments about using what on the surface appears to be an entertainment website.

## **VIII. Conclusions**

This research improved on previous work by focusing on mitigation of earthquake injuries and damages. In addition, it focused on specific mitigation techniques and barriers to those. The obstacles to mitigation found in previous work existed in the sample used here, but many of the obstacles were not as pronounced as previous research would indicate. Obstacles reported here were primarily the need for information and cost when dealing with home structures and systems, but a more important obstacle is priority given to mitigation of home contents. Important too is that building and contracting codes are apparently effective at expanding mitigation.

The research demonstrated that heightened perceptions of earthquake threats, experience with earthquake injuries and damage, and social relationships are critical predictors of mitigation. This confirms previous work: Perceptions of risk to a threatening disaster and social networks that confirm that risk and provide examples of mitigation activity will increase mitigation. Those whom persons trust are stronger social sources of mitigation. In addition, this work emphasizes that closeness to others affected by earthquakes intensifies the messages about mitigation: the closer to one's home damage has occurred (e.g., own home or neighbors') and the closer the relationship of others who have mitigated (e.g., family members) the more likely one is to mitigate. It is suggested that experts communicate the dangers and likelihood of future earthquakes, and make the public more aware of the threats posed by home contents. Finally, campaigns to encourage more open communication between persons on the topic of mitigation may be effective. It is clear that persons who know others who mitigated are more likely to mitigate their homes against injury and damages caused by earthquakes.

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## **Appendix Survey Instrument**

# Research on Barriers to Earthquake Damage Prevention

## 1. Instructions

### **\* Research on Barriers to Earthquake Damage Prevention**

**Guna Selvaduray, Ph.D., Principal Investigator**

**James Lee, Ph.D., Co-Investigator**

**Welcome! This is a survey for a research project under the direction of the Collaborative for Disaster Mitigation at San Jose State University.**

**Local residents are being asked to participate in this study. The purpose is to evaluate why people do or do not take measures to prevent earthquake-caused injuries and damage to their homes and its contents. Your participation will help to improve the ways by which residents can be assisted in preventing injury or damage.**

**To participate, you will complete a questionnaire which involves answering a variety of questions about yourself and your home. This will take approximately 15 minutes or less.**

**There are no anticipated risks for your participation. We will not collect personally identifying information and the questions are not sensitive in nature. However, if a question makes you uncomfortable, you may simply skip it. After collection, the data will be stored in a locked office. Research team members are the only persons who will ever see the data file this website generates. The results of this study may be published.**

**Your consent is being given voluntarily. No service of any kind, to which you are otherwise entitled, will be lost or jeopardized if you choose to not participate in the study in whole or part. Specifically, your participation or responses will have no effect on your employment at San José State University. You may refuse to participate in the entire study or to answer particular questions, and you may withdraw from the study at any time. No one will receive compensation from the researcher for this study.**

**Questions about this research may be addressed to Guna Selvaduray, Ph.D., at (408) 924-3874 or [guna.selvaduray@sjsu.edu](mailto:guna.selvaduray@sjsu.edu) or James Lee, Ph.D., at (408) 924-5866 or [james.lee@sjsu.edu](mailto:james.lee@sjsu.edu). Complaints about the research may be directed to Yoko Baba, Ph.D., Sociology Department Chair, at (408) 924-5320. Questions about a research subjects' rights, or research-related injury may be presented to Pamela Stacks, Ph.D., Associate Vice President, Graduate Studies and Research, at (408)**

## Research on Barriers to Earthquake Damage Prevention

924-2480.

**Thank you very much for your participation.**

**To begin the survey, please check "I agree" below and then click the "next" button.**

☐ I agree

### 2. Home Ownership

**When answering the questions about your "home" below, please refer to your current primary residence.**

**Do you own your home?**

☐ Yes

☐ No

### 3. Home Rental

**Do you rent your current home?**

☐ Yes

☐ No

### 4. Home Type

**Please mark below the type of home you live in:**

☐ Single family home

☐ Townhouse

☐ Condominium

☐ Apartment

☐ Mobile home

☐ Room

☐ Other (please describe)

**Please tell us how long have you lived in your current home (in years and months):**

**Please enter the zip code for your home:**



## Research on Barriers to Earthquake Damage Prevention

**In what year was your home built? (please approximate if you are not sure)**

### 5. Earthquake Likelihood

**Are you aware that earthquakes may occur in the San José area?**

- ☐ Yes  
☐ No

**In your opinion, how likely is it that a major earthquake will occur in the San José area within the next year?**

- ☐ Not Likely  
☐ Somewhat Likely  
☐ Very Likely

**In your opinion, how likely is it that a major earthquake will occur in the San José area within the next 10 years?**

- ☐ Not Likely  
☐ Somewhat Likely  
☐ Very Likely

**In your opinion, how likely is it that an earthquake will cause injuries to people within your home in the near future?**

- ☐ Not Likely  
☐ Somewhat Likely  
☐ Very Likely

**In your opinion, how likely is it that an earthquake will cause damage to your home or items within your home in the near future?**

- ☐ Not Likely  
☐ Somewhat Likely  
☐ Very Likely

### 6. Group 1: Research, engineer 1a

## Research on Barriers to Earthquake Damage Prevention

The questions on the following pages will be in reference to steps you have taken since moving into your home toward preventing earthquake damage or injuries in your home (including to structure, items, people, etc.).

Have you researched earthquake damage prevention?

- ☐ Done  
☐ Not Done  
☐ Don't Know

### 7. Group 1: Research, engineer 1b

You indicated that you have not researched earthquake damage prevention to prevent earthquake damage.

Please indicate your reasons for not doing so (check all that apply):

- ☐ Not enough information  
☐ Too expensive  
☐ Unnecessary  
☐ Requires too much time  
☐ Not useful/effective  
☐ Inconvenient  
☐ Not my responsibility  
☐ Other (please explain)

### 8. Group 1: Research, engineer 2a

Have you had an engineer evaluate your home for resistance to earthquake damage?

- ☐ Done  
☐ Not Done  
☐ Others did before I moved in  
☐ Don't Know

### 9. Group 1: Research, engineer 2b

## Research on Barriers to Earthquake Damage Prevention

**You indicated that you have not had an engineer evaluate your home for resistance to earthquake damage.**

**Please indicate your reasons for not doing so (check all that apply):**

- ☐ Not enough information
- ☐ Too expensive
- ☐ Unnecessary
- ☐ Requires too much time
- ☐ Not useful/effective
- ☐ Inconvenient
- ☐ Not my responsibility
- ☐ Other (please explain)

### 10. Group 2: Foundation, braced 1a

**Have you secured your home to its foundation?**

- ☐ Done
- ☐ Not Done
- ☐ Others did before I moved in
- ☐ Don't Know

### 11. Group 2: Foundation, braced 1b

**You indicated that you have not secured your home to its foundation.**

**Please indicate your reasons for not doing so (check all that apply):**

- ☐ Not enough information
- ☐ Too expensive
- ☐ Unnecessary
- ☐ Requires too much time
- ☐ Not useful/effective
- ☐ Inconvenient
- ☐ Not my responsibility
- ☐ Other (please explain)

### 12. Group 3: Safety straps - Water heater 1a

## Research on Barriers to Earthquake Damage Prevention

**You indicated that you have not fitted gas and other appliances with flexible connections.**

**Please indicate your reasons for not doing so (check all that apply):**

- ☐ Not enough information
- ☐ Too expensive
- ☐ Unnecessary
- ☐ Requires too much time
- ☐ Not useful/effective
- ☐ Inconvenient
- ☐ Not my responsibility
- ☐ Other (please explain)

### 16. Group 3: Safety straps - Water heater, etc. 3a

**Have you bolted large furniture items into place (e.g., bookshelves/entertainment centers)?**

- ☐ Done
- ☐ Not Done
- ☐ Others did before I moved in
- ☐ Don't Know

### 17. Group 3: Safety straps, bolted furniture, flexible connections, Water heaters...

## Research on Barriers to Earthquake Damage Prevention

**You indicated that you have not bolted large furniture items into place (e.g., bookshelves/entertainment centers).**

**Please indicate your reasons for not doing so (check all that apply):**

- ☐ Not enough information
- ☐ Too expensive
- ☐ Unnecessary
- ☐ Requires too much time
- ☐ Not useful/effective
- ☐ Inconvenient
- ☐ Not my responsibility
- ☐ Other (please explain)

### 18. Group 3: Safety straps, bolted furniture, flexible connections, Water heaters...

**Have you placed safety straps on large appliances (e.g., televisions or refrigerators)?**

- ☐ Done
- ☐ Not Done
- ☐ Others did before I moved in
- ☐ Don't Know

### 19. Group 3: Safety straps, bolted furniture, flexible connections, Water heaters...

## Research on Barriers to Earthquake Damage Prevention

**You indicated that you have not placed safety straps on large appliances (e.g., televisions or refrigerators).**

**Please indicate your reasons for not doing so (check all that apply):**

- ☐ Not enough information
- ☐ Too expensive
- ☐ Unnecessary
- ☐ Requires too much time
- ☐ Not useful/effective
- ☐ Inconvenient
- ☐ Not my responsibility
- ☐ Other (please explain)

### 20. Group 3: Secured, Secured, Safety latches, Glass 1a

**Have you placed safety latches on cabinets?**

- ☐ Done
- ☐ Not Done
- ☐ Others did before I moved in
- ☐ Don't Know

### 21. Group 3: Secured, Secured, Safety latches, Glass 1b

**You indicated that you have not placed safety latches on cabinets.**

**Please indicate your reasons for not doing so (check all that apply):**

- ☐ Not enough information
- ☐ Too expensive
- ☐ Unnecessary
- ☐ Requires too much time
- ☐ Not useful/effective
- ☐ Inconvenient
- ☐ Not my responsibility
- ☐ Other (please explain)

### 22. Group 3: Secured, Secured, Safety latches, Glass 2a

## Research on Barriers to Earthquake Damage Prevention

**Have you secured heavy wall hangings, art/paintings, or mirrors?**

- ☐ Done
- ☐ Not Done
- ☐ Others did before I moved in
- ☐ Don't Know

### 23. Group 3: Secured, Secured, Safety latches, Glass 2b

**You indicated that you have not secured heavy wall hangings, art/paintings, or mirrors.**

**Please indicate your reasons for not doing so (check all that apply):**

- ☐ Not enough information
- ☐ Too expensive
- ☐ Unnecessary
- ☐ Requires too much time
- ☐ Not useful/effective
- ☐ Inconvenient
- ☐ Not my responsibility
- ☐ Other (please explain)

### 24. Group 3: Secured, Secured, Safety latches, Glass 3a

**Have you secured decorative glassware or other table top items (e.g., with putty)?**

- ☐ Done
- ☐ Not Done
- ☐ Others did before I moved in
- ☐ Don't Know

### 25. Group 3: Secured, Safety latches, Glass 3b

## Research on Barriers to Earthquake Damage Prevention

**You indicated that you have not secured decorative glassware or other table top items (e.g., with putty).**

**Please indicate your reasons for not doing so (check all that apply):**

- ☐ Not enough information
- ☐ Too expensive
- ☐ Unnecessary
- ☐ Requires too much time
- ☐ Not useful/effective
- ☐ Inconvenient
- ☐ Not my responsibility
- ☐ Other (please explain)

### 26. Group 4: Foundation, braced 1a

**Have you braced, reinforced, replaced, or removed your masonry chimney?**

- ☐ Home has never had a masonry chimney
- ☐ Done
- ☐ Not Done
- ☐ Others did before I moved in
- ☐ Don't Know

### 27. Group 4: Foundation, braced 1b



## Research on Barriers to Earthquake Damage Prevention

**You indicated that you have not braced, reinforced, replaced, or removed your masonry chimney.**

**Please indicate your reasons for not doing so (check all that apply):**

- ☐ Not enough information
- ☐ Too expensive
- ☐ Unnecessary
- ☐ Requires too much time
- ☐ Not useful/effective
- ☐ Inconvenient
- ☐ Not my responsibility
- ☐ Other (please explain)

### 28. Group 4: Foundation, braced 2a

**Have you braced masonry and concrete walls?**

- ☐ Do not have masonry or concrete walls
- ☐ Done
- ☐ Not Done
- ☐ Others did before I moved in
- ☐ Don't Know

### 29. Group 4: Foundation, braced 2b

**You indicated that you have not braced masonry or concrete walls.**

**Please indicate your reasons for not doing so (check all that apply):**

- ☐ Not enough information
- ☐ Too expensive
- ☐ Unnecessary
- ☐ Requires too much time
- ☐ Not useful/effective
- ☐ Inconvenient
- ☐ Not my responsibility
- ☐ Other (please explain)

## Research on Barriers to Earthquake Damage Prevention

### 30. Group 4: Secured, Secured, Safety latches, Glass 3a

**Have you placed plastic film over window glass?**

- ☐ Done
- ☐ Not Done
- ☐ Others did before I moved in
- ☐ Don't Know

### 31. Group 4: Secured, Secured, Safety latches, Glass 3b

**You indicated that you have not placed plastic film over window glass.**

**Please indicate your reasons for not doing so (check all that apply):**

- ☐ Not enough information
- ☐ Too expensive
- ☐ Unnecessary
- ☐ Requires too much time
- ☐ Not useful/effective
- ☐ Inconvenient
- ☐ Not my responsibility
- ☐ Other (please explain)

### 32. Earthquake Injury Experience

**Have you, or anyone you know, ever been injured in an earthquake?**

- ☐ Yes
- ☐ No

### 33. No Earthquake Injury Experience

**If you or someone you know were injured in an earthquake, how likely would you be to take steps to prevent future earthquake injuries in your home?**

- ☐ Not likely
- ☐ Somewhat likely
- ☐ Very likely

### 34. Earthquake Injury Experiencers

## Research on Barriers to Earthquake Damage Prevention

**What relationship to you was the person(s) who was injured in an earthquake?  
(check all that apply)**

- ☐ Myself
- ☐ Parent
- ☐ Spouse or partner
- ☐ Sibling
- ☐ Son or daughter
- ☐ Other family member
- ☐ Friend
- ☐ Acquaintance
- ☐ Neighbor

**Did this event lead you to take steps to prevent future earthquake injuries in your home?**

- ☐ Yes
- ☐ No

### 35. Earthquake Damage Experience

**Have you, or anyone you know, experienced an earthquake that caused damage to their home or items within their home?**

- ☐ Yes
- ☐ No

### 36. No Earthquake Damage Experience

**If you or someone you know had home damage in an earthquake, how likely would you be to take steps to prevent future earthquake damage in your home?**

- ☐ Not likely
- ☐ Somewhat likely
- ☐ Very likely

### 37. Earthquake Damage Experiencers

## Research on Barriers to Earthquake Damage Prevention

**What relationship to you was the person(s) who experienced home damage in an earthquake? (check all that apply)**

- ☐ Myself
- ☐ Parent
- ☐ Spouse or partner
- ☐ Sibling
- ☐ Son or daughter
- ☐ Other family member
- ☐ Friend
- ☐ Acquaintance
- ☐ Neighbor

**Did this event lead you to take steps to prevent future earthquake damage to your home?**

- ☐ Yes
- ☐ No

### 38. Other People's Earthquake Preparation

**Do you have friends, family, or neighbors who have taken steps to prevent earthquake damage or injuries in their homes?**

- ☐ Yes
- ☐ No

### 39. No Other Experimental Preparers

**If your friends, family, or neighbors were to take steps to prevent earthquake damage or injuries in their homes, how likely would you be to take similar action in your home?**

- ☐ Not likely
- ☐ Somewhat likely
- ☐ Very likely

### 40. Other Earthquake Preparers

## Research on Barriers to Earthquake Damage Prevention

**What is your relationship to those who took steps to prevent damage or injury from an earthquake? (check all that apply)**

- ☐ Parent
- ☐ Spouse or partner
- ☐ Sibling
- ☐ Son or daughter
- ☐ Other family member
- ☐ Friend
- ☐ Acquaintance
- ☐ Neighbor

**Did the actions of your friends, family, or neighbors to prevent earthquake damage or injuries lead you to take earthquake damage or injury prevention measures in your home?**

- ☐ Yes
- ☐ No

### 41. Incentives to Prepare

**Suppose your local community were to take steps to encourage you to modify your home to prevent earthquake damage or injuries.**

**How likely would you be to take steps to prevent earthquake damage or injuries in your home if they offered you the following things for doing so?**

	Not likely	Somewhat likely	Very likely
Discount on your insurance (e.g., homeowners or renters)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tax break / tax incentive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Free items needed to prevent damage (such as straps, bolts, maintenance costs)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Free advice to assist in prevention efforts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Free service or labor to assist in prevention efforts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
More information on regulations and codes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Please describe other things that would make you more likely to take steps to prevent damage or injury from an earthquake in your home (if there are any):**

## Research on Barriers to Earthquake Damage Prevention

### 42. Demographics 1

Now we are almost finished with the survey! We need to gather more information about you to help us understand earthquake damage and injury prevention efforts.

#### What gender are you?

- ☐ Male
- ☐ Female
- ☐ I identify as another gender

#### What race or ethnicity are you? (check all that apply)

- ☐ White
- ☐ American Indian
- ☐ African American
- ☐ Asian
- ☐ Filipino
- ☐ Pacific Islander
- ☐ Hispanic

### 43. Demographics 2

#### What is the highest level of education you have achieved?

- ☐ less than a high school diploma
- ☐ High school diploma/GED
- ☐ some college/Associates Degree/Trade school
- ☐ Undergraduate Degree
- ☐ Masters Degree
- ☐ Doctoral Degree

#### What is your marital status?

- ☐ Single, never married
- ☐ Married
- ☐ Domestic partners
- ☐ Living with partner
- ☐ Separated, divorced, or widowed

## Research on Barriers to Earthquake Damage Prevention

**Do you have children under the age of 18 currently living in your home?**

☐ Yes

☐ No

### 44. Born in USA

**Were you born in the United States?**

☐ Yes

☐ No

### 45. Not Born in USA 1

**What was your country of origin?**

### 46. Not Born in USA 2

**At what age did you migrate to the US?**

☐ Under 10

☐ 10 to 17

☐ 18 to 25

☐ 26 to 30

☐ 31 to 35

☐ 36 to 40

☐ 41 to 45

☐ 46 to 50

☐ 51 to 55

☐ 56 to 60

☐ 61 to 65

☐ 66 to 70

☐ 71 or above

### 47. Born in CA

**Were you born in California?**

☐ Yes

☐ No

## Research on Barriers to Earthquake Damage Prevention

### 48. Not born in CA 1

**From what state or country did you move to California?**

### 49. Not born in CA 2

**At what age did you move to California?**

- ☐ Under 10
- ☐ 10 to 17
- ☐ 18 to 25
- ☐ 26 to 30
- ☐ 31 to 35
- ☐ 36 to 40
- ☐ 41 to 45
- ☐ 46 to 50
- ☐ 51 to 55
- ☐ 56 to 60
- ☐ 61 to 65
- ☐ 66 to 70
- ☐ 71 or above

### 50. Demographics 3



## Research on Barriers to Earthquake Damage Prevention

### What is your current age?

- ☐ 18 to 25
- ☐ 26 to 30
- ☐ 31 to 35
- ☐ 36 to 40
- ☐ 41 to 45
- ☐ 46 to 50
- ☐ 51 to 55
- ☐ 56 to 60
- ☐ 61 to 65
- ☐ 66 to 70
- ☐ 71 or above

## 51. Demographics 4

### What was your total household income (income from all those in your home) for 2007?

- ☐ less than \$30,000
- ☐ \$30,000 - \$49,999
- ☐ \$50,000 - \$69,999
- ☐ \$70,000 - \$89,999
- ☐ \$90,000 - \$109,999
- ☐ \$110,000 - \$129,999
- ☐ \$130,000 - \$149,999
- ☐ \$150,000 or more

### After accounting for all your expenses (such as mortgage or rent, taxes, utilities, food, and so forth), approximately how much income do you have each month?

- ☐ less than \$1,000
- ☐ \$1,000 - \$4,999
- ☐ \$5,000 or more

## 52. Thank You

THANK YOU VERY MUCH FOR COMPLETING THIS SURVEY!

If you are interested in learning about the results of this survey, please email Dr. Guna Selvaduray in the Department

## Research on Barriers to Earthquake Damage Prevention

of Materials Engineering, Guna.Selvaduray@sjsu.edu, or Dr. James Lee in the Sociology Department, james.lee@sjsu.edu.

You may also check the Collaborative for Disaster Mitigation's website at <http://www.sjsu.edu/cdm/main.html>