Title
Motivating Private Precaution with Public Programs: Insights from a Local Earthquake Mitigation Ordinance

Author
Rabinovici, Sharyl Jean Marie

Publication Date
2012

Peer reviewed|Thesis/dissertation

Motivating Private Precaution with Public Programs: Insights from a Local Earthquake Mitigation Ordinance

By

Sharyl Jean Marie Rabinovici

A dissertation submitted in partial satisfaction of the

requirements for the degree of

Doctor of Philosophy

in

Public Policy

in the

Graduate Division

of the

University of California, Berkeley

Committee in Charge:

Professor Michael O'Hare, Chair
Professor Henry Brady
Professor Jack Glaser
Professor Mary Comerio

Fall 2012

ABSTRACT

Motivating Private Precaution with Public Programs:
Insights from a Local Earthquake Mitigation Ordinance

by

Sharyl Jean Marie Rabinovici

Doctor of Philosophy in Public Policy

University of California, Berkeley

Professor Michael O'Hare, Chair

This dissertation investigates earthquake mitigation behavior among a group of rental property owners in Berkeley, California. About 320 owners were affected by a novel local ordinance that sought to address the problem of soft, weak, or open first story wood frame buildings. The law placed notice on the property title and required owners to inform tenants, post warning signs on-site, and hire a structural engineer to evaluate their property. Even though owners were not required to do a seismic upgrade, over 20 percent voluntarily took that costly extra step.

To investigate why some people took precautionary action while others did not, I conducted 43 semi-structured in-depth interviews, including a stratified sample of the affected Berkeley apartment owners (N=37) and some owners who did similar soft-story retrofits prior to the law (N=6). Using a mix of open-ended and survey questions, I developed a rich description of these owners and how the law affected their mitigation investment choices.

My principal finding is that post-law retrofitters were highly motivated by the near-term negative consequences created by the law. The desire to remove stigma (and its perceived economic implications), gain freedom from administrative hassles, and eliminate fear of further regulatory impositions compelled many to act, in some cases more than concern about the actual hazard. Retrofitters and non-retrofitters appear to own similar buildings and otherwise have similar demographic traits and earthquake risk perceptions.

To put this individual behavior into context, I also interviewed 22 key stakeholders involved in developing and implementing the policy and assessed the City of Berkeley's mandatory evaluation approach as a policy strategy. Berkeley's approach successfully influenced enough owners to take voluntary action that the remaining owners now believe that they must either do a retrofit or accept that their property is worth less. The greatest implementation challenge was the development, communication, and consistent application of technical standards for the evaluating engineers to use. Overall, this case illustrates the potential power – as well as some limitations and pitfalls – of using labeling, mandated evaluations, and disclosures to shift social perceptions and behavior regarding risk reduction behaviors.

DEDICATION

To my parents, J. and Duane, who taught me to always try my best at things that matter;
To Gil, my best friend and an invaluable partner, who walks beside me in all my journeys; and
To Ben and Naomi, our two "special projects", who were born along the way.

ACKNOWLEDGEMENTS

With profound gratitude, I acknowledge a long list of people who made this research possible and the process more pleasant. Jeanne Perkins turned me on to the case and the importance of the issue. Joan MacQuarrie and Dan Lambert, who led the policy effort I studied, graciously invited me in to investigate their life's work. Over 60 other research participants, many of whom are anonymous, generously contributed their time and thoughts. Together, these stories became the substance of the research. I made a professional decision early on to discuss the policy case without emphasizing the roles and specific actions of the many individual public figures and staff involved. I relied on key informant accounts, and sought to establish their veracity when possible, but any and all errors and omissions are my own responsibility. Along the way, a host of individuals from California's disaster preparedness community backed the project including David Bonowitz, Tom Tobin, Danielle Hutchings, Arrietta Chakos, Kate Stilwell, Laurence Kornfield, and many other members of San Francisco CAPSS Project and the Association of Bay Area Governments Earthquake Hazards Outreach committees.

Michael O'Hare, my thesis chair, was an indefatigable coach and fan. He is as inventive and approachable of an adviser as any student could wish for, writing countless letters of recommendation and singing my praises so loudly that I actually came to believe (most of) what he said. Professor Mary Comerio served as my anchor in reality – I couldn't have asked for a better subject expert work with. I was honored to have two other wise and patient committee members, Professors Henry Brady and Jack Glaser, who enthusiastically guided the project from start to finish. Other supportive Goldman School faculty and staff encouraged and nudged me forward at critical points, including Geno Smolensky, Steve Raphael, Lee Friedman, John Ellwood, Robert MacCoun, and Martha Chavez. Jane Mauldon in particular provided vital help with planning the human subject research.

I would also like to recognize previous mentors including Richard Bernknopf, Don Coursey, Jack Boatright, Keith Loague, and George Mader, who long ago set my course towards this topic and helped lay the intellectual foundations. I was also blessed with fabulous PhD colleagues who provided essential advice and companionship throughout my studies, most notably Mia Bird, Heidi Sommer, Erika Weissinger, Jeff Deason, Felicity Kolp, Nathaniel Bush, and Juanito Rus. Dear old friends like Sharyl Smith, Alice Cathcart, Lori Dinitz, Leila Gass, Sarah Henry, Lucas Mix, and Rose Nguyen kept me grounded and "thinking I could."

Far from least, my kind and intelligent husband played many visible and not so visible roles. He advocated, counseled, cheered, pushed, let be, and sacrificed throughout this learning experience. Thanks for everything you do, Gil. It was you who helped me understand that the best way to show my gratitude is to take pleasure in the process and to finish. This accomplishment is a milestone for us and for our family as much as it is my own.

DECLARATION OF FUNDING SOURCES

This research benefited from several past and concurrent external sources of funding and general fellowships that have supported my work as a doctoral student, including:

- National Science Foundation IGERT Program Fellowship, 2008-2009;
- National Science Foundation Division of Risk Management and Decision Sciences Dissertation Improvement Grant, Award #0962627; and,
- 2010-2011 EERI/FEMA-NEHRP Graduate Fellowship.

HUMAN SUBJECTS RESEARCH

Aspects of this research are covered by UC Berkeley Committee for Protection of Human Subjects protocols #*2010-01-555* and #*2010-08-2053.* Copies of the approval letters can be found in Appendix H.

ACRONYMS & ABBREVIATIONS

Abbreviation	*Meaning/Description*
ABAG	Association of Bay Area Governments
ATC	Applied Technology Council
BID	Building Inspection Division
BOCA	Building Officials Code Administrators International
BPOA	Berkeley Property Owner's Association
BSSO	Berkeley Soft-story Ordinance
CBC	California Building Code
C-SHIP	Cognitive Social Health Information Processing Model
CSM/EPPM	Common Sense Model/Extended Parallel Process Model
CSSC	California Seismic Safety Commission
EERI	Earthquake Engineering Research Institute
FEMA	Federal Emergency Management Agency
GSREB	Guidelines for Seismic Retrofit of Existing Buildings
HAB	Hazard Adjustment Behaviors
HBM	Health Belief Model
HPB	Health Protective Behaviors
IBC	International Building Code
ICBO	International Conference of Building Officials
ICC	International Code Council
IEBC A4	International Existing Building Code Appendix Chapter A4
NEHRP	National Earthquake Hazards Reduction Program
PADM	Precautionary Adoption Process Model
PAPM	Precaution Adoption Process Model
PMT	Protection Motivation Theory
PrE	Person Relative to Event Model
RFQ	Regulatory Focus Questionnaire
RSB	City of Berkeley Rent Stabilization Board
SBC	Standard Building Code
SBCCI	Southern Building Code Congress International
SCT	Social Cognitive Theory
SEAOC	Structural Engineer's Association of California
SEAONC	Structural Engineering Association of Northern California
SEUT	Subjective Expected Utility Theory
STAG	Seismic Technical Advisory Group
SWOF	Soft-, Weak-, or Open- Front
TMT	Terror Management Theory
TPB	Theory of Planned Behavior
TRA	Theory of Reasoned Action
TTM	Trans-Theoretical Model
UC	University of California
UCBC	Uniform Code for Building Conservation
URM	Un-reinforced Masonry
US	United States of America

TABLE OF CONTENTS

LIST OF FIGURES

CHAPTER 1

CHAPTER 2

CHAPTER 3

CHAPTER 4

CHAPTER 5

CHAPTER 6

CHAPTER 7

CHAPTER 8

CHAPTER 1 – INTRODUCTION & OVERVIEW

1.A – Summary and Roadmap to the Dissertation

This dissertation summarizes an in-depth case study of an innovative local policy that targeted the problem of soft-story wood frame apartment buildings, a particularly hazardous, socially important, and common building type, particular out West in coastal California. I investigated the earthquake beliefs and structural mitigation behaviors among a group of rental property owners in Berkeley, California who were affected by a 2005 municipal ordinance. That law placed notice on the title of 321 suspected soft, weak, or open first story wood frame apartment buildings and required owners to inform tenants in perpetuity, post warning signs on-site, and hire a structural engineer to evaluate their property. Even though owners were not required to do a seismic upgrade, over twenty percent voluntarily took that costly extra step within the first five years. The seventy five retrofits undertaken after the law represent a five-fold increase over the number of similar retrofits (13) initiated in the decade prior to the law. As such, this policy offers a unique opportunity to study in detail how a new policy was able to motivate a large number of property owners to retrofit.

To explore the case, I conducted 43 semi-structured in-depth interviews with a stratified random sample of the affected Berkeley apartment owners and, for comparison, a small group of similar owners who did retrofits prior to the law. Using a mix of open-ended (conversational) and closed format (survey) questions, I developed a rich description of how these owners think about mitigation. My principal finding is that voluntary retrofitters were highly motivated by the near-term negative consequences created by the law. Removing stigma (and its perceived economic implications), gaining freedom from added administrative hassles, and eliminating fear of further regulatory impositions were all powerful motivators, in some cases more than concern about the actual hazard. Underscoring this point, I found suggestive evidence that the law may have motivated retrofits among persons with a different personality profile: post-law retrofitters on average had a more "problem-avoidant" as opposed to "goal-attainment" regulatory orientation than people who retrofit prior to the ordinance. Although the number of study participants does not allow me to draw statistical conclusions, retrofitters and non-retrofitters appear to own similar buildings and otherwise have similar demographic traits and earthquake risk perceptions.

To put this individual behavior into context, I also interviewed 25 key stakeholders involved in developing and implementing the policy and assessed the City of Berkeley's mandatory evaluation approach as implemented. I conclude that Berkeley's approach successfully influenced enough owners to take voluntary action that the remaining owners now believe that they must either do a retrofit or accept that their property is worth less. Berkeley's greatest hurdle in implementing the law was the development, communication, and consistent application of technical standards for the evaluating engineers to use, but other cities face fewer obstacles now that a precedent has been established. Overall, this case illustrates the potential power – as well as some limitations and pitfalls -- of using labeling, mandated evaluations, and disclosures to shift the beliefs and behaviors of market participants.

My presentation of the study is organized as follows. In Chapter 2, I review several streams of literature that informed the study, including social-cognitive, economic, and risk-

perception based theories of self-protective behavior and also what is known about motivating preparedness behaviors from earthquake policy precedents and past empirical studies regarding earthquake preparedness and risk communication interventions. I also introduce the notion that subtle individual differences in personality and self-regulatory orientation might interact with issue framing to sway mitigation motivations and decisions, setting the stage for a novel exploratory aspect of this research. In Chapter 3, I describe the research design, data collection, and methods used to understand earthquake mitigation behavior in the Berkeley policy context. I use a mix of methods including archival data analysis, a survey, and in-depth interviews.

I present my report of the analyses and findings in four chapters, starting with a detailed history and discussion of the policy's origins and implementation in Chapter 4. In Chapter 5, I summarize what I learned about the affected population of building owners and the buildings themselves. Chapter 6 gives an in-depth analysis of owner beliefs and behavior regarding earthquake mitigation in the context of the law. In Chapter 7, I discuss each of the major implementation activities of the law, deriving specific insights and recommendations. I conclude with Chapter 8, in which I offer an overall assessment of the policy concept and the law's accomplishments relative to other possible policy strategies, and place the findings of this study in the broader context of precautionary behavior.

1.B –The Problem of Seismically Vulnerable Existing Buildings

Earthquakes are an important policy paradox. Catastrophic quakes pose a serious threat to many regions of the United States (US) – a fact of which nearly everyone is aware – and yet we also see policy indifference and personal inaction. Facts on the ground in California exemplify the situation: only a fraction of people take basic survival and preparedness actions (Kunreuther 1978; Palm and Hodgson 1992) or purchase insurance where it is available (Kunreuther and Pauly 2004).

Investment in structural mitigation is particularly rare, which is a problem because buildings – not earthquakes – kill people (Solberg, Rossetto et al. 2010). Most property owners do not understand or spend money to assess – much less correct – the potential seismic safety deficiencies of their properties. For residential single family structures in California's highest hazard areas that do not meeting modern building code standards (built prior to 1990), rates of structural mitigation (seismic retrofit) are at most five to ten percent. [1]

At the community scale, experts perceive a large gaps between the states of knowledge and public policy about earthquakes (Comerio 2004). Communities in high risk areas have large inventories of unmitigated properties yet few policies are in place to motivate owners to undertake seismic safety projects. Because of population growth and urban development in

[1] Consistent, recent, and representative data on earthquake adjustment behaviors is remarkably scarce. Single-family structural improvement rates in a *high risk* area of California (Zone 4) are on average less than 10%, basic preparedness actions like having stored water or even owning a flashlight are around 60%, and insured rates are around 10 to 30% (Nguyen et al., 2006). Rates are also known to vary over time and by community. (Shoaf & Peek-Asa, 2000) compared preparedness data collected in California found that around 38 percent in 1987 and 54 percent in 1999 had stored food for earthquakes or for earthquakes and other reasons. California earthquake insurance coverage rates fluctuated from 5% in 1973 to 50% in 1993 and are now back down to around 12%.

areas of high natural hazard, our exposure and the estimated losses when a major event occurs will be enormous (on the order of tens of billions of dollars) and growing (Burby, Beatley et al. 1999; Mileti 1999; Platt 1999).

From a societal standpoint, earthquake damage to residential buildings can have consequences that far exceed the private losses experienced directly by building owners. This is particularly true with so-called "soft-story" apartment buildings. "Soft-story" refers to a condition where one of the stories in a multi-story building, usually a parking level that doesn't require partitions for functionality, is weaker than the one or more stories above it. During strong ground shaking, the lower resistance to shear forces in the "soft" level can significantly increase the chance of collapse or damage sufficient to render the building unusable after the event. Most of this type of construction can be found in apartment buildings built in the 1960s and 1970s, when the safety risks of soft-stories were not yet fully understood, much less addressed in common building codes. Vast numbers of these buildings exist in California communities that grew substantially during that time span. Soft-story buildings constituted about half (7,700) of the 16,000 housing units rendered uninhabitable by the 1989 Loma Prieta earthquake and over 34,000 of the housing units rendered uninhabitable by the Northridge earthquake in 1994 (ABAG 2003).

Consequently, soft-story buildings are a particularly dangerous and socially-important building type for high earthquake hazard regions like the San Francisco Bay Area. The chance of a major earthquake (magnitude 6.7 or greater on the Richter scale) on the Hayward fault that runs through Alameda County is 31 percent in the next 30 years (USGS 2008). Such a quake could destroy more than a quarter of the East Bay building stock, leaving thousands injured and over one hundred thousand homeless. The Association of Bay Area Governments (ABAG) estimates that soft-story buildings would account for two thirds of the some 160,000 units that might be affected by a major Hayward Fault quake (ABAG 2003). That magnitude of loss in the local housing stock could cripple the local economy for a decade or more, devastate the tourism sector, and irrevocably change the character and affordability of the region. Soft-story buildings not only pose a serious risk of injury or death to the occupants, but hundreds of thousands of residents would likely be displaced for four to six months or longer in a major Bay Area earthquake. A recent analysis by the City of San Francisco estimated that one in five of its soft-story buildings will likely collapse and another three out of five would be uninhabitable (ATC 2009).

Despite all this, retrofit rates for multifamily buildings with more than four units remain very low at under one percent, which is approximately one fourth of the rate for single-family homes or small multifamily buildings of two to four units (ABAG 2003). A handful of Bay Area cities have taken action to identify and promote retrofit of soft-story buildings. But for the most part, short of forcing or paying owners to retrofit, local governments have struggled to find viable policy options.

Overview of the Policy Case: The Berkeley Soft-Story Ordinance

In 2005, the Berkeley City Council amended its Municipal Code (Chapter 19.39) to establish an Inventory of Potentially Hazardous Buildings due to a Soft, Weak, or Open-Front first story condition. The full ordinance text is given in Appendix A. The Berkeley Soft-Story

Ordinance (BSSO) targeted all existing wood frame multi-unit residential buildings or portions thereof that contain five or more dwelling units that were designed prior to adoption of the 1997 Uniform Building Code. Under the law, soft-story is defined as a building where:

> *1. The ground floor, whether itself constructed of wood or other materials, of the wood frame structure contains parking or other similar open floor or basement space that causes Soft, Weak, or Open Front Wall (SWOF) Lines and there exists one or more levels above, or;*
> *2. The walls of any story or basement of wood construction are laterally braced with Nonconforming Structural Materials as defined in the Chapter and there exist two or more Levels above.*

Between February and October 2006, the City of Berkeley sent notices to 321 buildings that were suspected of meeting these criteria, as identified in a comprehensive review of public records and a street-by-street visual assessment conducted by two city employees back in 1996. The typical building affected by the BSSO is a small to medium sized mid-century multi-family apartment building; the average number of units is eleven and the average year built is 1965. In total, the final Inventory covers about 3,500 dwelling units or about 10 percent of Berkeley's total multifamily housing stock. Less than five percent of these properties have some type of commercial use on the first floor. Figure 1 is a photo of an example Berkeley soft-story property with eight units.

Figure 1. Photo of an example soft-story property in Berkeley.
Photo credit: Sharyl Rabinovici, May 2010.

The BSSO required owners of all residential buildings on the Inventory to obtain an engineering study of the property according to provided guidelines within two years from date of notification plus a six month appeal period. The BSSO also required owners to inform tenants in writing in perpetuity of the "listed" status of the building, with signed copies of each tenant notification to be held on file by the city government (with the tenants' names blacked out for privacy reasons). Additionally, owners must display at all entrances to the building a clearly visible warning sign not less than eight inches by ten inches with the following statement: *"Earthquake Warning. This is a soft story building with a soft, weak, or open front ground floor. You may not be safe inside or near such buildings during an earthquake."* Figure 2 shows the soft-story warning sign posted near the tenant mail boxes on the building seen in Figure 1.

On a practical level, the City of Berkeley's Building Inspection Division (BID) manages the program. BID is organizationally housed within the Department of Planning. BID staff delivered the initial notification to each owner along with a technical guidance document and general educational materials designed to promote retrofitting. The BSSO also established an administrative process for removal from the Inventory by either demonstrating that the building was either exempt or did not have a soft-story weakness, or by verifying that the soft-story weakness had been resolved to the level specified in the law. Buildings that are removed from the Inventory following a retrofit are exempt from being placed on any other hazardous building inventory for 15 years (BMC 19.39.100). Importantly, the choice to complete any recommended retrofit work was left to individual building owners.

The ordinance included penalties for non-compliance via the city's general public nuisance provisions that allow for up to $5,000 per cited violation (each day can be considered a separate violation) and up to $10,000 per injury-related incident. In practice, enforcement is handled at the discretion of BID staff in consultation with the City Attorney.

Figure 2. (a) Exemplar warning sign on the Berkeley soft-story property depicted in Figure 1, and (b) the location of that warning sign on the building.

Five Years Out: Overview of Owner Responses to the Law

The initial two-year period for compliance ended between October of 2008 and February of 2009, depending on when the owner first received their notification. An initial wave of letters urging non-compliers to act was sent out in spring of 2009. A second wave of non-compliance letters was sent out in spring of 2010, along with materials reminding owners of the signage and tenant notification requirements. No citations or penalties have been issued to date.

Figure 3 shows the status of the 321 buildings originally listed on the Inventory as of April 2010. At that time, BID officially regarded 252 (79%) of the buildings as in compliance with the engineering report requirement, including 127 buildings with approved reports. Forty-six properties had been officially removed from the Inventory for reasons such as having fewer than five dwelling units or verified lack of soft-story condition, representing a false positive rate of around five percent. Most interestingly, 79 buildings had voluntarily applied for permits to retrofit their buildings in lieu of or addition to producing the required engineering report. As of April 2010, about half of those planned retrofit projects were officially completed (i.e., the building permit had been "finaled").

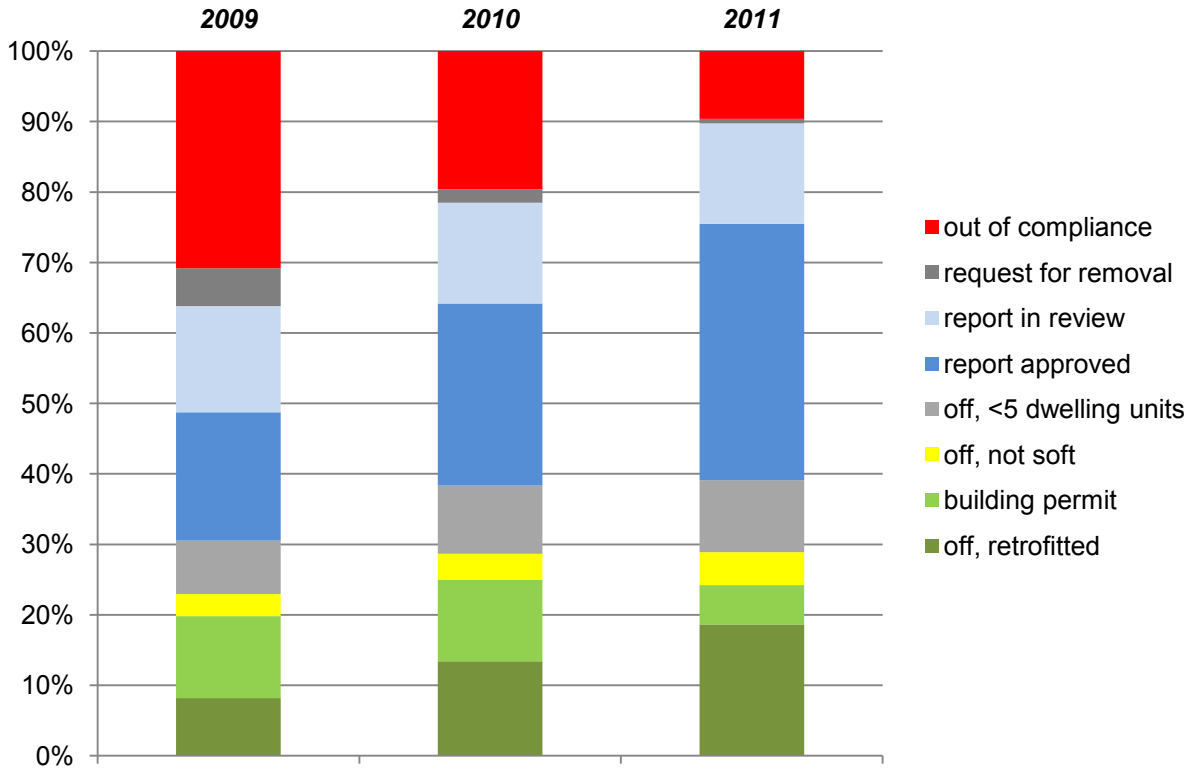

Figure 3. Compliance status with the seismic evaluation report aspect of Berkeley's Soft-Story Ordinance as of April, 2010. N=321.[2]

[2] Source: Compiled from public data available online, City of Berkeley, http://www.ci.berkeley.ca.us/contentdisplay.aspx?id=622, Accessed: May 2011.

To put this information in context, there are about 3,500 housing units in the 321 soft-story buildings that were on the original BSSO Inventory[3], representing about 18 percent of the 18,855 total registered rental housing units in the city as of April 2009. The voluntary retrofits done after the law affected at least 976 units, or about five percent of Berkeley's total multifamily housing stock.

1.C – Specific Aims and Justification for a Mixed-Methods Approach

Specific Aims

The overall goals of this study are to document the policy case and learn from it in terms of how to create and successfully operate a local public program, where success is defined as motivating belief and behavior change in the intended stakeholder audience. More specifically, this research focuses in on two aspects of the policy case: (1) the processes through which local government actors were able to create an innovative new approach to a serious threat to their community, and (2) the mechanisms through which that local regulation and program contributed to behavior and attitude changes among private citizens and organizations.

On the first point, the prevailing theory is that major shifts in earthquake policy do not occur except during the period immediately following a local major quake. A corollary is that political action on earthquake issues is easiest and most effective when the public, media, and political leaders are paying attention. At least one study found that communities and local decision makers were more willing to undertake mitigation soon after a disaster (the study addressed both hurricanes and earthquakes) than at other times (Birkland 1997).

However, because the Berkeley City Council passed its law 16 years after the 1989 Loma Prieta earthquake and with virtually no citizen involvement, this case directly contradicts these ideas. My first aim, therefore, is to document the policy development timeline and explore the conditions under which the policy's proponents were able to sustain the interest of elected officials and get an important new law passed so many years after the most recent major local quake.

Specific Aim 1: This study documents the history of the City of Berkeley's Soft-Story Ordinance, focusing on key policy actors, decisions, and events as well as the factors that contributed to sustained interest in the soft-story policy issue well over a decade after the most recent local earthquake.

By design, this research is retrospective and oriented towards a single case. It contributes to the understanding of human behavior, earthquake policy, and policy development processes in general by providing detailed information about a milestone policy event. That does not, however, imply that all of the phenomena explored in the study are atypical. Rather, the study functions as a robustness check to existing generalizations and as a

[3] A precise total cannot be determined because unit data is missing from some of the properties. The estimate was generated by multiplying the number of buildings for which the unit total is missing by the average number of units for all buildings.

source of potential extension, refinement, or new theory that can be tested in future research. Additionally, I conclude this study with a formal assessment of the policy's implementation and concept to provide applied insights for local decisionmakers and policy practitioners on this and other substantive topics.

At the core of this study are questions about beliefs and behavior, which invites us to consider what *can* people tell us about why they do what they do, or how a certain event affected them? In-depth single-case analysis can be a valuable tool for understanding how people frame and solve problems (Barzelay 1993). As a singular policy event, the BSSO offers an opportunity to deeply explore both local policy making and individual and organization behavior at a micro level. It is rare for any local policy to be examined in this close historical manner, and even more so one about seismic safety. One precedent comes from the California Seismic Safety Commission (CSSC), which conducts a review every five years of the many local Un-Reinforced Masonry (URM) laws in existence statewide. The most recent report is from 2006 (CSSC 2006). However, these reports are typically high level summaries that emphasize administrative outcomes and do not address any specific implementation processes or stakeholder views.

A handful of studies from the early 1990s attempted to characterize local land use planning policies towards earthquakes and seismic codes in Western states (Berke, Beatley et al. 1989; May and Birkland 1994). One study evaluated outcomes from a Los Angeles ordinance that mandated retrofit policy of that city's URMs (Comerio 1992). The CSSC's report on the City of Palo Alto's URM ordinance was the only previous study identified that gives detail on the events, people, and processes involved in creating a local seismic safety law (Herman, Russel et al. 1990).

The use of qualitative interviews to understand how seismic safety policies get passed at the local level and how well they work was pioneered by R.S. Olson and colleagues in their assessment of policymaking in the Cities of Oakland and Los Gatos before and after the Loma Prieta earthquake (Olson, Olson et al. 1999). I conduct here a similar in-depth study for the Berkeley soft-story case, addressing a shorter time period but considering a broader range of factors.

The BSSO provides a rich, real-world forum for exploring existing theories of self-protective behavior and decisionmaking under uncertainty, and to the use of information-oriented policy interventions more broadly. As the literature review in the previous chapter showed, we do not fully understand why so few individuals and institutions invest in protective measures for earthquakes. The classical economic paradigm evidently lacks the capacity to predict actual behavior. The risk perception and social-cognitive influences on decisionmaking about mitigation are at best vaguely defined. Researchers have only recently begun to explore the personality and social-psychological influences on risk judgments and decisionmaking. This study's second aim, therefore, is to explore these factors in an applied context.

Specific Aim 2: This study explores the economic, risk perception, social influences, and individual personality factors contributing to owner beliefs and behavior regarding earthquake mitigation in the context of the City of Berkeley's Soft-Story Ordinance.

Justification for a Mixed-Method Approach

I pursue Specific Aim 1 by looking for commonalities, corroboration, and discrepancies between and among the self-reported narratives of various key informants in conjunction with an assessment of the available documentation and archival administrative records. Specific Aim 2 also calls for a search for commonalities, corroboration, or discrepancies, but in this instance between and among self-reported beliefs and behaviors as reported in both interviews and a survey, and in conjunction with official program records that provide an alternative source of information about those same behaviors.

The principal feature of this mixed-method strategy is the qualitative interviews. My literature review found that rich, comprehensive description is typically absent from previous studies on this topic. Furthermore, the inability of current theories to predict actual behavior suggests that some important concepts or mechanisms remain unknown, or if they have been identified, those factors are not yet well-enough understood or described to be consistently measured and useful research constructs. Qualitative information is therefore useful at this juncture to support theory testing, expansion, and consolidation as well as construct development.

Even though the overall approach is qualitative, I included a large number of fixed format and quantitative measures in an original survey questionnaire for the owner belief and behavior aspect of the research. Fixed format questions can be answered more precisely, summarized quantitatively, and are commonly used to measure many of the well-established constructs known to be associated with protective behaviors (most notably the earthquake risk and mitigation perception questions). The five-trait personality (Gosling, Rentfrow et al. 2003) and regulatory focus orientation (Higgins, Friedman et al. 2001) scales that I employ are established, validated scales.

Inclusion of a survey provided additional practical benefits. Some people are more comfortable being asked about their actions and beliefs in written form. Indeed, several subjects that refused the open interview were willing to complete the survey. Surveys can be more efficient, making the overall interview experience shorter and less burdensome for the subjects. And, the survey adds some redundancy to the data collection process. Regardless of how deeply each topic was covered in an open interview, the survey covers basic questions in each topic category in a consistent manner. This also allows me to evaluate potential inconsistencies in beliefs. Finally, the survey produces a type of data that is more easily replicated for the purpose of comparing Berkeley's owners to other populations or to themselves at a different point in time.

1.D – Significance and Contributions

Individual adjustment to earthquake hazards has been a topic of academic attention since at least the 1970s. Still, the literature remains thin in many ways. Despite our escalating exposure to earthquake threats, the total number of studies about preparedness and mitigation behaviors is modest. A 2000 review article found just 23 relevant books and peer-reviewed articles (Lindell and Perry 2000) and only a handful have been published since (Lindell and Prater 2002; Whitney, Lindell et al. 2004; Celsi, Wolfinbarger et al. 2005; Nguyen, Shen et al.

2006; Spittal, Walkey et al. 2006). The approaches used have been idiosyncratic, resulting in limited consistency in terms of the populations, variables, and constructs studied. Many past studies focused on narrow constituencies (e.g., university students, single-family homeowners) or geographies (e.g., southern California) and therefore the findings are of limited general applicability. Overall, the processes through which households, investors, firms and communities make decisions about hazard adjustment have not been comprehensively described.

As the literature review of Chapter 2 demonstrates, there is no satisfying unified theory for describing, much less predicting or judging, decision processes and behavior in this context. Subjective Expected Utility Theory (SEUT) continues to be the dominant normative paradigm despite evidence that it does not describe well how people actually decide (Kunreuther 1978; Kunreuther and Pauly 2004). Many relevant but competing social cognitive theories exist, but rarely are they tested with empirical data or applied to field settings.

This research addresses gaps in the existing literature and contributes to contemporary policy developments in the following ways. First, this study focuses on a seldom studied population – multi-unit residential property owners – rather than a convenience sample (e.g., college students) or a random sample of the general population of single-family homeowners. I found only one group of researchers in New Zealand that have done interviews with private property owners specifically (Egbelakin, Wilkinson et al. 2011; Egbelakin, Wilkinson et al. 2011). Owners of residential rental property are making decisions related to *other peoples*' safety, which is of acute social importance, while previous studies focus on self-protective behaviors.

Secondly, I integrate alternative theories from different disciplines (i.e., economics and psychology) to form hypotheses about the adoption of hazard adjustments. Specifically, this is one of the first studies to explore the influence of individual characteristics and social cognitions related to earthquake risk and mitigation options, not just "factual" beliefs (i.e., knowledge and perceptions about the earthquake threat and the costs and benefits of mitigation).

Third, because I analyze a policy intervention that resulted in diverse behavioral responses, this research addresses changes in actual behavior not just behavioral intentions. Exclusive focus on *intentions* is a major limitation in past studies of protective health behaviors. I was able to compare and verify survey report data with independent behavioral observations. Two additional strengths of the research design, described further detail in Chapter 3, are my efforts to identify and study a "control" group and to use a mixed of qualitative and quantitative measures.

Overall, this research looks from a fresh angle at the long-standing concern that both individuals and communities are under-investing in mitigation and pre-disaster preparedness. By exploring how a policy was able to influence some people to mitigate, I can provide the people most in a position to influence mitigation action-taking (e.g., local policymakers, planners, seismic engineers, contractors, bankers, current and prospective tenants) with useful information about the decision processes employed by the people who are in the position to decide whether or not to mitigate and how a change in social context can influence those processes.

This study is also important for the contribution it makes to the applied policy issue of how to design cost-effective tools for public intervention and social change more broadly.

Government practitioners and issue advocates need evidence about when, where, and how to use the various tools of public education, information campaigns, disclosure requirements, fee waivers, tax rebates, subsidized loans, and grants – either separately or in combination – to promote social welfare goals. The results of the present study thus have relevance beyond the issue of earthquakes. Similar dilemmas about how to influence private behaviors that affect community wellbeing are encountered in countless other public problems in the domain of health and safety (e.g., driving, bicycle and pedestrian behavior, the use of sunscreen, or green home cleaning products) and outside it (e.g., energy efficiency in buildings, saving for retirement, or volunteering and charity giving).

Limitations

Scientific investigations often raise more questions than they answer, and this study is no exception. The generation of new ideas that can be tested in future studies is a contribution in itself. The most important limitation is the small sample size; 43 subjects are too few to have sufficient power to detect effect size differences among the large number of important categories and groupings that divide up the target population. Also, in the quantitative survey, so many measures were used that I further decrease the power to detect meaningful differences among the various difference statistics.

Because the study is retrospective and observational, I am unable to make causal inferences regarding the relative influence of risk perceptions and economic, social and personality factors being studied. The study depends on individual recollections, self-awareness, candidness, and ability to articulate motivations in what may be a politically- and emotionally- charged setting, which is a tall demand. The stories I heard in retrospect naturally deviate from how things actually occurred.

Regarding the qualitative studies, I was the sole researcher recruiting subjects and conducting the interviews. Although I followed a detailed interview guide, the questions asked and the framing, order, and terminologies used often varied through the course of the interviewer-subject interaction. I was also the sole researcher developing and assigning codes to the transcripts so there is no independent test of the reliability of the codes that were applied. Despite my best efforts to document key decisions, steps taken, and trade-offs made during the qualitative analysis, building a coding set and code hierarchy is inherently a subjective process. Additionally, all the quantitative data derived from the qualitative interviews and the city's administrative data had to be hand-entered, creating the potential for researcher-induced errors.

Finally, because this study addresses an exceptional law at an exceptional time in an exceptional city, the findings are specific to Berkeley and do not directly generalize to other settings. However, this study does add an important data point and overall weight to the growing belief that social cognitions are absolutely central to motivating the public to take action about earthquakes (Kano, Wood et al. 2008; Solberg, Rossetto et al. 2010; Lindell and Perry forthcoming; Wood, Mileti et al. forthcoming). Because the physical world provides us with almost no useful information (and even misleading information) about the timing and probably consequences to ourselves of earthquake hazards, people rely on their social environment to provide evidence and cues. Most individuals, even if they are convinced that

the threat of earthquakes is quite real, may not invest in mitigation until they see others in their own community or social network do so.

Thus, rather than communicating to the public as individuals, intervention strategists would be wise to focus on (also) changing the social environment in ways that promote mitigation, such as making mitigation behavior more visible and publicly rewarding those who take socially-desirable steps. I return to this point and make more detailed recommendations in the final chapter, but some example approaches could include: developing positive labeling and/or evaluation and disclosure policies that make mitigation choices more transparent and its potential outcomes easier to understand; passing laws that clarify the rights and responsibilities of various stakeholders with regard to seismic safety; and "hero lists" that allow property owners to claim credit for the mitigation investments they make.

CHAPTER 2 – APPLIED LITERATURE REVIEW

This chapter reviews previous theory and evidence in several major topic areas that underlie and inform this research. I first review a suite of theories and modeling approaches to behavior and behavior change, primarily drawing from economics and health psychology. I then survey the existing empirical literature to set the context and establish the baseline level of knowledge about earthquake policy and behavior. In doing so, I find an absence of clear guidance for policymakers and advocates about how to influence property owners to take action about earthquake risk. Finally, I tie together these literatures to build a unified conceptual framework that serves as the architecture for the study design.

2.A – An Economic Representation of the Soft-Story Problem

Despite the up-front cost and long term payoff, seismic strengthening of a soft-story building can be a net-beneficial private investment. To demonstrate this, I offer an example calculation. Earthquake mitigation decisionmaking can be formally portrayed using subjective expected utility theory (SEUT) (von Neumann and Morgenstern 1944; Savage 1954). In SEUT, an individual has a utility function (a mapping or set of weights that translate different outcome states into relative improvements in overall well-being) and their own subjective set of probabilities over all possible outcome states. Under this theory, a rational, risk neutral utility-maximizing decision maker would purchase mitigation up until the point where the expected present value of those investments (i.e., the change in the probability of loss multiplied by the value of the loss, discounted to present value terms) exceeds the cost of the investment.

To illustrate, imagine a property owner considering whether to invest in mitigation that will reduce the potential negative consequences from a future earthquake. To keep the analysis simple, assume the owner does not have access to insurance coverage for earthquakes. Let p be the *annual* probability of a large earthquake of specified magnitude or greater occurring. Also for tractability, assume that earthquake occurrences follow a Poisson distribution. This implies the probability is constant in time and fully determined by the long-term rate of occurrence of the rupture source. Let q be the probability that a soft-story property will suffer a total loss conditional on that magnitude or greater event.

The replacement value of the property is given by V. Next, assume a loss reduction measure costing M dollars that will be partially effective against losses in the earthquake event under consideration. Thus, if the owner spends M, the possible damage from an earthquake is reduced to $L(M)$, where $V = L(0) > L(M) > 0$. One useful and simple approach to the loss function is to use a discrete damage factor, DF, for each mitigation state being considered. DF is the loss amount expressed as a fraction (ranging from 0 to 1) of the total replacement value of a property, so $L(M) = DF \cdot V$. The loss function $L(\cdot)$ is assumed to be concave, implying that the marginal benefit of mitigation decreases as M increases.

Finally, the time-value of money is reflected by the discount rate, d, and T is the expected time period of ownership under consideration in years. Time is particularly relevant in earthquake decisionmaking because the costs of mitigation occur up front but most (if not all) of the benefits will accrue at some unknown time in the future (and are therefore worth less in present value terms). Also, different owners (or a bank or investor that holds a property's

mortgage) might consider different time horizons depending on how long it is until a property will be sold. In general, the longer the term and/or the lower *d* is, the more attractive will be mitigation.

Using these assumptions and definitions, the expected present value, *EPV,* associated with investing mitigation *M* is given by:

$$\text{Expected Present Value}_{\text{Mitigation}} = \sum_{t=1}^{T} \text{p} \cdot \text{q} \cdot \text{L(M)}(1-\text{d})^{\text{t}} \qquad \textbf{(1)}$$

Again, the implication from Equation 1 is that for mitigation to be worthwhile, the expected present value after mitigation should exceed the cost, or $EPV_{Mitigation} - M > 0$. Note that increases in either *p* or *q* will increase the incentive to mitigate.

Figure 4 outlines some plausible values for these parameters for a hypothetical 7,500 square foot, 8-unit Bay Area soft-story property estimated to have a replacement value of $330 per square foot.[4] Under these assumptions, the expected present value of the mitigation investment after 30 years is $120,392, which well exceeds the $100,000 cost. This mitigation investment of $12,500 per unit for this building pays off in year 21.

The outcome is sensitive to the annual earthquake probability, the conditional probability of failure, the replacement cost of the property, and the damage factor assumed with and without mitigation. Mitigation pays off up to a damage factor of 0.58, all else held the same.

[4] Seismic Probabilities: The probability of exceeding a certain level of ground shaking in a locality is typically calculated using the Probabilistic Seismic Hazard Analysis, or PSHA. PSHA begins by modeling earthquake occurrence as a Poisson process, i.e. the probability of the next event is independent of the time of the previous event.

Building Response: The San Francisco Community Action Plan for Seismic Safety (CAPSS) recently released a detailed study to date of the potential technical solutions to soft-story buildings and their potential costs (ATC, 2009). The technical appendix of their report discusses scenario retrofits for four building prototypes, finding that a seismic retrofit would cost between $50,000 and $130,000 per building, or $6,000 to $30,000 per housing unit (apartment or condominium). Additionally, these values do not include residential content value, which is commonly estimated by insurers to be about 40% of total replacement cost. In general, the retrofits reduce the expected damage by up to half, though at very high levels of shaking the benefit of a retrofit may be reduced.

Parameter	*Value*	*Description and Source(s)*
p	0.033	The *annual* probability of a Bay Area earthquake of magnitude 6.7 or greater in the next 30 years.[5]
q	0.2	The probability of total property loss (DF=1) conditional on a magnitude 6.7 local event.
M	$100,000	The estimated cost of installing steel moment frames and additional shear supports for a prototypical 3-story eight unit building.
L(0)=V	$2,475,000	The expected loss (DF=1) in a magnitude 6.7 local event based on a replacement cost of $330 per square foot for a 7,500 sq. ft. property.
L(M)	$1,237,500	The expected loss (DF=0.5) conditional on mitigation in a magnitude 6.7 local event.
d	0.05	The assumed discount rate.
T	30	The assumed period of ownership in years.
EPV	$120,392	$= \sum_{t=1}^{T}(0.0065) \cdot (1237500)(0.95)^{t}$

Figure 4. Table of assumed parameters for an example calculation of the expected present value of a soft-story retrofit.

This manner of representing the decision problem yields a conservative estimate of the benefits of soft-story mitigation for a number of reasons. From the hazard perspective, it does not include all possible events and magnitudes of ground shaking or ancillary hazards such as liquefaction or fire-following earthquake. I acknowledge that the Poisson process assumption is a strong one. In reality, strain accumulates over time and is relieved in an earthquake event (Lombardi and Marzocchi 2007). The multiple independent events model is an approximation to a hazard function (which is more complicated to calculate and use), but the same building cannot collapse more than once.

From the benefits perspective, it does not consider any benefits that accrue primarily to building occupants (e.g., injuries or contents damage avoided, temporary housing or relocation costs avoided) or to the broader community (e.g., less need for emergency shelter for earthquake victims using public dollars, reduced risk of post-event neighborhood blight, and lessened economic disruption). Furthermore, a landlord that retrofits may be less likely to be sued for negligence regarding any injuries or tenant property damages experienced, and that benefit is not considered here. Also, I used a fixed replacement value for all years, even though property values and replacement costs probably increase over time.

The list of assumptions and simplifications made here is obviously long. Buildings are subjected to multiple earthquakes with different shaking intensities over their lifespan. Their physical strength may deteriorate over time as the materials age or if there is improper maintenance, or improve as renovations are made. Site effects can magnify or reduce regional probability estimates. The actual benefits of mitigation measures in terms of loss reduction in

[5] I converted the 30-year magnitude 6.7 or greater event probability to an independent event annual probability using the formula: $1-(1-p)^{1/30}$. The 30-year event probability is referenced from: Field, E. H., T. E. Dawson, et al. (2008). The Uniform California Earthquake Rupture Forecast, Version 2. Menlo Park, CA, US Geological Survey Working Group on California Earthquake Probabilities**:** 104.

any given quake are both inherently uncertain and unknowable. However, it is useful to see that the net benefits of soft-story mitigation are positive under a range of plausible values.

If Mitigation is Net Beneficial, Why So Little of It?

Numerous theories exist to explain why so few people take preventative actions to protect themselves and their properties from earthquake hazards. The causes include, in the language of economics, both lack of demand and reluctance to supply. No single explanation is sufficient because a large range of issues are involved and intertwined.

Let us first consider the demand side of the market. In the US, tenants/leasers and property buyers/owners appear to have little to no willingness to pay for earthquake safety. Optimists might suggest that people are efficiently sorting themselves out in terms of where they live and what actions they are taking according to their tastes, values, and risk tolerances. Indeed, in the absence of public outrage, we should cautiously assess whether the revealed preference for inaction truly represents a market failure or even a public problem (May 1991). It may be the case that some individuals and businesses want to be better prepared for earthquakes but are simply budget- or credit- constrained. However, wherever cost-effective mitigation opportunities are going ignored, insufficient resources alone cannot account for why rates of mitigation uptake are so low.

Classical economists have suggested that a variety of market failures and cognitive obstacles are involved. (Millman and Roberts 1985) put forth five broad arguments as to why inaction on the part of the public about earthquakes may not be well-informed and may be a serious enough public concern to justify government intervention. Their list included:

1. Bounded rationality, information asymmetries, and uncertainty;
2. Heuristics and biases in the processing of available earthquake information;
3. Public goods and collective action problems;
4. Other divergences between private and social marginal costs; and
5. Moral hazard, in light of the prevailing opinion that post-disaster relief should not, and expectation that it will not, be made contingent on pre-disaster behavior[6].

Of the many stories that can be told about why people do not mitigate, attention has most often been paid to ignorance, lack of awareness, or knowledge deficiencies. According to this notion, people are making decisions about mitigation without sufficient information or with inaccurate beliefs about the earthquake threats they face and about the available mitigation actions steps and their relative costs and effectiveness. At least two studies have demonstrated individuals' limited knowledge of available mitigation steps, insurance availability, and coverage terms, as well as inaccurate beliefs about mitigation costs and effectiveness (Kunreuther 1978; Lindell and Perry 2000). Admittedly, it is difficult to ascertain whether existing ignorance is inadvertent ("*Wow, I had no idea!*") or conscious and willful ("*I understand that an earthquake might affect me and that I know little about either the consequences or solutions, but I choose not to search for more information or take recommended actions.*")

[6] Note: Since the Disaster Management Act of 2000, federal policy at the community-level has somewhat altered this stance, making receipt of post-disaster aid conditional on the community having in place a prior disaster mitigation plan. However, it is unlikely that the average citizen is aware of or would be affected by that.

From a technical standpoint, earthquakes pose a threat about which humans cannot nor ever will possess perfect information. The complexities of earthquake occurrence have proven accurate prediction to be unattainable in the foreseeable future. The precise responses of the built environment and the socio-economic systems operating within and shaping it to any given earthquake at any given time are similarly impossible to forecast.

Layered on top of that, individuals face multiple perceptual barriers in learning what can be known about how earthquakes might affect them. Catastrophic earthquakes are rare and caused by unseen, complex, and difficult to conceptualize processes. In general, infrequent events tend to be less familiar, and people may lack memories or imagery to associate with the potential outcomes. The threat of *major* earthquake consequences may seem particularly remote (in space and time), abstract, and uncertain. The absence of frequent, significant focusing events may contribute to lack of salience, low thought intrusiveness (few external cues), and a sense that the threat is ambiguous and difficult to evaluate. Mitigation benefits may be conceptualized as "losses not experienced," which are also difficult to conceptualize, much less estimate, claim credit for, or place value on in market transactions. Finally, the overall complexity of the mitigation decision problem should not be understated. Even professionals in the field of emergency response and risk management have difficulty assessing the cost-effectiveness of alternative earthquake mitigation strategies (Gupta and Shah 1998).

A wide variety of decision heuristics and biases, a wide variety of decision heuristics and biases also affect earthquake mitigation decisions at both the individual and organizational levels (May 2004). First, earthquake-related choices are made in precisely the conditions in which people tend to employ heuristics such as the over-confidence, normalcy, and optimistic biases, which may contribute to a "failure to personalize" or chronically underestimate the threat. In other words, people often believe "*that could never happen to me*", unless they have been injured personally in the past (Helweg-Larsen 1999). Second, if the benefits of continuing present behavior are far easier to evaluate than the benefits of changing behavior (Hsee 1996), *evaluability* of the benefits might be used as a proxy for the levels of benefit themselves. Third, the types of information gaps discussed above may serve as signals that in one way or another facilitate fatalism, ignoring, and denial. For instance, the inability of scientists to predict the exact location and timing of "the next big one" offers the kind of wiggle room our associative minds might find hard to resist. Or, when people do not see other people they know mitigating their properties, they might take it as "social proof" that mitigation is not necessary, effective, or affordable. Finally, once completed, mitigation actions tend to be invisible, which works against the potential for new norm establishment or social influence processes as well as market valuation of any new safety or loss reduction benefits.

Another well-studied type of judgment bias that might affect earthquake mitigation behavior is systematic distortions in how people make decisions about low probability high consequence (LPHC) gambles. Studies show people exhibit inaccurate perceptions about LPHC events (Camerer and Kunreuther 1989). The literature on LPHC decisionmaking contains several studies that directly address earthquake-related behaviors. In the most thorough empirical study on this topic to date, Kunreuther et al. (1978) found that SEUT did not describe actual earthquake insurance purchasing behavior, given existing terms and individuals' self-reported probability and outcome beliefs. Interestingly, observed deviations from normative SEUT predictions went in both directions: to maximize utility, 20 percent of the uninsured should

insure and 40 percent of insured should not have insured. Researchers have shown that SEUT also does not fit how people tend to make choices regarding low probability/high consequence gambles or insurance in general (see, e.g., (Camerer and Kunreuther 1989; Hogarth and Kunreuther 1989)).

A third potential source of judgmental distortion is temporal abstraction and delayed consequences. Earthquake preparedness and mitigation commonly involve upfront costs but the benefits are delayed and uncertain. Many of the standard explanations for short-term thinking (also, *myopia*) apply. The more weight a decisionmaker places on short term consequences, the more mitigation looks like a bad investment. Models of present-biased preferences can be used to explain why people might procrastinate on actions that people would genuinely prefer to take (O'Donoghue and Rabin 1999; O'Donoghue and Rabin 2001). Temporal dynamics may also be a factor in how little attention elected officials seem to pay to pre-disaster mitigation policy if they perceive little or no opportunities to claim credit prior to the next election.

Even if none of the above informational or judgmental phenomena are occurring, private behavior towards earthquakes would still be a legitimate public concern. (May 1991) classifies earthquakes as a "public" risk because many earthquake mitigation actions (e.g., the seismic safety of roads and bridges) are public goods that tend to be underprovided through traditional market behavior even when participants in the market are fully rational. Divergence between private and social marginal costs (externalities), free-riding, and collective action problems are also evident. And, these problems are unlikely to be resolved within the standard political process because earthquakes are experienced by dispersed individuals, not by a unified interest or identity group that would have other natural reasons for organizing to argue for or to exert political pressure on leaders to act. Potential remedies also involve collective action issues and moral hazard problems. For instance, it is widely believed that the expectation of after-the-fact disaster relief deters optimal private preparedness.

In sum, existing data suggests that people rarely invest in structural mitigation and in theory they might be irrational in failing to do so.

2.B – Theoretical Foundations for Behavior and Decision Research

This research focuses on a law that was somehow successful in influencing a fraction of property owners to *change* their mitigation choice from *not doing* to *doing*. Consequently, I proceed now to explore theories that relate to the affirmative angle of what actually motivates preventative behaviors and behavior change in general. This puts the research squarely in the behavior change literature which is closely linked to Social-Cognitive Theory (SCT).

Theories of Health Protective Behavior

SCT is distinguished from the economic approach in the view that not all behavior is the result of conscious and deliberate "choice". SCT carves out a role for biological determinants as well as context-specific "meta-beliefs" such as perceived self-efficacy and beliefs about the recommended behavior. Figure 5 outlines several leading general-purpose theories of health

protective behavior (HPB) and behavior change from health psychology, categorized by whether or not the theory explicitly relates to earthquake safety behaviors.

The relevant theory base includes the Theory of Planned Behavior (Fishbein and Ajzen 1975; Ajzen 1991) and the Transtheoretical Model (Prochaska, DiClemente et al. 1992; Prochaska and Velicer 1997), as well as their numerous applied precautionary behavior theory progeny, such as the Precaution Adoption Process Model (Weinstein 1988; Weinstein and Sandman 1992; Weinstein, Lyon et al. 1998), the Protective Action Decision Model (Lindell and Perry 1992; Lindell and Perry 2000; Lindell and Perry forthcoming), and Protective Motivation Theory (Rogers 1983; Mulilis and Lippa 1990; Rogers and Prentice-Dunn 1997).

Various subsets of these theories have been reviewed and compared with regard to their mathematical form and testability (Weinstein 1993), their relevance to designing persuasive communications in disaster management (Mulilis 1998) and disaster preparedness (Tierney, Lindell et al. 1998; Wood, Kano et al. 2008), and their treatments of social cognitive influences (Armitage and Conner 2000). The review by Armitage and Conner usefully distinguishes HPB theories into three types: *motivational* (focusing on assessment of the threat and the development of motivation to do something about it), *behavior enaction* (focusing on bridging the gap between motivations/intentions and action), and *multi-stage theories* (describing an overarching suite and sequencing of processes) (Armitage and Conner 2000).

Health Protective Behavior (HPB)Theories	
General Purpose	***Earthquake-Specific***
• Hierarchy of Needs • Theory of Reasoned Action (TRA) • Theory of Planned Behavior (TPB) • Health Belief Model (HBM) • Transtheoretical Model TTM) • Precaution Adoption Process Model (PAPM) • Common Sense/Extended Parallel Process Model (CSM/EPPM) • Cognitive Social Health Information Processing Model (C-SHIP) • Terror Management Theory (TMT)	• Person-Relative-to-Event Model (PRE) • Protective Action Decision Model (PADM) • Protection Motivation Theory (PMT)

Figure 5. List of psychological theories related to protective behavior and behavior change.

General Purpose Theories

No HPB theory to date has been able to deliver in one package all of the many features a policy researcher or practitioner might desire, such as: parsimony; the ability to distinguish and consistently predict behavior and intentions to act; falsifiability/testability; easily-, validly- and reliably- measured constructs; generalizability across different behaviors and risk settings;

and utility for informing intervention design when observed behaviors are not deemed to be in the individual or in society's best interest.

Most HPB theories can be represented as formal mathematical models, even when equations are not featured in the original publications. The left-hand variable is typically dichotomous (zero/one) – i.e., someone either takes a specified action to protect themselves from a harm (something harmful already occurring) or a threat (something harmful that might occur) or not – but the implicit goal is to *describe the factors* that determine the *likelihood* (probability) of the action being taken (Weinstein 1988). This framing is an often necessary but significant simplification of real world conditions where protective choices involve a range of behavior options, durations, and contingencies.

Abraham Maslow developed Hierarchy of Needs Theory (HNT) through studies of exceptionally healthy and high achieving people (Maslow 1943). HNT's relevance to my topic comes from his attempt to describe a holistic description of what motivates behavior, and the suggestion that certain types of self-care oriented behaviors might take priority over others. HNT would predict that earthquake preparedness activities that relate to basic security and safety should take precedence over social concerns, self-esteem, and pleasure-seeking activities. In practice, this did not appear to be the case with most health protective behaviors, so theorists looked for other ways to conceptualize behavior change processes.

TRA, the Theory of Reasoned Action (later extended into the Theory of Planned Behavior or TPB) was among the first to suggest that people move through stages on their way to behavior change (Fishbein and Ajzen 1975). TRA is closely linked to Social Cognitive Theory (SCT, which suggests that people learn primarily by observing the behaviors of others and that behavior is highly variable and contextual as the joint-product of situation and personal factors) (Bandura 1977). The two core concepts emphasized in TPB are *self-efficacy* – a person's beliefs about their ability to control or make desired outcomes come about, and *response efficacy* – a person's beliefs about the utility of undertaking the recommended coping response (Bandura 2001). These constructs help operationalize two theories as to why intentions are not always translated into action: a lack of belief in the appropriateness, effectiveness or usefulness of the recommended action and a lack of belief in one's own ability to carry it out. TPB is among the most tested and effectively applied theories in the HPB field. A review of 87 published applications of TPB to health behaviors found it to account for 41 percent of variation in behavior intentions (R = 0 .64, N = 76 correlations) and 34 percent of variation in actual behavior (R = 0.58, N = 35 correlations) (Godin and Kok 1996).

Thanks to the influence of TRA/TPB, two previously neglected facets of health protective behavior now seem entirely obvious and critical: *beliefs* about the threats and the behaviors matter (i.e., not just "facts"), and that includes individual appraisals of the *social implications* of current and prospective behavior (namely, beliefs about the relative approval/camaraderie or disapproval/rejection one might face from peers based on the behavior selected). These ideas imply that action-taking may correlate more with beliefs *about the actions* than beliefs about the impetus for the action. And, beliefs underlying attitudes and behavior must be adequately understood in order to design persuasive information campaigns capable of resulting in behavior change.

In the Health Belief Model (HBM), first proposed by G. Hochbaum in the 1950s, then applied and updated by numerous others (see in particular: (Janz and Becker 1984)), behavior

change is operationalized through four basic constructs: *perceived susceptibility* to a threat, *perceived severity* of the threat, *perceived benefits* of a recommended counter-action, and *perceived barriers* to taking the counter-action. These variables, together with a person's *readiness (motivation) to act* if and when *cues to act* become salient, determine behavior. HBM is a relatively parsimonious model, which contributed to its use in hundreds of studies on a wide range of health-related behaviors. However, critics note that HBM is more a catalog of variables than a model of how those variables interact to produce a behavioral effect (Weinstein 1993; Armitage and Conner 2000; Floyd, Prentice-Dunn et al. 2000).

In Neil Weinstein's 1988 review article, the author proposed five sequential stages that together constitute the *precaution adoption process model*, or PAPM. He listed a variety of diagnostic belief statements and potential determinants for each stage, but did not propose any formal equations to describe how the constructs combine to determine movement through the stages (Weinstein 1988). Figure 6 summarizes the PAPM framework as originally proposed. Weinstein and colleagues later revised and added details to the model when applying it to a field experiment for home radon testing (Weinstein and Sandman 1992; Weinstein, Lyon et al. 1998). Despite its sophistication, their approach remains surprisingly underutilized (and often un-cited) in other HPB publications.

	Stage 1 AWARENESS	Stage 2 SIGNIFICANCE TO OTHERS	Stage 3 SIGNIFICANCE TO SELF	Stage 4 INTENTION TO ACT	Stage 5 ACTION TAKEN
Example Diagnostic Belief Statement	"I have heard of the radon problem."	"Radon is a problem for quite a few people."	"There is a real chance that I could have a radon problem in my home."	"I plan to ventilate my home to reduce the radon level."	"I have added ventilation to reduce the radon level."
Example Counter-Indicating Belief Statement	"I have not heard of the radon problem."	"The number of people who have a radon problem is negligible."	"There isn't much of a chance that I have a radon problem in my home."	"I do not plan to ventilate my home to reduce the radon level."	"I haven't added extra ventilation."
POTENTIAL DETERMINANTS	• communications about hazard • personal experience with hazard • *know someone who's experienced hazard*	• credibility/clarity of communications regarding prevalence • personal experience with hazard • *know someone who's experienced hazard*	• risk and susceptibility factor information relative to self • personalized risk information • personal experience with hazard • information about peers' status on risk factors	*Beliefs about seriousness of threat:* • personal severity & susceptibility • salience of short- vs. long-term threat aspects • behavior of others and communications implying seriousness • personal capacity to act, resources	*Factors determining strength of intentions (all Stage 4 items plus…)* • complexity of precaution • ease of obtaining information required to carry out • time, effort, and resources required by precaution • time until hazard noticeably fades/disappears • opportunities that decrease costs of action • reminders of threat • reminders to take precaution

Figure 6. A multi-stage framework for explaining the precaution adoption process, with example references to the problem of radon gas. Adapted from: Weinstein (1988).

The Transtheoretical Model (TTM) constitutes the other major attempt to combine concepts from other leading theories, although it is firmly grounded in the authors' own clinical experiences in treating addictive behaviors. TTM emphasizes two "transtheoretical" concepts (hence the name): stages of change (the "*when*") and the processes that cause movement between stages (the "*how*") (Prochaska, DiClemente et al. 1992; Prochaska and Velicer 1997). People are hypothesized to move both forward and backward along a continuum from pre-contemplation, contemplation, and preparation to action and finally to action and maintenance, "spiraling" over time towards the ideal behavior. Time-related intentions signal what stage a person is in (e.g., contemplation is defined as someone considering making a change in the next six months but hasn't yet made plans or taken any actions; a person is in the preparation stage when an intention to act within a month is formed and some planning behaviors are initiated). The authors provide no formal justification for why they chose the cut-offs they did. Debate also continues as to whether stages of behavior change can be appropriately expressed in discrete categories, but the general idea is that discrete shifts along a continuum are measurable and that this adds considerable depth to our understanding of health behaviors.

Regarding the many different processes that contribute to stage-change, TTM theorists have used factor analyses from data collected in a large number of studies and settings (mostly of addictive behaviors such as smoking) to suggest at least ten distinct processes that are named and described in Figure 7.

Processes of Health Behavior Change	***Description***	***Intervention Most Effective at Stage…***
Consciousness Raising	Increasing information about self and problem	Pre-Contemplation
Dramatic Relief	Experiencing and expressing feelings about one's problems and solutions	Pre-Contemplation
Environmental Reevaluation	Assessing how one's problem affects physical environment	Pre-Contemplation
Self-Reevaluation	Assessing how one feels and thinks about oneself with respect to a problem	Contemplation
Self-Liberation	Choosing and commitment to act or belief in ability to change	Preparation
Counter-Conditioning	Substituting alternative behaviors	Action/Maintenance
Stimulus Control	Avoiding or countering stimuli that promote the old behavior	Action/Maintenance
Reinforcement Management	Rewarding one's self or being rewarded by others for making changes	Action/Maintenance
Helping Relationships	Being open and trusting about problems with someone who cares	Action/Maintenance
Social Liberation	Increasing alternatives for non-problem behaviors available in society	Maintenance

Figure 7. Ten behavior stage-change processes in the Transtheoretical Model, primarily isolated from factor analyses of studies of smoking cessation.
Source: (Prochaska, DiClemente et al. 1992).

Earthquake-Specific Theories

Most of the theories just discussed originated from studies of repeat behaviors (e.g., diet & exercise, protected sex, sun screen use, smoking) which tend to involve small nuisance costs per "choice" and either uptake of a new behavior or cessation of a bad habit. That may be relevant for some earthquake preparedness actions such as practicing a family evacuation drill or refreshing stockpiles of emergency provisions, but maybe less so for one-time procedures like retrofitting a building that can involve large up front stakes that play out over a long time horizon.

In this section, I summarize three health psychology theories that have been directly applied to earthquake preparedness behaviors. I first describe Protective Motivation Theory, or PMT – a general purpose health protective behavior theory later adapted by the original authors and others into an explanatory model for why people might undertake various earthquake preparedness actions (Rogers 1983; Mulilis and Lippa 1990; Rogers and Prentice-Dunn 1997). The other two theories – the Person-relative-to-Event model, PrE, (Mulilis and Duval 1995) and the Protective Action Decision Model (PADM) (Lindell and Perry 1992; Lindell and Perry 2000; Lindell and Perry forthcoming) – were proposed as extensions of previous theories to the specific context of explaining earthquake preparedness behaviors.

PMT is rooted in the social-cognitive tradition and the notion that what people "hear" goes through additional filters of perception before they finally "choose" what to "think" or "do". According to PMT, sources of information, both environmental and intrapersonal, are evaluated and mediated by an individual's impressions about the probability of the threat and its severity (a threat-appraisal process) and their own self-efficacy and the effectiveness of recommended coping responses (a coping-appraisal process) that together produce an individual's level of protective motivation. Motivation produces behavior change *unless* it is outweighed by the attractiveness of maladaptive coping behaviors. PMT essentially describes behavior as the outcome of a kind of contest between maladaptive and adaptive coping responses: the behavior that rates the highest "wins".

PMT was originally intended as a way to describe how negative threat (fear) appeals might influence health attitudes and behavior (Rogers 1983). (Floyd, Prentice-Dunn et al. 2000) conducted a meta-analysis of 65 peer-reviewed PMT studies, limiting their sample to health topics (by excluding applications like injury-prevention, environmental concerns, and protection of others). Their review found considerable support for the ability of the constructs in the theory to predict *intentions to act*: all mean effect sizes (*d*-statistic, (Cohen 1977)) were in the moderate range and statistically significant. However, the link to actual behavior is seldom investigated, and with equivocal results.

(Mulilis and Lippa 1990) are among the few authors who have attempted a randomized experimental field test of PMT. The topic was low-cost earthquake preparedness behaviors among single-family homeowners in a small California town. Their major finding was that treatment "essays" manipulating each of the four constructs separately did influence intentions to act measured immediately after the treatment. The effects dissipated, however, by five weeks later when actual behavior change was measured. A major unresolved issue in the PMT literature is the manner in which the four cognitive processes combine: is it a multiplicative, additive, sub-additive or other type of mathematical relationship?

(Mulilis and Duval 1995) therefore proposed a "new" theory, the Person-relative-to-Event model, or PrE, to try to resolve confusions within PMT regarding how levels and mixtures of perceptions about the self (person) and the event (the threat) combine or interact to stimulate intentions and behavior. Mulilis and Duval drew upon the research of E.S. Lazarus regarding emotions and adaptation (Lazarus 1991) to develop ideas about how changes in PMT variables might predict the degree to which a person engages in problem-focused coping (PFC) as opposed to emotional coping (EC) responses. An implication of PrE from a policy point of view is that the goal should be to design interventions that raise an individual's appraisal of their capacity to address the threat because this frees people to focus effort on executing recommended problem-solving responses, rather than on regulating (i.e., suppressing or cognitive reappraisal of) anxious emotions related to the threat and how to deal with it.

(Mulilis and Duval 1995) made at least two other useful points. First, the combinatorial process among health psychology variables will likely be contingent on whether the behavior being studied involves stopping a harmful behavior or initiating a protective one. These cases differ importantly in the accessibility or ease of assessing potentially harmful consequences. For a harm-reducing behavior like stopping smoking, there are likely to be clear physiological symptoms and immediate feedback. For earthquakes and other threat-protective behaviors, the potential for physical change to the body remains an abstract construct, and thus the psychological barriers to action tend to be greater. Also, the authors found that behavior change was better predicted when an individual's sense of personal responsibility for responding or preparing was considered.

The Protective Action Decision Model (PADM) is a contemporary, complementary model to the PMT/PrE tradition. PADM is a stage-focused model formulated by (Lindell and Perry 1992; Lindell and Perry 2000; Lindell and Perry forthcoming) to describe the transition of a persons from threat awareness/perception (triggered by social, observed or experiential cues) to conducting a low cost search for appropriate solutions (that will not unnecessarily disrupt usual routines) to a decision to act or not based on their assessment. It was originally formulated to explain evacuation behavior in response to warnings. The stage aspect of PADM is not as well-developed and thus has not been tested. PADM theorists hypothesize that the efficacy of prescribed coping responses is evaluated along two dimensions: hazard-related and resource-related. Specifically, (Lindell and Whitney 2000) proposed a list of eight measurable attributes – three related to the efficacy/hazard (efficacy in protecting persons, efficacy in protecting property, and suitability for other purposes) and five to related inconvenience, costs, difficulty and resources required (costing a lot of money, requiring specialized knowledge and skill, requiring a lot of time, requiring a lot of effort, and requiring a lot of cooperation from others) – that contribute to the overall perception of a given hazard adjustment action. Actions are likely to be taken when they are rated low on resource-related attributes and high on hazard-related attributes (Lindell and Prater 2002). This is consistent with intuition and with the notion that people do use some kind of rough cost-benefit calculus to decide or rationalize about what preparedness action opportunities they do or don't intend to take. In a recent revision to the theory, the authors added "stakeholder perceptions" as a third core belief to bring in issues of perceived trust and responsibility (Lindell and Perry forthcoming).

Social-Cognitive Insights for Studying the Influences on Mitigation Behavior

HBP theories contain many insights that are important to understanding and influencing earthquake mitigation behavior. The first lesson is that policy researchers would be wise view current behavior as a firmly fixed status quo, and that it will be difficult to get people to *change* their tacit mitigation choices. This may be especially true for earthquakes, because the threats they pose to individuals are not at all obvious and the behaviors involved in lessening those threats can be complex, costly and involve multiple decision points and time-consuming action steps. Another way to say this is that earthquake hazards rarely produce *symptoms*. Images of how the hazard could impact the individual are not mentally accessible. The health part of the threat is relatively abstract in that there is seldom any observable change in the environment to attract an individual's attention to the problem other than the occasional minor earthquake event.

In the specific case of the Berkeley law, the threat is not even necessarily related to health or bodily protection because mitigation would affect *other people's* safety rather than the decisionmaker's. However, the liability, social and financial threats related to owning a building that is publicly known to be hazardous are quite personal. These situational nuances are not well-addressed in past HPB research. These facts make mitigation behavior a particularly interesting domain in which to apply test and apply general HPB theories; therefore, mitigation advocates and behavior researchers may be able to learn useful things by deeply considering the Berkeley case.

Structural mitigation for earthquakes is also atypical in that it only needs to be "done" once. One-time behaviors may be less difficult to influence via policies than someone's ongoing diet or exercise routines which involve the "full cycle" of initiation, follow-through, and maintenance behaviors. It transforms a property into a new condition which will remains "permanent" until the next major renovation or quake. However, it involves large perceptual and financial barriers and its abstract, remote, and uncertain benefits. The nature of the threat and the recommended action suggest that many intermediate decisions have to be made, like whether and when to "buy" personalized risk information and how to respond to any new information received.

These features add additional layers to the challenge of explaining and predicting behavior that are not well-addressed in models that relate to commonly understood hazards. As Weinstein and colleagues note (Weinstein and Sandman 1992), it seems particularly important with natural and environmental hazards to consider the possibility that some people are totally unaware of the potential relevance of the problem *to themselves.* To be blunt, we can each be experts at low cost with regard to whether or not we are fat or whether we are or are not a smoker. Not so with earthquake hazards. As with many other environmental (e.g., radon gas, lead exposure) and health threats (e.g., cardiac disease, diabetes), even experts cannot just "inform" someone about how at risk they are without a screening or diagnostic assessment that could be costly and that might involve additional behavioral considerations and barriers (e.g., insurance status, fear of public disclosure). Of course, all diagnostic tests involve trade-offs between false positives and false negative results that can make the information difficult to interpret and apply, but seismic risk assessments involve long chains of assumptions and predictions that even experts view as highly complex and uncertain.

Earthquake decisions surely invoke *as much or more* potential for confusion and systematically biased interpretation.

These points help explain an important piece of folk-wisdom from the field of disaster communications that blanket (non-targeted, non-specific) recommendations don't work (Mileti, Nathe et al. 2004). Behavior change interventions related to disasters must first be aimed not at the entire population, but at individuals who already perceive they are at risk or are differentially-susceptible, or can be made to believe that they are or will be. Once the immutable characteristics of the target population are understood and taken into account, interventions can then be matched to the behavior stage of the target audience because certain change processes work best or are most relevant at different stages of change. The Berkeley law did well to target a specific at-risk audience, but officials at the time did not have access to detailed knowledge about the stages of behavior related to earthquake mitigation, nor the general traits, knowledge, skills and beliefs among that audience.

Does this line of thinking imply anything about what type of communication content is most effective? An emphasis on fact-based or cognitive interventions could be justified by appealing to the complexity of the earthquake mitigation decision problem (Weinstein 1988). However, the HPB literature has not yet addressed the possibility that emotions and heuristics might be given even *more* weight in decision problems which are complex, ambiguous and uncertain.

All of the HPB theories portray behavior as the consequence of reliably and validly *measurable* phenomena and constructs. And, many of them can be *externally influenced,* though admittedly to different degrees and sometimes only in contingent ways. In other words, people are not mere prisoners of their personality traits and past experience, and there is plenty of room for using policies to influence socially-desired behaviors.

Finally, HPB theories tend to frame behavior change as the co-product of "client" and "intervention" factors. This conceptualization instructively analogizes to my goal of trying to understand why a policy does or does not produce a desired behavioral outcome. *Client factors* include personality traits, past history and experience, demographic and present circumstances and constraints*. Intervention factors* include all the program design and implementation details, both small and large – e.g., from the color and size of the font used on the program brochures to whether and how much of a financial incentive is offered – that can influence the behavioral outcomes of interest, either independently or through interaction with client factors. Ideally, program operators should understand which client factors are immutable (fixed) and which interact with intervention factors to create barriers to or potential for action. This helps foster reasonable expectations as to the degree of behavior change that a program can achieve, and facilitates targeting of resources toward the program features that have the most leverage on the ultimate effectiveness of the intervention. Giving Berkeley officials and other interested parties a clear sense of what the policy *could have* accomplished will help put its *observed* accomplishments in a realistic perspective. Also, even though this study is retrospective, it delivers empirical evidence along these lines that other cities and government agencies can use in designing future approaches to the problem.

Comparison of HPB and SEUT

All the theories just reviewed tend to conceptualize behavioral response to latent dangers in terms of an assessment of relative costs and benefits of either the situation itself or of the salient action options, though each theory varies in the range of cost and benefits considered and the functional form of the assumed relationship.

According to SEUT, individuals facing a choice of what action to take regarding a hazard should compare the expected utilities of each mutually exclusive and exhaustive element in the set of potential actions and select whichever one creates the highest net present value. This requires information on what alternatives are in the action set, beliefs about the probability of occurrence of each specified event, and the costs and benefits of each available action. HPB theories also include these concepts but often with wider breadth and depth. To see the similarities, therefore, one must liberally interpret the terms "cost" and "benefit". In SEUT, hazard severity is typically the total dollar value of all losses that will occur if the threat event is realized, and likelihood is the probability of a person's own exposure to that event. In HPB theories, severity is sometimes interpreted to mean "seriousness", which combines some notion of outcome severity with an assessment of how many other people the threat might affect and the degree of personalization – i.e., how it might affect the actor personally (Weinstein 1988).

Some behaviors are highly influenced by costs or benefits that are not easy to evaluate or price – e.g., because those states or services are not directly traded in markets, for instance, social cognitions such as approval and threat to reputation or internal subjective experiences like freedom from worry. It is hard to see how SEUT can compete with social-cognitive HPB theories in describing *how* and *why* people behave in a certain way for such cases, even if SEUT can approximate *what* people do fairly well in some situations. This helps explain two main critiques on the use of SEUT as a benchmark for analyzing choices. Objections to the use of SEUT as a normative tool arises partly from skepticism that all the things people care about or that influence them can be expressed in even the broadest definitions of costs and benefits that SEUT can accommodate. And, objection to the use of SEUT as a descriptive tool arises from the lack of an obvious way to integrate all of the many biological, physiologic, and social cognitive factors that permeate behavior and decisionmaking.

In contrast to HBP theories, SEUT has far less flexibility to explain why different choices can arise from the same objective circumstances[7] and the many different processes from which behavior change comes about. The only mechanisms available in SEUT for explaining how two similarly-situated individuals can react very differently are the assumptions of subjective probabilities and individual differences in utility functions (the functional form that describes overall subjective well-being as a function of the different attributes or quantities of goods and services being consumed and states experienced). The interaction of circumstances with personality traits, the possible distortionary effects of incidental emotions, and socially-contingent assessments of information are essentially ignored. Whether or not these are reasons why SEUT sometimes doesn't fit observed behavior is an open question. HPB theorists

[7] I use the term *objective* here to distinguish how decision circumstances as characterized by a technical professional might differ from subjective expectancies and perceived psychological costs.

have devoted considerably more effort than economists to describing the potentially diverse influences of social cognitions on health behaviors. Their theories list a large universe of cognitions about four general targets – the self, the social setting, the threat, and the coping response. However, the social-cognitive approach is sometimes executed with frustratingly inadequate specificity about the exact constructs, how they can be measured in practice, and how they relate to each other and to the behavior outcomes (Armitage and Conner 2000).

Upon close inspection, surface distinctions between the economic and psychological approaches to behavior change tend to fade, but not disappear. As (Weinstein 1993) pointed out in his seminal article comparing four approaches to modeling health behavior change – HBM, TRA, SEUT, and PMT – there are many substantive similarities and overlap in terms of the constructs used and overall set-up. I therefore begin by highlighting similarities.

Figures 8 and 9 extend the comparison of the principal parameters begun by Weinstein (1993) with regard to just four theories, showing that many of the constructs are quite similar if not identical. When preparing these tables, I noted that the constructs could be placed into four major groupings: perceptions about the hazard or risk setting, beliefs about the recommended action, beliefs about the social setting, and individual differences. I will return to this point later in the section on Individual Adjustment to Earthquakes, where I identified a similar pattern in the evidence regarding actual preparedness and the effectiveness of risk communication and mitigation policy efforts.

			Leading Theories Related to Health Protective Behaviors										
	Construct Names & Description	***Sub-Constructs (if applicable)***	**SEUT**	**TRA/ TPB**	**HBM**	**PAP M**	**TTM**	**CSM/ EPP M**	**C-SHIP**	**TMT**	**PrE**	**PADM**	**PMT**
RISK Constructs	perceived severity/consequences for self (SELFSEV)		X	X	X	X	X	X	X	-	X	X	X
	perceived severity, seriousness of threat in general (SERIOUS)					X				-			
	disease identity (DISIDENT)							X		-			
	knowledge of susceptibility factors (KNOWSUSC)					X	X			-	X		
	knowledge of hazard (KNOWHAZ)						X			-			
	perceived personal likelihood (PROB)		X	X	X	X	X	X	X	-	X	X	X
RECOMMENDED ACTION Constructs	perceived benefits of new action/response efficacy (EFFECT)	efficacy in protecting property (PROP)	X	X	X	X	X	X	X	-	X	X	X
		efficacy in protecting persons (PEOP)		0		X				-		X	
		suitability for other purposes (USEFUL)		0	X		X			-		X	
	perceived barriers to new action (DIFFICULT)	direct monetary cost (COST)	X	X	X	X	X	X	X	-	X	X	x
		specialized knowledge requirements (SKILL)		0		X				-		X	
		time required (TIME)		0		X				-		X	
		difficulty/high effort required (EFFORT)		0						-		X	
		cooperation required (COOP)		0			X			-		X	X
		ease of obtaining info to carry out (EASE)		0		X	X			-	X		

Figure 8. Risk and Recommended Action constructs used in leading theoretical approaches to health protective behaviors.
Note: (X) *indicates inclusion in the standard model,*(0) *indicates possible inclusion, and* (-) *indicates not applicable.*

Construct		Sub-Construct (If Appropriate)	*Leading Theories Related to Health Protective Behaviors*										
			SEUT	**TRA/ TPB**	**HBM**	**PAP M**	**TTM**	**CSM/ EPP M**	**C-SHIP**	**TMT**	**PrE**	**PADM**	**PMT**
SOCIAL SETTING Constructs	know someone affected by hazard (OTHEREXP)						X			-			
	benefits of complying with normative beliefs (NB)	e.g., external rewards	X	X			X			-			X
	confirmatory cues (CUES) and/or cues to action	e.g., total #, frequency			X	X	X			-		X	
	importance placed on complying w/norms), α			X						-			
INDIVIDUAL DIFFERENCE Constructs	intend to take protective motivation (INTEND)			X	X	X	X			-			X
	decisional balance, action inclination (FAVOR)						X			-			
	self-efficacy re: coping behavior (SELFEFF)			X		X	X			-	X		X
	mortality salience (MS)									X			
	internal rewards of current behavior (IR)	e.g., self-identity (IDENT)	X				X			-			X
	affective response to threat (NEGEMO)							X	X	-	X		
	related goals and values (GOALVAL)						X		X	-			
	self-regulatory competencies (SELFREG)						X	X	X	-	X		
	hazard intrusiveness (INTRUS)							X		-			
	past experience with the hazard (PERSEXP)				X					-			
	personal responsibility for preparing (PERRESP)					X	X			-	X		
Interac-tion Terms	EFFECT * SELFEFF			X						-			X
	α *NB			X						-			
	PERSSEV*EFFECT									-			X
	SELFSEV * PROB		X	X						-			

Figure 9. Individual Difference and Social Setting constructs used in leading theoretical approaches to health protective behaviors.

2.C – Earthquake Hazard Policy and Behavior: Context, Assessment, and Evidence

Earthquake Policy at the Federal, State and Local Levels

Public policy about disasters is naturally divided into activities typically undertaken before (i.e., harm prevention through pre-adaptation, mitigation, and adjustment), during (i.e., emergency response, search & rescue, immediate coping responses), and after an event (i.e., longer-term management of the recovery process). Actions in all of these of phases contribute to the overall community goal of *resilience* – the capacity to be effectively protected from, respond quickly to, and recover as completely as possible in the long-term from future disasters. From a societal point of view, the need for an appropriate (if not optimal) mix of anticipatory actions on the one hand and response and recovery actions on the other is acknowledged but rarely confronted directly through policy making, incentive structures, or institutional designs.[8] Government policies and structures at all levels – federal, states, counties, special districts and cities – affect local vulnerability and recovery, but they generally do it in implicit, disjointed ways (May 1991; Bostrom, Turaga et al. 2006).

Regarding *pre*-disaster policy in the US, the federal role is primarily to fund scientific investigations of the hazard and to offer broad oversight of general preparedness activities. The National Earthquake Hazard Reduction Act of 1977 established a unified program among the various national agencies with a stake in earthquake safety. States and local jurisdictions handle land use planning, building codes and the bulk of emergency response planning and capacity-building activities.

The primary preventative strategy for earthquakes is to use zoning and building codes to establish a minimum level of seismic safety; these local laws dictate where new construction can occur, how dense it can be, appropriate building materials and design for different types of structures, and allowable uses. Codes and plans are continually revised, so a given area at a given moment always contains a mix of buildings that meet various past standards. Since the 1970s, earthquake prone states like California mandate city and county planning departments to address seismic safety in their general plans. The strength of local seismic planning programs is not well-explained by the level of hazard or vulnerability. (May 1991) showed that local jurisdictions can be classified as either leaders or laggards with respect to implementation of seismic safety provisions.

Even the best seismic design practices and building codes cannot reduce post-quake injuries and property damage unless they are followed when the building is constructed. Devastating events in several nations with modern building codes – for example, Chile and Italy in 2010, and New Zealand and Japan in 2011 – are potent reminders of this fact. The effectiveness of building code systems depends on professional practice (i.e., a mix of training requirements, licensing, exams, and self-monitoring among engineers, architects, and contractors) and market mechanisms (e.g., competition and the value of maintaining a good reputation in contexts where repeat business matters), backed up by a common law system and tort liability.

[8] For example, the bulk of FEMA's budget relates to coordinating disaster response and relief efforts but the agency also is responsible for operating several mitigation planning and grant programs.

Two glaring policy gaps remain. The first is how to prioritize and motivate appropriate retrofitting – the renovation up to current standards of buildings built under codes now considered antiquated and insufficiently safe. In most cases, existing buildings are not required to conform to new, stricter standards unless and until substantial improvements are made. State and local governments have in rare instances mandated, directly funded, or encouraged retrofit actions (i.e., through tax credits or subsidy incentives). Case reports of mitigation success stories at the state and local level tell us that mitigation does occur and can change the vulnerability of those communities (May and Birkland 1994; CSSC 1999). A prominent success story is the case of Un-Reinforced Masonry (URM) buildings in California. A second policy gap is how to estimate and ameliorate the "soft" losses and economic disruption caused by catastrophic earthquakes that go beyond damage to structures and contents and immediate injuries and loss of life.

What these issues have in common are ambiguities about what an acceptable level of risk is and how to allocate responsibility for doing retroactive safety upgrading and other preparedness activities. A paradigm shift is occurring in the field of seismic engineering away from a focus on code-compliance towards attainment of negotiated levels of desired societal consequences. Two new lines of thinking on this matter are performance-based earthquake engineering (PBEE) and consequences-based engineering (CBE), which takes a broader, socio-technical systems perspective (Bostrom, Turaga et al. 2006). PBEE does not address the responsibility question, and CBE addresses it only partially. What share of costs should be paid by the property owner whose building conformed to code when it was built or when they bought it but is now considered sub-standard? What should be paid by her tenants, neighbors, and the broader community who will suffer less from a quake because the owner and some of her peers have invested in retrofits? What about process mitigation activities that often "belong" to no one?

During and immediately after an event, fire and police departments provide emergency response and search and rescue, often coordinated at the regional or state level and assisted by non-profit relief agencies like the Red Cross. Relevant non- and quasi-governmental organizations work to treat the wounded, shelter those made homeless, and restore basic transportation and utility services. The federal government can step in, once an official disaster is declared by the President at the request of state governors, according to Stafford Act procedures. Significant resources are then made available in the form of National Guard troops, relief supplies and funds to individuals, largely through small business loans and grants. Under a major amendment in 2000, local communities are required to have in place a FEMA-approved pre-disaster mitigation plan in order to be eligible for Stafford Act grants and programs. These activities gradually transition from a disaster response mode to recovery management.

Individual Adjustment to Earthquake Hazards

Definitions and Examples of Mitigation

I begin my discussion of the mitigation investment choices of individual property owners by defining what I mean by *mitigation*. Conceptually, individuals can "prepare" for earthquakes through *avoidance* (also called averting behavior, i.e., people choosing to live somewhere that

earthquakes are less of a threat), *mitigation* (actions that make injury, damage or loss *less likely*), and *adaptation* (actions to *lessen the severity* of injury or loss, including survival preparedness and insurance). To clarify these distinctions, Figure 10 gives some examples of each types of activity for a single-family homeowner. Admittedly, these three categories are not mutually exclusive (for instance, some of these actions can substitute for each other or accomplish more than one objective at the same time), but the terms are a useful starting point for discussion. Some in the literature used the term "hazard adjustments" to categorize all types of changes made to life as a result of a hazard. Many low-cost, survival oriented preparedness measures like storing extra water and food on-site are by definition only useful once and the preparatory action must be repeated over and over, a clear distinction from one time large decisions like where to live or whether to retrofit.

Avoidance	***Mitigation***	***Adaptation***
• Choose to live somewhere where earthquakes are less likely • Refrain from buying heavy framed wall art or tall furniture	*Project*: • Bolt foundation to frame • Strap water heater to wall or foundation • Hang art with shake-resistant wall hooks *Process:* • Develop a family emergency plan	• Purchase insurance • Do not hang heavy or framed wall art above beds • Keep copies of documents out of state • Learn how to turn gas off

Figure 10. Examples of different types of hazard adjustment actions for an individual property owner.

In this study, I use the term *mitigation* to refer to any action that reduces an expected loss, be it by lessening the probability of loss, its severity, or both. The term hazard adjustment is often used in the literature to cover both preparedness (survival) actions and mitigation. I review the full literature on hazard adjustment behavior (HAB) because studies of structural mitigation behavior are exceptionally rare.

The mitigation options available to any given person are numerous and have been categorized in a number of different ways by different authors. Governmental institutions have produced numerous informative "guides" for dissemination to the public (see, e.g., (ABAG 2003; CSSC 2005; FEMA 2005; USGS 2005; LAFD 2008)). The relevant option set differs, of course, across individuals and time. For a property owner, mitigation opportunities depend on the present state of the property and the owner's current rights, legal obligations, resources, knowledge, and skills. For instance, an owner might have a different capability or motivation to retrofit depending on whether it is an investment or vacation property as opposed to a private residence.

According to the above definition, mitigation includes only measures that are undertaken *prior* to an event. Figure 11 offers a typology and examples of available preparedness actions typically available to a household. Note that some mitigation activities involve a one-time, up-front capital investment (e.g., removing a dangerous chimney structure)

while others involve recurring minor costs, maintenance, or repeat action (e.g., keeping the supply of extra water fresh). Some provide benefits that are inherently private and tradable in markets (e.g., extra food) while others have public (and generally positive) spillover effects (e.g., bracing a water heater can reduce the chance of a fire that could spread to neighboring structures). Recently, experts have also begun to distinguish between *process* and *project* mitigation[9], acknowledging the tremendous time and expense that can be devoted to – and the potential benefits that can be realized from – "soft" efforts to motivate individuals to educate themselves and others and to organize and prepare.[10] Process mitigation is often (but not always) cheaper and sequentially antecedent (by convention) to project mitigation, and can have large multiplier effects.

[9] Process mitigation activities lead to policies, practices, and projects that reduce risk. They include efforts to assess hazards, vulnerability, and risk; conduct planning to identify projects, policies, and practices and set priorities; educate decision-makers and build constituencies and political will; and facilitate the selection, design, funding and construction of projects. Project mitigation activities include measures designed to directly avoid or to reduce damage resulting from disasters including projects to elevate, acquire, and/or relocate buildings, lifelines, and structures threatened by floods; strengthen buildings to resist earthquake or wind forces; and improve drainage and land conditions. Source: NIBS (2002). Parameters for an Independent Study to Assess the Future Benefits of Hazard Mitigation Activities. Washington, D.C., National Institute of Building Sciences, Multihazard Mitigation Council**:** 69.

[10] A contemporary example is the Great Southern California SHAKEOUT, a multi-agency collaboration to involve thousands of people in staging a one-day mock earthquake scenario event. Information is available at: http://www.shakeout.org (Accessed July 18, 2012)

Hazard-Reduction Measures (direct prevention of injury and damages)	*Structural*	bolt foundation to frame
		increase lateral/shear strength
		reinforce soft story openings
		brace or remove masonry chimney
		roofing material is reasonably secured
	Non-Structural	brace water heater
		securing or removal of fragile/heavy/sharp items from high shelves and above beds and sitting areas
		shake-safe wall hangings
		strap down electronics and heavy objects
		removal or extra securing of heavy overhead lighting
		installation of automatic gas shut-off features
		heavy furniture strapped to walls
		cabinet latches, shelf lips
Survival Measures (enabling immediate comfort and communication; safe and effective response and recovery)	*Knowledge/Skills*	family emergency communication plan
		basic first aid skills
	Items	extra non-perishable food
		extra water
		operational flashlight
		first aid kit
		outdoor toilet supplies
		alternate cooking source
		working battery radio
		spare essential medicines
		basic repair and safe clean-up supplies (e.g., adjustable wrench, work gloves, buckets, shovel, duct tape, tarps, dust masks)
		duplicate survival items stored in car and/or at work
		working fire extinguisher

Figure 11. Common earthquake hazard adjustment actions available to property owners.

In general, previous studies in this literature have not consistently adopted standardized question items and constructs or rigorously tested the items used for reliability and validity (Lindell and Perry 2000). Experts have been slow to converge towards a single scale for measuring earthquake preparedness. Some of the earliest studies experimented with open-ended, spontaneous mention formats (e.g., (Jackson 1981; Turner, Nigg et al. 1986)); later studies tend to use Likert-scale items or other forced choice formats. (Mulilis, Duval et al. 1990) prepared a 27 item list of possible earthquake preparedness measures, claiming that these represented "all standard suggestions appearing in earthquake preparedness brochures and books that are specifically and clearly related to earthquake preparedness." The authors also asked respondents to rate the perceived "difficulty" of carrying out each measure on a scale of 1 to 5. More recently, (Spittal, Walkey et al. 2006) created a 23-item scale that includes mostly low but also a few high cost measures and tested it extensively for reliability and validity in a New Zealand town (Spittal, McClure et al. 2008).

A Brief Note about Insurance.

Earthquake insurance is relevant to this research because some people might view it as a partial substitute for mitigation. The function of insurance is to reduce the expected variance of wealth across future potential states; in this way, it is fundamentally different than mitigation because it does nothing to alter probabilities or severities of actual damage or to reduce injuries or deaths during an event. I ask insurance-related questions to try to understand how owners think about it, but I do not treat it directly in any hypotheses or theory-development because the behavior process and outcomes of insurance purchase are distinct.

The State of Knowledge about Who Prepares and Why

Key Studies, Information Sources, and Methodologies Employed.

Historically, a modest amount of data is available regarding what people believe about each type of hazard adjustment action and who undertakes them. The most comprehensive recent review article on earthquake hazard adjustment behavior (HAB) is by (Lindell and Perry 2000), who identified 23 relevant books and peer-reviewed papers. To their sample, I add a handful of studies published since: two papers that discuss a survey contrasting citizen behavior in less versus more policy-proactive towns in Washington state and California (Lindell and Prater 2000; Lindell and Prater 2002), and three studies with southern California university students (Lindell and Whitney 2000; Whitney, Lindell et al. 2004; Nguyen, Shen et al. 2006). There were also some new international studies, including: New Zealand (Spittal, Walkey et al. 2006; Spittal, McClure et al. 2008); Israel (Soffer, Goldberg et al. 2011); and Turkey (Ozdemir and Yilmaz 2011) . The review in (Tierney, Lindell et al. 1998) is also informative but encompasses a much wider literature. Readers will note that I leave aside the substantial literatures on determinants of behavior toward other natural or man-made threats such as wild fires, hurricanes, tornados, floods, tsunami, nuclear power, and terrorism. I do this to limit the overall scope, even though some researchers have found value in comparing across risk topics (see for example (May, Burby et al. 1998), who found potential policy lessons for earthquake mitigation in the cases of energy conservation, radon, and termite control).

Before summarizing the overall findings, I present some general comments about the major studies and methodological approaches that researchers have employed to assess HAB. I organize these comments according to two basic strategies used for studying the determinants and possible causal factors in the decision the take preparedness actions: correlational studies of existing variation and studies that attempt to capitalize on the occurrence of some type of exogenous “shock” or deliberately administered stimulus (e.g., a major earthquake, media event, or risk communication program).

The majority of past studies of the first type are cross-sectional surveys (i.e., 15 out of 23 in Lindell and Perry’s review and 6 of the newer studies). The findings of cross-sectional studies can speak to the state of preparedness only in the studied population (e.g., university students or single-family homeowners) and at that exact time. Thus, depending on the sample design (e.g., representative, purposive or convenience), the findings might be considered more

or less generalizable. A second issue of external validity among past correlational studies is the concentration on California and its southern metropolitan areas in particular.

A limited number of longitudinal surveys have been done with two, four or five waves of survey data collection (Turner, Nigg et al. 1986; Palm and Hodgson 1992; Bourque, Shoaf et al. 1997), a design which can capture aspects of attitude or behavior change over time in the study population. The two panel studies to date carry the added advantage of observing the SAME individuals' beliefs and behaviors at two different times (Mulilis, Duval et al. 1990; Mulilis and Lippa 1990), which permits the researcher to factor out effects of respondent characteristics that are stable over time, and to factor in those that are measurably changed.

Among the studies designed to exploit a new source of variation, the external "shocks" studied range from a recent earthquake event (Mulilis, Duval et al. 1990; Palm and Hodgson 1992; Nguyen, Shen et al. 2006) to the streams of media coverage associated with warnings of aftershocks (Mileti and O'Brien 1992) and of heightened risk or a pending earthquake (Turner, Nigg et al. 1986; Mileti and Fitzpatrick 1992; Mileti and O'Brien 1992; Mileti and Fitzpatrick 1993). The types of deliberate stimuli studied range from controlled laboratory experiments of persuasive messages with university students (Mulilis and Duval 1995; Whitney, Lindell et al. 2004) to field experiments and pre/post-assessments of a new policy intervention or program such as regional hazard preparedness campaigns (Mileti and DeRouen-Darlington 1995; Mileti and Darlington 1997; Karanci, Aksit et al. 2005). One study employed a repeat-measure between-subjects factorial design to test the effect of different formats of a negative threat appeal pamphlet on homeowner HAB (Mulilis and Lippa 1990). Finally, I found two studies that assess land use planning and seismic codes (Berke and Beatley 1992; May and Birkland 1994) and one that evaluated a Los Angeles mandatory retrofit ordinance (Comerio 1992).

Two methodological issues that pervade the earthquake information delivery and persuasion literatures are: (1) the use of belief, attitudes, or intentions to act rather than behavior as the outcome variables, and (2) the reliance on retrospective (often long-term) self-reported behavior, when behavior is addressed. A meta-analysis of experimental studies designed to explore the causal effect of intentions to change on subsequent health behaviors found on average that a medium-to-large effect size relative to intentions ($d = 0.66$) leads to a small-to-medium change in behavior ($d = 0.36$) (Webb and Sheehan 2006). Behavior data can itself be weak if self-reports are not externally verified. Interestingly, there is some evidence that repeatedly assessing preparedness levels may trigger additional action-taking (Mulilis, Duval et al. 1990). If testing itself might motivate preparedness, this would counteract the effect of upward bias in self-reported behavior. However, this cannot resolve the basic logical that correlations weaken and dilute as one moves from considering factors and intentions and intentions and behavior to factors and behavior.

Recently, a new national US data set on disaster preparedness became available through the National Survey of Disaster Experiences and Preparedness (NSDEP), a study designed to document people's experiences with, preparedness and mitigation actions for, and perceptions related to terrorism but natural disasters were also addressed (Kano, Wood et al. 2008; Wood, Kano et al. 2008). With Department of Homeland Security and the National Science Foundation funding, researchers at the UCLA School of Public Health collected the data in late 2007. A national probability sample of 3,300 households, contacted by random-digit dialing, were interviewed over the telephone (using computer assisted telephone interviewing,

or CATI), with over-sampling in Washington, D.C., New York, and Los Angeles and of certain less-represented groups.

The resulting data provides the broadest view ever of contemporary US preparedness beliefs and behavior. In particular, the authors believe the data support a revised approach to risk communication that they term "communicating actionable risk" (Wood, Mileti et al. forthcoming). New preparedness behaviors, they argue, arise from both information observed (watching what others are doing) and information received (recommendations regarding what to do). Communications about *what to do* are important to an individual initiating search and milling behavior in their social environment, whereby the appropriateness of taking the precautionary behavior is then either supported (confirmed) or not. Failure to find support for the behavior recommendation during the social milling process can lead new information to be ignored or discounted, implying that the social environment acts is pivotal to either enhancing or counteracting the effects of the information originally communicated.

Determinants of Behavioral Adjustment to Earthquakes.

Past studies have linked earthquake beliefs and associated behaviors to a number of innate and immutable person-specific variables, primarily socio-economic, demographic, and experiential (Tierney, Lindell et al. 1998). Typical demographic factors measured include: gender; income; education; marital, parental, and immigrant status; race; home ownership; and neighborhood tenure. Demographic characteristics appear to have at most modest and occasionally inconsistent effects, while economic and experiential traits, risk perceptions and perceived adjustment attributes play more prominent roles (Lindell and Perry 2000). I collect some demographic data in this study but mostly for descriptive purposes because such traits may not vary much in the target population. I will address assessment of mitigation benefits in the next section, and proceed here to summarize the major findings within the other categories, which are more readily influenced by policies.

Statistically significant correlations are generally – but not always – found between risk perceptions and HAB (Lindell and Perry 2000). Two possible explanations for this lack of consistency are: (1) poor and inconsistent measurement of risk perception constructs, and (2) failure to account for potential reverse causation in the relationship between risk perceptions and risk-related behaviors (Weinstein and Nicolich 1993). An implication of the latter point is that *past* behavior must be controlled for in studies looking at whether or not risk perception correlates with *new* behavior uptake. Otherwise, the study might mistakenly treat past-action and inaction as equivalent, failing to account for how mitigation action-taking might reduce perceived risk.

A second nearly universal finding in the earthquake belief literature is the tendency of people to ascribe a higher level of threat to their community than they do to themselves (Lindell and Perry 2000). This "failure to personalize" is probably linked to a general tendency for *optimistic bias,* a robustly demonstrated phenomenon in many areas of human judgment and decisionmaking.

What these two findings point out for future studies of HAB is that extreme care must be taken in measuring all the relevant aspects of risk perception. Many authors in the risk field note the inherent difficulty in measuring this concept, even with multiple items, and lament the

generally inconsistent manner in which it is done (see, e.g., (Weinstein and Nicolich 1993; Webler, Rakel et al. 1995)). Risk perception blurs together a person's overall impression of whether a threat is salient or imminent, whether it causes serious problems generally, and how likely various different levels (severities) of consequences are for that individual. Also, when a person answers a risk perception question, is the researcher clear whether the person is responding about consequences that are personal and not regarding the community as whole? And, did the consequences considered include assessments of potential lives lost and injuries, not just financial cost and physical damage? HAB should be better predicted by measures of risk perception that relate to the *self* and that are richly explored through multiple items, including past behavior.

The key findings from the HAB literature about beliefs about mitigation actions are that they *matter* and probably help explain why some mitigation actions are more "popular" than others. This may seem obvious given decades of SCT-inspired health behavior theorizing that emphasized coping response beliefs. Also, early studies identified a high prevalence of ignorance and inaccurate beliefs about adjustment actions and their costs (Kunreuther 1978; Jackson 1981; Palm and Hodgson 1992). Still, some HAB studies neglect to measure these perceptions (Lindell and Perry 2000). Recent studies have made progress in both clarifying and measuring relevant perceptions of mitigation attributes. Actions are likely to be taken when rated low on resource-related (cost) attributes and high on hazard-related (usefulness) attributes (Lindell and Prater 2002). And, different person-specific traits might correlate with the taking of different types of mitigation actions (Spittal, McClure et al. 2008).

Situations and events also influence HAB through both independent processes and through person-situation interactions. At the broadest level, communities differ in level of hazard and policy proactivity, which explains some, but not all, of the variance in their citizens' HAB (Lindell and Whitney 2000; Lindell and Prater 2002). This probably results from a mix of social, hazard proximity, and experiential influences. (Lindell and Prater 2002) surveyed residents of two regions – one subject to high seismic risk and one subject to low seismic risk – to explore beliefs about hazard adjustments, adoption intentions, and actual adoption. They generally found no significant differences in beliefs, intentions, adoption of HABs.

Past experience with earthquakes is generally correlated with preparedness action-taking (Lindell and Perry 2000). But, the net effect of *new* earthquake events on beliefs about the severity of the threat and peoples' motivation and action-taking to prepare for the next event are more ambiguous. One thing people might "learn" from a recent event is that "that wasn't so bad!" (Celsi, Wolfinbarger et al. 2005) or that the government will step in with disaster aid after the fact, which could decrease preparedness behaviors (Comerio 2004). In the absence of any significant damage or impact, personal experiences could increase optimistic bias and lead people to believe that no further protective action is necessary. Additionally, people might reason that the threat is now dissipated ("lightning won't strike the same spot twice"); with earthquakes, there is some scientific justification for this belief (Lombardi and Marzocchi 2007). Finally, immediate salience effects that temporarily increase claims of concern and intentions to act may dissipate before people get a chance to follow through.

On the other hand, a flurry of new personal and policy activities sometimes follows local or distant dramatic events. The idea of an earthquake happening, once abstract and dormant, becomes more salient and intrusive through repeated media coverage and personal

conversations, or what sociologists refer to as *milling* behavior (Wood, Kano et al. 2008). People receive confirmatory messages through the inquiries they make and learn how their choice is likely to be viewed by others. Both private citizens and policy makers alike may act on the perceived need to be seen as responsive and vigilant.

(Dooley and Semner 1992) found that level of concern about the threat increased and this was associated with future preparedness behaviors. (Helweg-Larsen 1999) found that being injured in a quake in the past eliminated optimistic biases in reported risk perceptions.

Part of the confusion about the effect of past experience on preparedness could relate to the difficulty of accounting for selection into and out of the regions of high hazard that are being studied. The evidence from studies of HAB before and after local earthquakes thus provides a stronger methodological strategy (Mulilis, Duval et al. 1990; Palm and Hodgson 1992; Russel, Goltz et al. 1995; Nguyen, Shen et al. 2006). These reports suggest modest, mostly short-term effects, moderated by the actual level of psychological, financial, and social disruption personally experienced. For instance, (Nguyen, Shen et al. 2006) found a positive association between degree of personal injury and post-quake preparedness actions.

A at least one surprising *non*-finding relates to location: HAB is not generally correlated with proximity to fault and level of hazard (Lindell and Perry 2000). This could be due in part to the low salience of disasters in people lives (Tierney, Lindell et al. 1998). An exception is a natural experiment from the establishment of the Alquist-Priola Special Studies Zone Act of 1972 that showed residents in fault zones paid on average about $400 less (in 1980 dollars) for their homes, suggesting at least some incorporation of the idea of fault proximity in the minds of home-purchasers (Brookshire, Thayer et al. 1985).

Studies examining the effects of warnings and public education campaigns show that broadcasting earthquake preparedness information and pleas into the social environmental can modestly affect HAB. Media warnings of an impending quake or a window of heightened risk of aftershocks tend to increase risk perceptions with some modest effects on behavior. Receiving social cues that confirm the message is positively associated with response (Mileti and Fitzpatrick 1992; Mileti and Fitzpatrick 1993), as is the number of environmental cues received (message frequency) (Mileti and O'Brien 1992). The NSDEP found strong confirmation for these principles regarding overall disaster preparedness (Wood, Kano et al. 2008). Field tests of regional hazard preparedness campaigns (Mileti and DeRouen-Darlington 1995; Mileti and Darlington 1997; Karanci, Aksit et al. 2005) added insight by showing that information sources matter, as does trust in the source and the consistency of the information being transmitted.

Laboratory and field experiments have been used to test the impact of persuasive communications delivered to specific individuals. The two laboratory studies that gave a one-shot preparedness messages to students with randomly-assignment found modest effects. (Mulilis and Duval 1995) tested a classic negative threat appeal approach, while (Whitney, Lindell et al. 2004) found significantly higher intentions to act in participants who received a Myths and Facts message format compared to those who received only earthquake Facts.

Studies evaluating the impacts of non-communication policies on earthquake HAB are rare. A few studies assess local land use planning and seismic codes (Berke, Beatley et al. 1989; Berke and Beatley 1992; May and Birkland 1994). (Berke, Beatley et al. 1989) did a survey of randomly-chosen 104 communities in California and 156 communities in 21 other seismically active states to assess action-taking of seven broad types: development regulations, building

standards, planning, property and land acquisition, critical and public facility policies, tax policies, and information dissemination. The Berke et al. study confirmed that California cities do more, largely because local officials have personal experience with earthquakes and the state requires communities to address seismic safety issues in their general plans. May and Birkland (1994) documented a range of policy approaches and their degree of implementation by local governments through a survey of selected cities in Washington and California states. The authors found that the local level of proactivity toward earthquakes was better explained by political and resource circumstances than the level of hazard.

A notable exception to the general paucity of evaluative information about local earthquake policies is California's policy toward URM buildings. In 1986, the state mandated high-hazard localities to inventory and implement a plan to address their stocks of URMs. The California Seismic Safety Commission regularly surveys communities subject to the law to track progress on the roughly 26,000 pre-1933, un-retrofitted URMs originally identified. Jurisdictions were allowed to choose whether to adopt a voluntary or mandatory program, and cities with voluntary programs took longer to make progress and have achieved less progress overall than cities with mandatory programs. However, most California URMs (over 78%) were located in cities that have a mandatory program, and the law is generally considered a success because 70 percent of the owners as of 2006 had either demolished, retrofit, or taken approved measures to reduce the threat (many of these buildings are recognized historic properties) (CSSC 1999; CSSC 2006). Comerio (1992) directly evaluated Los Angeles' URM retrofit ordinance, rather than the general impacts of the state law.

My overall conclusion from these studies is that new information, changed environmental circumstances, and even proximate major earthquake events tend to lead to at most small and short-lived changes in individual beliefs and behavior about earthquakes. In contrast, what few policies that have been tried – particularly new legal mandates as opposed to voluntary programs – have been more effective, although sometimes only briefly and accompanied by unintended, undesired effects as well.

To summarize, Figure 12 organizes a list of factors that previously studies have identified as influences on HAB according to whether the construct could potentially be influenced by a policy or program intervention (left vs. right column).

"INNATE"	*"INFLUENCABLE"*
DEMOGRAPHIC	**SELF-ORIENTED COGNITIONS**
income (+)	activated goals and values (+/-)
education (+)	knowledge of hazard (+)
female (+)	perceived personal risk/susceptibility (+)
property ownership (+)	hazard salience, intrusiveness (+)
being an immigrant (-)	internal rewards for old *vs.* new behavior (+)
being married(+)	affective responses (+/-)
age (+)	perception that the new behavior is consistent with self-identity (+)
being a parent/number of dependents living in household (+)	
PERSONALITY	**PERCEPTIONS OF MITIGATION**
need for control (+)	perceived barriers to mitigation action (-)
emotional stability (+)	perceived efficacy (+)
extroversion (+)	knowledge of coping response options (+)
conscientiousness (+)	self-efficacy to perform the action (+)
high risk taking (-)	
propensity for anger, fear (+)	
PAST EXPERIENCE & BEHAVIORS	**SOCIAL COGNITIONS/SOCIAL NETWORK**
information search about earthquakes (+)	know someone who's retrofit in past (+)
time in residence/length of ownership (+)	moral, injunctive, or descriptive norms (+)
past disaster experience of self or close associates, especially earthquakes (+)	external rewards for old versus new behavior (+)
expected tenure (+)	social support (+)
have earthquake insurance (+)	
	NEW INFORMATION
	trust and credibility of source (+)
	number of channels received (+)
	number of cues received (cue frequency) (+)
	message frame (of both goal and recommended action) **(+**/-)
	message consistency over time (+)

Figure 12. Reported correlates of hazard adjustment behavior.

Principal Sources: Wood et al., 2008; Lindell and Perry, 2000; Lindell and Whitney, 2000; Tierney, 1998.

Building Owners and Organizational-Level Preparedness.

Studies of how small businesses and organizations approach disaster *preparedness* are uncommon, with the possible exception of pre-disaster business continuity planning. Within the existing literature on behavioral adjustment to earthquake threats, a few studies exist of preparedness decisionmaking or behavior in public or private institutions like companies, universities, or non-profits (e.g., (Meszaros 1999; DeVries, Mannen et al. 2000; Sadiq and Weible 2010)). One study, commissioned by the Pacific Earthquake Engineering Research Center at UC Berkeley, layed out a theoretical and normative discussion of organizational decisionmaking in light of the trend towards performance based design (May 2001). Another set of studies out of New Zealand are aimed at creating practical strategies to help organizations become more resilient to crises (McManus, Seville et al. 2008).

Recently, a new study has come out addressing how public hospitals in California responded to a state-wide mandated earthquake preparedness law (Alesch, Arendt et al. 2012). The authors use qualitative methods to document and analyze the struggles of acute care hopsitals and the state agency overseeing the program to implement a state mandate to assess and upgrade hopsital facilities for seismic safety. Their principal finding is that institutional factors, including culture, resource constraints, incentives, and complexity, impeded progress towards the otherwise straightfoward and universally appealing aim of improved seismic safety in hospitals.

Finally, I identified one qualitative study that addresses what building owners think about structural mitigation (Egbelakin, Wilkinson et al. 2011; Egbelakin, Wilkinson et al. 2011). The study involved 35 interviews with New Zealand real estate stakeholders in four communities with different levels of earthquake hazard and policy pro-activity; about 15 of the respondents were building owners. In assessing the barriers to getting building owners to retrofit existing hazardous structures, the authors found that owners fear the cost implications of retrofits (owners equate high seismic performance with high cost) and have low levels of trust in the recommendations of engineers. In regions of low to medium risk, passive governmental approaches to the problem support owner beliefs that earthquakes are not a large problem. In high hazard areas, study participants were highly concerned but skeptical that losses can be mitigated. Also, owners that did retrofits were interested in receiving more recognition for their efforts.

Overall, these studies suggest that organizational preparedness activities, when they do occur, typically involve “soft” measures such as business continuity planning but occasionally also include facilities safety measures such as securing non-structural components (e.g., lighting, shelving, and filing). Obstacles to preparedness in organizations include lack of financial resources, lack of convincing information about the potential impacts of a disaster, lack of information about the likelihood of such disasters, and lack of clear benefit to the organization from the preparedness actions. Additionally, disaster planning in general tends to fall low on organizational priority lists, so managers may have difficulty supporting efforts to address the issue in light of other pressing agenda items.

Personality Differences and Precautionary Behavior

In this section, I briefly try to highlight interesting potential connections among the literatures on personality, health preventive behaviors, gain-loss framing effects, and risk communication. My aim is not to comprehensively survey or summarize, but rather to introduce and justify my decision to investigate the personality traits of building owners in addition to their risk perceptions, earthquake beliefs, and personal backgrounds. This aspect of the research is highly exploratory and may not lead to conclusive results, but for the reasons given below, I felt it could be important to hypothesis generation for future studies.

Precautionary Behaviors and the "Big Five" Personality Traits

Since the 1980s, personality research has converged towards a five-factor model of personality, with the principal dimensions being: Extroversion, Openness, Agreeableness, Emotional Stability, and Conscientiousness (Costa and McCrae 1985; John 2000). These traits (also called the "Big Five") capture broad and enduring dispositions that shape how people respond to the stimuli they encounter in the world—i.e., which behaviors and ideas they find appealing. For instance, Openness is associated with curiosity and a willingness to entertain new ideas.

In turn, these broad personality traits seem to be associated with behaviors—including health behaviors—and systematically so by health behavior domain (Booth-Kewley and Vickers 1994). For example, openness correlates with substance risk taking, neuroticism with traffic risk-taking, conscientiousness with wellness promotion behaviors, and extroversion with accident control behaviors. The two traits that seem most relevant to study of precautionary behaviors are Emotional Stability, which reflects a person's overall poise or emotional fortitude when faced with negative stimuli, and Conscientiousness, which is associated with dutifulness, norm compliance, practicality, achievement, striving, and seeking of instrumental benefits.

Most past studies on the role of personality in health and safety behaviors involve the realms of sexuality, diet, exercise, and addiction (e.g., alcohol or drug dependency and recovery). However, a few recent investigations on earthquake preparedness have found influences on risk perceptions and intentions or behavior of more subtle attitude and personality concepts including: need for control (Whitney, Lindell et al. 2004); extroversion, conscientiousness, and emotional stability (Hampson, Andrews et al. 2006); neuroticism and social network influences (Heller, Alexander et al. 2005); and general risk-taking proclivities (Spittal, McClure et al. 2008). One could imagine dozens of other possible correlates along these lines, such as fatalism, optimism, or world views.

A highly specialized line of previous research in the field of judgment and decisionmaking has addressed the role of personality in "risky choice" generally, namely the tendency of individuals to do risky bad things or behave in a risk-seeking as opposed to risk-averse manner (Blais and Weber 2006; Weber and Johnson 2009). Additionally, an individual may exhibit widely different risk-taking tendencies in different domains of his life, from personal health and safety to finances to social circumstances (Blais and Weber 2006). One bottom line finding is that risk attitudes are probably situation-dependent but informed by

stable personality traits. I therefore decided to include a very short personality inventory scale on my survey to explore the underlying personality traits of owners who may have responded differently to the new risk information and regulatory setting created by the Berkeley law.

Message Framing, Gain-Loss Sensitivity, and Regulatory Focus

Loss aversion, one of the central tenants of Prospect Theory, or PT, (Tversky and Kahneman 1981; Kahneman and Tversky 2000), suggests that behavior patterns might be different when the choice under consideration involves a proactive "gamble over gains" versus a preventative "lottery over losses." People tend to be more risk averse in the former setting and risk seeking in the latter. Furthermore, PT stresses the importance of how a choice is perceived – namely, if people view mitigation as a risky choice over losses, it might explain why fewer people invest in mitigation than SEUT suggests would or should.

This also might matter from a policy intervention design or risk communication perspective. The experimental evidence on gain-loss framing effects literature suggests that message framing can be influential to risk communication and health intervention outcomes (Rothman and Salovey 1997; Salovey and Williams-Piehota 2004). In general, such studies find that loss-framed appeals (emphasizing the downsides of not taking the recommended action) generally elicit greater progress towards target health behaviors that are seen as risky and that relate to screening for and detection of exposure or extant risk. Gain-framed appeals (emphasizing the upsides of taking the recommended action) generally elicit greater progress toward targeted health behaviors that are seen as low-risk and that relate to preventing harm. From here, I found myself wondering whether building owners naturally view earthquake mitigation as a promotion- or prevention- oriented behavior, and found that I could construct a reasonable argument either way.

If property owners think of mitigation as a *preventative* behavior, it would imply that a gain-frame message might be most effective. In contrast, the one study I know of involving message framing and earthquakes found the most effective message frame for motivating earthquake preparedness intentions emphasized avoidance of negative consequences (McClure, White et al. 2009). This could be because structural mitigation typically involves a costly screening step – the precise step that the Berkeley law mandated owners of suspected soft-story properties to take. Once the first critical screening step in any retrofit decision process has been taken, might the "preventative" act of investing in mitigation kick in, making that choice feel less "risky"? Also, the presence of new legal requirements may cause a shift in frame of reference from the aspiration of obtaining the reward to avoiding a penalty.

A quick review of related research into the mechanisms and potential power of message framing showed more nuance and applications since the initial forced choice laboratory experiments of Kahnemann and Tversky. Early on, use of a wide variety of research designs, risk topics, and decision tasks led to a confusing mix of null and positive effect findings (Kuhberger 1998; Latimer, Salovey et al. 2007). More recent studies have focused on potential moderating factors and interactions among features of the message, the recipient, the threat context, and the response behavior being advocated (Levin, Schneider et al. 1998; Levin, Gaeth et al. 2002; O'Keefe and Jensen 2007). For instance, a gain-framed message frame might be more

influential than a loss-framed one only for individuals with low prior awareness of the threat or minimal prior intentions to do anything about it (Detweiler, Bedell et al. 1999).

Furthermore, current theoretical research on message framing is dominated by discussions of the possible roles for degree of "fit" between the message frame and the recipient's general regulatory focus. Regulatory focus theory addresses how people attempt to bring their own situation and goals into alignment. At any given moment, someone is thought to be either interested in a: (a) preventing bad outcomes by doing what they *ought* to do, or (b) promoting desired ones by doing what they could *ideally* do (Higgins 1997). Regulatory focus can be thought of either as a consistent trait (chronic regulatory focus) or as situationally-induced.

Messages that are congruent with the receiver's activated goals and motives carry more influence on behavior intentions, according to studies related to skin cancer detection (Shen and Dillard 2007), dental flossing (Sherman, Mann et al. 2006), and vaccination (Gerend and Shepherd 2007). In other words, a loss-framed message might be more effective than a gain-framed message only among subjects who rate high in avoidance motivations. This literature hinted to me that chronic regulatory focus might be a mechanism and source of population variability related to how people evaluate earthquake risk information and risk reduction opportunities. Hence, I decided to include the Regulatory Focus Questionnaire in the survey as well.

2.D – An Integrated Conceptual Framework

Out of this broad literature review, I created Figure 13 to organize the ideas covered in this chapter – primarily drawing from Figures 8 and 9 (the aggregated lists of behavior theory constructs) and Figure 12 in the empirical section (the list of known correlates of preparedness behavior). The boxes represent four broad influence factors that emerged from the literature review and my own critical thinking about the issue. The questions in between highlight interactions I then used this diagram as the broad conceptual basis for the study design presented in the next chapter.

The shaded, left hand side represents what could be called a "traditional" approach to conceptualizing decisionmaking, which (not coincidentally) parallels the "traditional" approach to communicating about risk. My review of the literature review demonstrated that both are deficiencient as stand-alone guides for understanding and influencing earthquake-related behaviors. Economic theories of choice emphasize the probabilities of easily-monetized consequences with and without mitigation; however, such theories do not track well with peoples' understandings of earthquake risk, nor do they predict well how people behave in response to them. In a similar vein, traditional risk communication efforts have focused on informing individuals about the negative consequences of failing to take the recommended actions. Such "negative threat appeals" have been generally ineffective at convincing people of the problem, much less motivating behavior change. Risk perceptions and perceptions of the recommended action are both important to peoples' cognitive assessment of the situation, but as the literature shows, they are not typically sufficient to get people to decide to act and to follow-through on those intentions.

I place the individual, organizational, and social aspects of behavior on the right hand side. Social-cognitive theories emphasize that human beings rely heavily on their social environment for information and guidance regarding which threats to pay attention to and what, if anything, to do about them. My review of disaster preparedness studies clearly established the importance of social context. When we're uncertain about how to act, we look for clues—first from our own emotions, experiences, and senses. But especially in decision arenas like earthquakes those sources of information are basically absent or even misleading, we've evolved to take the generally wise shortcuts of relying on signals from our social environment. In other words, we are likely to do what we see our family, peers, and competitors doing, and sometimes also what authorities and experts think we ought to do.

The importance of social context could explain why public policies tend to outperform educational programs and even earthquake events in terms of motivating earthquake preparedness actions. Also, perceptions of the social environment and interactions with it that favor mitigation are among the best predictors of disaster preparedness intentions and behavior, along with demographic and personal background factors.

My review also hints at an important but poorly understood role for individual personality and experience. Another possible source in formulating beliefs and making choices about earthquakes is our own *intuitive, instinctual* judgment. Overall, no single theory, no isolated factor or two are capable of representing earthquake mitigation decisionmaking and the pathways through which it can be influenced. To study mitigation behavior through the lense of only one or two of these factors would be too narrow of a view and inevitably exclude important aspects. Also, the *interrelationships* between the individual, the action, the threat, and the social setting are evidently vital but poorly understood.

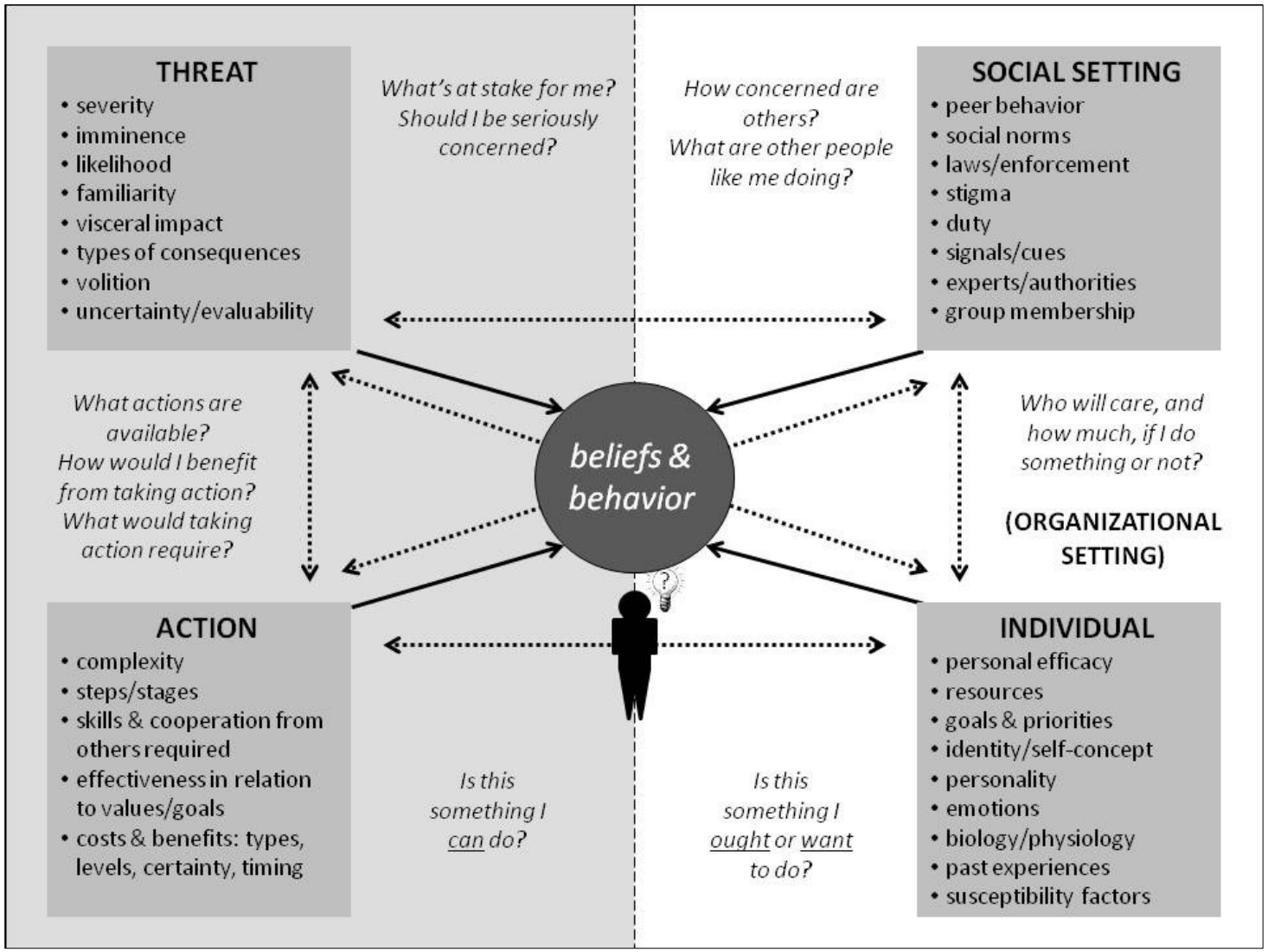

Figure 13. Diagram depicting four types of influences on earthquake-related beliefs, behavior, and decisionmaking, derived from the author's review of both theory and empirical evidence.

CHAPTER 3 – RESEARCH CONTEXT, AIMS, DESIGN & METHODS

This chapter presents my overall research strategy and methods for documenting and assessing the BSSO case. I use this policy case as a window into how property owners and managers approach thinking and deciding about mitigation, thereby illuminating the processes through which educational, labeling, warning, and disclosure programs can influence the beliefs and behaviors of market participants. Also, by reconstructing how this recent local earthquake safety policy came about, this research expands our understanding of policy entrepreneurship and policy implementation at the local level.

3.A – Research Questions and Hypotheses

<u>Research Questions and Approach</u>

The research questions that drive this study fall into two general categories: descriptive and exploratory/evaluative. My analytical approach to this policy case can further be broken up into different elements based on the units of analysis and types of research question. Figure 14 shows some of the key research questions according to that typology. I note the chapter in which each question is addressed in parentheses.

The retrospective nature of the data and the small, non-random sample of study participants mean that at most, this research will be able to suggest possible explanatory factors or causal mechanisms that might warrant future study. For the most part, I do not conduct statistical inference tests for correlation, association, and differences in mean values, because the amount of data I was able to collect does not support their use. Also, because of the large number of measures being investigated, some of those tests would pass statistical significance test simply out of chance alone.

Unit of Analysis	*Research Questions by Type, With Examples*	
	Descriptive	***Exploratory/Evaluative***
Berkeley's Soft-Story Law and Program	• Who were the key persons involved in advocating for, designing, & implementing the law? (4) • What do these persons believe are the goals and strengths of the law? (4) • What key events, decisions, or turning points happened in developing the policy? (4) • What steps & activities were involved in implementing the law? (4, 7)	• What factors inspired & enabled the City of Berkeley to focus on this problem? (4) • How did proponents develop the overall approach? (4, 7) • What challenges were encountered & how were they overcome or not? (4, 7) • How could the policy be improved or implemented more smoothly in future or by other municipalities? (7, 8) • Did the policy achieve its goals? (8) • Was the regulatory approach reasonable compared to other possible alternatives? (8)
Affected Buildings	• What is the compliance & retrofit status of the properties? (3, 5) • What are the characteristics (e.g., number of units, year built, date of last sale) of affected properties by retrofit status? (5)	• What kinds of obstacles (e.g., confusion over engineering standards, cost, administrative delays) did owners encounter in doing retrofit projects? (7)
Affected Owner Entities	• What are the characteristics (e.g., ownership structure, age, education, profession) of affected owners by retrofit status? (5) • What attitudes do owners express about earthquake risk & mitigation? (6) • What do owners believe about the hazards facing their properties? (6) • What did owners do and experience during key steps in the compliance process (finding an engineer, filing their report)? (6, 7)	• What evidence is there that the policy did or did not *alter* owner beliefs about mitigation or contribute to retrofits that would not have occurred but for the law? (6) • Why did some owners pursue retrofits when they didn't have to? (6) • What barriers to retrofitting do owners perceive? (6) • What do owners think about the law? (7, 8)

Figure 14. Diagram of the study's main research questions by question type and unit of analysis.

Note: The chapters in which each question is addressed are shown in parentheses.

Outcome Measures

The belief and behavior aspect of this study focuses on the outcome of structural mitigation to remedy a soft-story condition. Hereafter, this is what I am referring to when I use the terms *retrofit or seismic upgrade*. I consider this a "terminal" state in that once a building is

retrofitted, it cannot revert to a previous state. However, completing a retrofit is achieved through multiple action steps or stages that occur over time. For tractability, I treat structural mitigation status as a dichotomous classification. Importantly, I classify retrofitters together with people who have obtained a building permit but have not completed their project, to distinguish them from owners who have not expressed an intention to retrofit or made any specific plans or financial commitments to retrofit beyond what the law required of them.

There is no universally applicable definition of what structural mitigation is or to measure relatively how much of it has been done. In a practical sense, each building – and therefore each retrofit – is unique. Modern engineering practice involves defining a projected "performance level" such as life safety, immediate resumption of occupancy and use, or fully operational (Bostrom, Turaga et al. 2006), but each structural mitigation project is unique and most properties could be structurally improved in a number of different ways. Fortunately, the BSSO specified a specific code of standards to which all retrofits were supposed to be held. I will follow whatever program staff judged as an acceptable degree of seismic upgrade, even though I acknowledge that the standards each building may have been held to could have differed systematically over time or across characteristics that I may or may not be able to identify. The same cannot be said about the pre-law retrofits, which may vary from what would have been considered adequate had those projects been given the same level of scrutiny and review. This should be kept in mind as I draw comparisons between people who initiated retrofits before and after the law.

Finally, the city's official records of both compliance and retrofit status are not necessarily available or up to date with field conditions in any given time snapshot. Regarding compliance behavior, I designed the study based on the entire set of properties originally listed on the Inventory (N=321) using official records of compliance as of April 2009. However, once it became clear how out of date those records were, I constructed my own compliance and retrofit status and timing dependent variables using April 2010 data *with corrections* made from self-reported compliance status at the time the subject was interviewed (N=43). In keeping with BID's official record-keeping practices, I will treat all properties with official pending requests for appeal or removal from the Inventory as being "in-compliance".

Regarding mitigation intentions and behavior, I again report both on the entire set of properties originally listed on the Inventory plus the identified pre-law retrofit set of properties (N=334) using official records of mitigation status at different points in time as specified in the text (either April 2009 or April 2010), and on the self-reported mitigation intentions and status at the time the subject was interviewed (either April through July 2010 or January through February 2011).

Hypotheses for Specific Aim 1: The Policy Development Timeline and Implementation

The policy history aspect of this study is mostly descriptive in nature, so it does not lend itself well to hypotheses-driven analysis. However, where possible, I describe and interpret my findings in light of following theoretical lenses that are sometimes used to explain policy change processes. When trying to understand policy change processes, the key questions usually involve *when, who,* and *how*.

The literatures on policy innovation and diffusion and policy entrepreneurship suggest that government institutions and actors will innovate successfully when a combination of intrinsic organizational or individual characteristics (skills, incentives, and motives) – in interplay with external conditions in their political, economic, and social environments (means and opportunity) – become favorable to such changes (Schneider and Teske 1992; Teske and Schneider 1994; Mintrom 1997). J.W. Kingdon's conceptualization of "Multiple Streams" suggests that moments of major policy transition can be traced to separate developments in the problem, policy, and political "streams" that come together during a window of opportunity. Change happens when these streams coincide or converge, perhaps due to the timely actions of policy entrepreneurs or reform advocates (Kingdon 1995). The Advocacy Coalition Framework, or ACF (Sabatier and Jenkins-Smith 1993), gets into more detail on the "who" and the "how" of policy evolution. ACF suggests that policy change initiates through topic-specific subsystems in the overall political and institutional environment.

Finally, because the facts of this case run counter to a widely held belief that policy change regarding seismic safety only occurs in the period immediately following a major regional earthquake, I also focus my recounting of the policy narrative on why and how interest and policy action on this issue was sustained for a decade or two after the most recent major earthquakes.

Hypotheses for Specific Aim 2: Owner Beliefs and Behaviors

Overall, this study deals with both retrofit status (whether or not someone invested in a retrofit) and timing (whether a retrofit was initiated before the BSSO, after it, or not to date/never). My strategy to understand retrofit motivations in the study population is to compare the qualitative stories and various belief and trait measures of retrofitters to those of the non-retrofitters. Then, by searching for distinctions in the stories of post-law retrofitters compared to pre-law retrofitters, I will investigate *how* the law influenced additional people to take action. And finally, by drawing comparisons between post-law retrofitters and non-retrofitters, I will assess where the law felt short in its aim to motivate voluntary precautionary action. Differences between owners affected by the BSSO that did and did not voluntarily initiate a retrofit may indicate important underlying or moderating factors, areas for implementation improvement, or gaps in the original program theory.

I used the four influence factors identified in Chapter 2 to anchor my decisions about what data and observations to collect to enable these comparisons. To reiterate, the four factors are: perceptions of the threat (RISK), perceptions and past experiences with the recommended action (ACTION), the social setting (SOCIAL), and individual characteristics such as history and demographic and personality traits (INDIV). Admittedly, many factors that I investigate relate to two or more of these factors or interactions between them. Figure 15 shows a list of measures that I expect will associate positively with investment in a retrofit.

Trait or Factor	*As Reflected by the Following Attributes and Measures*
Past experiences with and beliefs about earthquakes (RISK, INDIV)	• Negative past experiences with earthquakes, esp. damage or injury to self or acquaintances • Perceived likelihood and severity of a major nearby earthquake • Perceived likelihood and severity of earthquake outcomes to self • Degree of concern about earthquakes • Have earthquake insurance • Have searched for information about earthquakes in the past
Past experiences with and beliefs about mitigation (ACTION, INDIV)	• Past seismic upgrading to own home, other properties • Favorable attitudes about mitigation effectiveness • Favorable attitudes about mitigation feasibility/self-efficacy • Experience in manual, engineering, or construction trades
Demographic factors (INDIV)	• Age • Level of education • Being a parent/having children living at home • Connectedness to the community (e.g., born nearby, affiliations with UC Berkeley, years living in Bay Area)
Position relative to property (INDIV)	• Dependence on the property for income or retirement • Proximity to the property (e.g., how far away the owner lives) • Real estate or property management experience (profession, # of investment properties owned in total, owner association membership and degree of involvement) • Intentions to own the property a long time
Low emotional stability, high conscientiousness, and high openness (INDIV)	• Emotional stability, conscientiousness, and openness as measured on the Ten-Item Personality Inventory
Promotion-dominant goal-orientation (INDIV)	• Regulatory Focus Questionnaire (RFQ)

Figure 15. Factors addressed in this study that are hypothesized to positively associate with retrofit behavior.

Importantly, people who were affected by the law are in a qualitatively very different position than those who were not affected. So how might motivations differ in the post-law retrofitters? One theory is that all retrofitters are relatively alike and motivated by the same things, but that some (the post-law retrofitters) were simply uninformed previously. To the degree that owners were ignorant of the hazard facing their property prior to the law, the BSSO could have had a purely informative influence. If that is the case, we would expect post-law retrofitters to be very similar to pre-law retrofitters except in their prior knowledge of the hazard and in areas that might relate to why or how pre-law retrofitters became aware of the hazard *on their own*. I expect persons who invested in a retrofit prior to the law's passage to differ *in degree* from those who retrofit after the law on things like their financial stake or personal connection to the property (e.g., having ever lived in it, involvement in past major capital improvements), level of earthquake concern, and neuroticism, conscientiousness, and openness scores.

A second possibility is that the law made retrofitting relatively more attractive, or owners more capable of carrying out a retrofit project, or both. If that is true, we should expect to find differences in the beliefs of owners relating to their own capacity to take action or to the social context affecting their decision of whether to do so. Because I am only speaking to retrofitters after the fact, I will have to listen for evidence that either supports or contradicts the idea that the law enabled owners in their capacity to undertake a mitigation project. Figure 16 shows several social influence topics and measures that I expect to be absent from or receive low emphasis in the narratives of the pre-law retrofitters compared to those of post-law retrofitters.

Trait or Factor	***As Reflected by the Following Attributes and Measures***
Social context (SOCIAL, INDIV)	• Reliance on advice from others about whether to retrofit • Report knowing others who have retrofit a rental property • Concern for liability exposure or potential lawsuits • Concern for tenant recruitment • Concern about perceptions of other owners/potential buyers
Degree of experience and involvement in local property management and real estate (INDIV, SOCIAL)	• Membership in property owner association • Ownership type (e.g., individual, family, business, institution) • # of properties owned on the BSSO Inventory

Figure 16. Social influence factors addressed in this study that might differentiate study participants that retrofit after Berkeley's Soft-Story Ordinance compared to people who retrofit prior to it.

Finally, the vast majority of owners affected by the law did not retrofit, so why might the law have failed to influence them? If non-retrofitters, too, were ignorant of the potential vulnerabilities of their properties prior to the BSSO, then its informative value was evidently not sufficient to get them to take action and neither were the changes in their own perceived circumstances or the social context, if any, that it created. I see at least four possible (but not mutually exclusive) explanations. First, non-retrofitters may simply remain unconvinced of the actual risk. That is especially likely to be true for non-retrofitters that were mistakenly notified about being on the Inventory, but even some owners of verified "soft-story buildings" may believe that the engineering community and city set the hazard threshold too low. Second, non-retrofitters may still be unconvinced of the benefits of doing a retrofit relative to its costs. This could be related to the type of building they own, or to who the owner choose as their engineer, or the experiences they had with their engineer or the program. Third, non-retrofitters may somehow be less able to detect or less influenced by the type of enabling or social context changes, if any, that were brought about by the law. Fourth, there may be some non-retrofitters that intend to do a retrofit but are unable to afford it or actualize a project for other reasons. Therefore, I will look for evidence throughout that either supports or contradict these ideas.

3.B – Study Design, Data Collection, and Analysis Procedures

To address the research aims, this study utilizes three different types of data, often in combination: (1) administrative data and archival documents, (2) qualitative data resulting from a series of semi-structured interviews with two types of subjects – key informants such as BID staff, seismic policy experts, politicians, and engineers and owners, managers, and institutional representatives – and survey data. The survey data I collected as part of the owner and owner representative interviews includes a range of questions types from Likert-type personality scale and opinion items to demographic questions. The interview guides and the survey questionnaire are shown respectively in Appendices A, B, and C. I now discuss each type of data in detail.

Administrative Data

The types of administrative data and archival documentation collected used in this project include:

- Detailed property, business license, tax, and ownership records drawn from publicly available County of Alameda databases; queried by BID staff in 2006 and updated by me in 2009 and 2010 as needed;
- Berkeley City Council meeting agendas and minutes[11];
- City of Berkeley building permit records, queried on my behalf by BID staff in April of 2009;
- Reports to the City Manager and City Council prepared by Building Inspective Division staff;
- Visual presentations materials produced by BID staff that were shown at public meetings[12];
- Texts of relevant local and state regulations and legislative acts;
- Informal program documentation and compliance records provided by BID staff under a data sharing memorandum.

Key Informant Interviews

Key Informant Subject Identification and Recruitment

In total I interviewed 22 key informants. That number was enough to include most of the principal players as well as a few representatives each from of a range of stakeholder groups. I chose a preliminary list of potential participants from the following four categories:

1. Employees of various City of Berkeley departments (e.g., building inspection officials, program staff, City Attorney staff, and Rent Stabilization Board staff)
2. City of Berkeley elected officials (e.g., Mayor, Rent Board Members, Councilmen);

[11] Available online, http://www.ci.berkeley.ca.us/citycouncil/
[12] Available online, http://www.ci.berkeley.ca.us/contentdisplay.aspx?id=622

3. Seismic policy and technical experts from the engineering community who were involved in working for or advising the City of Berkeley on technical or seismic safety issues, including UC Berkeley faculty members and former students who worked as interns while the City was drafting the policy; and
4. Practicing structural engineers from the local community who have done or are doing engineering reports on behalf of affected property owners.

Candidate subjects in Groups 1 through 3 were easily identified from public meeting minutes, public information available on the internet, and from the City of Berkeley staff directory as having been involved in creating the law or in a position to comment on it in some way. Additionally, I asked key individuals to name other people who played key roles in the creation or carrying out of this law, or who would have relevant opinions about Berkeley real estate, politics, structural design or construction, or municipal administration during the relevant time period (1994-2009).

Approximately 70 persons fit in Group 4, as determined from a publicly available list from the City of Berkeley of all engineers who either attended city-held training workshops or filed one or more approved engineering reports pursuant to the law. To select persons to invite for an interview from this group, I contacted four engineers who had done four or more reports. Three out of four engineers I contacted agreed to speak with me. I used input from other interviewees in choosing which experienced engineers to contact to represent the maximum possible range of viewpoints. Thus, it is a purposive, non-random convenience sample. I then contacted four engineers at random from the group of engineers who have filed only one report as of April 2010. I was not able to reach or complete and interview with any of those engineers. There could be any number of reasons for their non-responsiveness, but it would make sense if these engineers felt there was a very low possibility of benefit to them – or even some harm – to participating.

Figure 17 summarizes the key informants I spoke with by type. I obtained the contact information for candidate subjects exclusively from publicly available sources (i.e., public documents, online staff directories, and business websites). Potential interviewees were then contacted via email or phone. I described the purpose of the research and discussed the study procedures, and if the person agreed to participate I arranged the date, time and mode for the interview (over the phone or in-person). Most interviews were done in person at the place of business of the interviewee or at the author's campus office; two interviews were done over the phone because those people now live in another part of the country.

	Invited Interviews	*Completed Interviews*	*Effective Response Rate*
City of Berkeley Employees	8	8	100%
Contractor/Consultants	3	3	100%
Topic Experts	4	4	100%
Elected or Appointed Officials	3	3	100%
Practicing Engineers	8	3	38%
Stakeholder Representatives	2	1	50%
Totals	*28*	*22*	*79%*

Figure 17. Details on key informant interviews for the program history and implementation aspect of the study, as of February 15, 2010.

Content and Conduct of the Interviews

The interviews followed a semi-structured interview guide of 10-15 questions (shown in Appendix B) that covered topics such as the person's professional background, their involvement with the BSSO, and details of the program history and its implementation. I also asked them for their opinions about the ordinance and any recommendations for improving it. I developed the question list to cover the major topics areas necessary for understanding the origins and events that were involved in the law's creation and implementation as well as to document and interpret any obstacles experienced or successes achieved. I organized the questions with the idea of providing a natural, conversation-like, and predominantly chronological flow from the most general and factual to the most specific and interpretive questions. During the interview, I tried to probe deeper when subjects brought up specific events and decisions to elicit specific recollections rather than generalized responses.

The average interview length was 78 minutes (minimum = 43, maximum = 161). Three key individuals were interviewed multiple times in sessions lasting not more than 90 minutes each. All interviews were audio-recorded with permission from the participants. The recruitment and interviewing process took place over about five months, from September 2010 through February 2011.

Owner/Manager/Organization Beliefs and Behaviors: Qualitative Interviews and Survey

The second in-depth data collection effort of this study involved contacting a stratified sample of owners that were affected by the policy and inviting them to an interview consisting of a semi-structured in-depth interview and to complete a survey.

The research design involved the following steps (in approximate sequence):

- random selection of potential subjects from the target population;
- procurement of names, addresses, and phone numbers for those subjects from public information sources;
- recruitment of a sample of subjects using mail, email, and phone contact information;
- semi-structured, audio-taped interviews that include both open-ended verbal and written questionnaire aspects and production of field notes;
- transcription of interview recordings;
- data consolidation, coding and analysis; and,
- writing of summary and interpretive reports.

Target Population

The target population and sampling frame for this part of the project consisted of 334 entities representing two distinct groups:

1. All owners of noticed properties on the City of Berkeley's official Inventory of potentially soft-story residential buildings (N=321), and
2. Owners of all identified *previously* soft-story properties in Berkeley (as determined by a retroactive building permit search conducted in 2007 by BID staff using the terms “seismic” or “earthquake”) that would likely have met the criteria to be listed but were retrofit in the eight years prior to the law (N=13).

For purposes of subject recruitment, I divided the properties listed on the Inventory into four strata along two dimensions: April 2009 compliance status relative to the 2005 law and April 2009 mitigation status. The fifth group consists of the properties that did a retrofit prior to the law. I summarize the desired quota of subjects in each stratum and the assumptions and calculations used to arrive at these numbers in Figure 18.

	Pre-Law Retrofits	Compliers		Non-Compliers	Removed from Inventory or Active Removal Request	Row Totals
		Post-Law Retrofits	Comply Only			
Target Population Totals	13	63	106	98	51	331
Desired Within-Group Response %	35%	20%	10%	10%	10%	
Assumed Contact to Completion Ratio	2	2	3	5	3	
Anticipated Effective Sample Sizes (ESS)	5	13	11	10	5	43
# of Contacts Needed to Achieve ESS	9	25	32	49	15	130

Figure 18. Research design sampling size targets and assumptions.

I chose these target numbers by dividing the planned total number of interviews by the number of groups, and then adjusting to over-sample from the smallest group (so that I could be confident of exploring their full range of beliefs) and under-sample from the stratum I considered least relevant to my specific research questions. I anticipated favorable contact to completion ratios (ranging from 2:1 in the most accessible stratum to 5:1 in the least accessible stratum. My reasoning was that the study topic is highly salient to the target population. This study provides subjects with an opportunity to recollect and share their personal opinions and experiences on a topic that involves significant financial stakes. Most of the target population either took one of the actions being studied within the past two years or have been contacted by BID staff recently about the law's requirements.

For reference, a previous mail-based survey of single family homeowners in Berkeley regarding earthquake retrofits had an overall response rate of 40.8 percent (ABAG 1999). That study used multiple reminders to reach adequate number of owners in each behavior category. Retrofitters tended to be higher educated and higher income persons, and these groups responded disproportionately early and often to the initial contact letter, while lower income and less educated persons who were less likely to be retrofitters responded more in the later waves of contact.

Recruitment and Screening Procedures

I obtained legal owner names, mailing addresses, and building description information for buildings on the Inventory from publicly-available databases maintained by the City of Berkeley Planning Department under a data sharing memorandum. I obtained valid phone numbers for the randomly selected subset of subjects to be contacted for interviews using a combination of Alameda County property databases, on-file City of Berkeley permit application information, Berkeley Rent Stabilization Board records, online reverse directory services, and Yellow Page business listings.

Within each behavior stratum, I constructed a random ordered list of potential subjects[13]. I initiated contact with potential respondents from each strata in that sequence in small batches of four or five (i.e., about 25 owner contacts were initiated in the each of the five rounds)[14]. To encourage participation (which helps maximize the meaningfulness of randomly selecting subjects within each strata), I used a combination of standard techniques including a personalized pre-contact letter and the offer of a token thank you gift as an incentive (a $25 gift card to a local hardware store)[15]. A sample generic recruitment letter and reply postcard are shown in Appendices E and F[16].

Slightly over 20 percent of contacted subjects voluntarily responded to my letter in some fashion, with the postcard being the most common voluntary reply mode. I received a total of 17 return postcards (13 percent of contacted potential subjects), nine of which ultimately led to a completed interview. Figure 19 shows respondent use of the return postcard.

Led to Interview	9
Provided New Owner Info But Did Not Lead to Interview	1
Did Not Lead to Interview	3
Refusals	3
Ineligible	1
Total Return Postcards Received	**17**

Figure 19. Statistics on participation outcomes from return postcards received.

If I did not receive any contact from a potential subject within one or two weeks after the pre-contact letter was mailed, I began a series of telephone contact attempts, all within the course of the next month (generally on weekday mornings or afternoons). During the initial phone contact, I introduced myself and summarized the nature of the study. When necessary, I

[13] Due to a data processing error, the randomization did not take into account that some owners own multiple properties on the list. Therefore, those persons were more likely than others to be selected.

[14] I tried to exhaust the full contact protocol (described elsewhere) with each potential subject before proceeding to send invitations to the next ranked batch in the next round, but some case files were open for about a month if there had been some positive preliminary contact.

[15] Successful "completion" for the purposes of giving out the incentive was defined as participating in either the verbal or written question parts of the interview. This part of the research design was made possible by a grant from the National Science Foundation Award 0962627. For subjects interviewed over the phone, the gift card was sent via U.S. postal service to an address of the subjects' choosing along with their copy of the informed consent document. For in-person interviews, the gift card was sometimes handed to them after the interview and sometime delivered later by U.S. Post. Overall, three subjects refused to take the gift card or asked that I give it to someone else.

[16] The pre-contact letter describes the purpose of the study, invites the subject to participate, and lets the subject know that they will soon be contacted by phone to arrange a mutually convenient interview date and time. I sent the pre-contact letter in an official UC Berkeley emblem envelope with US Postal Service first class postage. These measures were designed reduce the chance of the letter being discarded as "junk mail" or going unread, and also to speed recollection of the letter during subsequent recruitment conversations over the phone. The letter also included a colorful pre-paid reply postcard so that an owner could easily send me their correct name or address, provide an email or phone number, or express a preference as to how they'd like to be contacted.

inquired to be sure that the person reached was a person designated or empowered to make decisions regarding the identified property on Berkeley's soft-story Inventory.

I limited contact attempts to a maximum of four and waited several days in between each to avoid being viewed as a nuisance. Only in cases where affirmative contact had been made did I phone or email with a prospective participant more than four times. If I used an available email address in place of a phone call, I did so just once or twice.

Persons who refused to complete an in-person or phone interview were then offered the options of: A) completing only the online survey portion of the interview or B) responding to a subset of the interview questions on their own time in writing. Two subjects took Option A and one took Option B. As the study progressed, I monitored non-contact, refusal and completion rates by stratum and adjusted the invitation proportions by strata.

Prior to and during their interview sessions, several subjects asked me questions about what I am finding out in the study and about various details regarding the law itself. I offered to answer questions after the entire interview was complete. All subjects were offered the option to receive a summary report after completion of the study and every subject accepted. No subjects reported an interest in receiving a general fact sheet about earthquake preparedness and mitigation information sources.

Content and Conduct of the Interviews

The interviews followed a semi-structured interview guide (shown in Appendices B and C) that covered eight broad areas including the person's entry into real estate ownership, their purchase and subsequent management of the property in question, their general attitudes about earthquakes and mitigation, their specific experiences with the BSSO, their interactions with peers on related issues, and any recommendations they have for how other cities or owners should handle seismic issues. I developed the question list for the interview guide with three main goals in mind:

1. To provide a natural, conversation-like flow from the most general and factual to the most specific and interpretive questions;
2. To deemphasize the law at the beginning of the conversation, so as to discuss background beliefs before discussing issues related to the case in particular;
3. To cover the major topics areas reflected in the research hypotheses, including the perceived costs and benefits of retrofitting or not retrofitting, the owner's social perceptions and potential social influences on the owner's decisions and behaviors related to the law, and various personal circumstances or philosophical beliefs that might be relevant to their compliance and mitigation behaviors.

Three interviews involved a conversation with more than one person – a spouse, a middle school-aged child, and a business partner. Three interviews occurred in public places, such as a coffee shop. Subjects were asked during the consent process whether were willing to have the interview audio digitally recorded. Two subjects refused this, and for those interviews I took written notes. I recorded a paragraph or two of short field notes following each interview and later added to these when coding each particular interview. The average oral interview length was 41 minutes (minimum = 22, maximum = 86).

At the end of the interview, subjects were given the choice to complete the online survey immediately using their own computer (or in some cases the interviewer's laptop), or to receive an email link to the interview so they could complete it later. Figure 20 shows that a majority of subjects chose to do the survey later on their own time. Of the 35 subjects who chose to do the survey at their own convenience, three chose to do it on paper and mailed it back, 21 completed the survey online on the same day, five did it within one day, and the remainder took up to 2 weeks (and received at least one reminder prompt). Two people failed or eventually declined to complete it.

The full text of the paper Retrofitter version of the questionnaire, covering risk perceptions, beliefs and experience with earthquakes and mitigation, attitudes towards the policy, and both personality and demographic items, are shown in Appendix G. The online version differed only in interaction mode – subjects are shown one to three questions at a time. The average time it took subjects to complete the online survey was 29 minutes (minimum = 10, median = 23, maximum = 83, N=32). Note that that I calculated that statistic after removing four outliers that took four hours or more. I assumed that those subjects left their computer window open and returned later.

Did Survey Online Later	66%	29
Did Survey Online During Interview	17%	7
Did Survey by Self, Paper	7%	3
Later Refused or Failed to Complete the Survey	7%	2
Did Survey Only (No Interview)	2%	2

Figure 20. Statistics on survey completion setting and mode (N=43).

Effective Response Rates

The recruitment and interviewing process in total lasted about eleven months, including two active periods from April through July of 2010 and January through February of 2011. I contacted 130 persons in total and completed 41 interviews for an overall effective response rate of 32 percent. For comparison purposes, the response rate excluding initiated contacts that resulted in *Could Not Reach*[17], *Insufficient Information*[18], or *Ineligible*[19] determinations was 48 percent. Figure 21 shows a summary comparison of recruitment goals to outcomes.

[17] In a few cases, I was told to call back at another time yet the person ultimately neither refused nor would agreed to an interview after our having spoken three or more times. These subjects were eventually listed as "Dropped" contacts rather than "Could Not Reach".

[18] This designation includes returned mail, unidentified new owner, no available phone number for use in follow-up. I received nine returned (bounce-back) letters; presumably either the property had been sold or the owner had moved. I was able to find new contact information for four of these cases, but in no cases did I successfully reach any of these potential subjects.

[19] Two owners were deemed ineligible. In one case, the property was owned by the City of Berkeley. The other property had been identified as a pre-law retrofit, but the property actually had no residential uses onsite and therefore I deemed it dissimilar enough to the properties on the Inventory to be excluded.

	Pre-Law Retrofits	Compliers		Non-Compliers	"Misfits" (Removed or Active Removal Request)	Row Totals
		Post-Law Retrofits	Comply-Only			
*Population Totals**	13	63	106	98	51	331
Contacts Initiated	12 (92%)	25 (40%)	35 (33%)	33 (34%)	26 (51%)	131 (35%)
Interview-Phone	0	4	4	1	4	13
Interview-In Person	4	8	1	10	5	28
Total Interviews	4	12	5	11	9	41
Actual Contact to Completion Ratio	3.0	2.3	6.8	3.0	2.9	3.3
Actual Response %	33%	44%	15%	33%	35%	31%
Survey-Paper	0	0	1	1	1	3
Survey-Online	3	11	6	9	9	38
Total Surveys	3	11	7	10	10	41

Figure 21. Overall recruitment statistics for the study by mode.

Note that two participants did not complete a survey and two other participants did not complete an interview. Therefore, the total number of unique participants is 43.

** Population totals are given by official status as of April 2009.*

Among persons actually reached, response rates varied by group, but not exactly in the ways I anticipated. I originally thought the hardest to reach group would be owners who have not yet filed the required report. It turned out that many "non-compliers" were actively working on complying or had very recently complied, so the issue was salient for them when my letter arrived. On the other hand, recruited subjects who had complied several years earlier yet have no plans to do anything further proved to be both the most difficult to reach (more investment partnerships, more "not enough information/could not reach" study outcomes) and, when reached, the most reluctant to participate. Finding and securing participation was easiest for persons and organizations that did retrofits.

Figure 22 shows that direct refusals were highest in the compliance-only strata. Pre-law retrofitters were hard to find as opposed to unwilling to participate.

		By Recruitment Group				
	Total	Pre-Law Retrofits	Post-Law Retrofits	Comply Only	Non-Compliers	"Misfits"
Direct Refusals as a Percent of Non-Completes	21%	25%	8%	31%	14%	24%

Figure 22. Differences in refusal patterns by behavior outcome group.

Specific reasons given for refusal to participate varied widely. Here are some example sentiments, followed by the number of people who expressed them in parentheses:

- An owner or co-owner just died recently or the property's ownership status is somehow otherwise in question (4).
- Uncomfortable sharing feelings about the law given the local political setting (3).

- I do not share private information with strangers (3).
- Language barriers prevent the owner's participation (2).
- Too busy to participate/It's a bad time (2).
- "I have nothing to offer the study." (1)

Participation by Recruitment Group and Ownership Type

During recruitment, three issues came to the surface that directly relate to how the collected data can or should be analyzed and interpreted. First, I encountered many owners who were in a different behavior outcome strata than when I constructed the strata until the interviews were actually conducted. In some instances the cause was inaccuracies in BID's official data; in other cases, owners were responding to recent BID compliance efforts and owners were progressing in their compliance and retrofit efforts. This is inevitable when using a mutable state as a stratifying variable. It meant that a lot of "non-compliers" I talked to were actually in the process of complying or had done so by the time I reached them. In fact, that could be part of why the issue was salient to them and they responded to my invitation, while other non-compliers and many "early compliers" did not. Figure 23 shows movement among behavior categories across a one-year period for the overall target population, while Figure 24 shows this same data for the actual study participants.

	April-09		April-10		
	Count	Percent	Count	Percent	Net Change
Pre-Law Retrofits*	13	3.9	9	2.7	-4
Post-Law Retrofits	63	19.0	79	23.9	+16
Comply-Only	106	32.0	128	38.7	+22
Non-Compliers	98	29.6	63	19.0	-25
"Misfits"	51	15.4	52	15.7	+1
Total	331	100.0	331	100.0	

Figure 23. Breakdown of target population behavior strata by date for the target population.
** Note: Movement in this category reflects either original mis-classification or an administrative decision to assign a property to the Inventory that was not on it originally.*

	Official Status April 2009		*Official Status April 2010*			*Status as Determined At Interview*		
	Count	Percent	Count	Percent	Net Change ('09-'10)	Count	Percent	Net Change ('09 - Interview)
Pre-Law Retrofits*	4	9%	1	2%	-3	6	14%	+2
Post-Law Retrofits	13	30%	21	49%	+7	22	51%	+9
Comply-Only	7	16%	10	23%	+4	11	26%	+4
Non-Compliers	11	26%	3	7%	-8	0	0%	-11
"Misfits"	8	19%	8	19%	0	4	9%	-4
Totals	43	100	43	100		43	100%	

Figure 24. Breakdown of behavior strata by date and data source among study participants.

Another set of issues involves distinctions among types of owners and also *who* in the ownership-management team I was able to reach or interview. Figure 25 shows the range of "owner types" I was able to speak with. Some types of owners were easier to find and recruit than others. In particular, I discovered that some owners depend so heavily on their property manager that it was impossible to communicate with the owner directly about my study. In two cases, an owner specifically directed their property manager to answer my questions as their representative. In two other cases, the manager simply asserted that they themselves were the party I should speak with. This suggested to me the potential relevance of these owner-manager relationships. It might be important in future research to explore the impacts these relationships might have on mitigation choices in general as well as responses to the Berkeley law in particular.

Note that the participant set for this study includes six females and 37 males, even though this was not a factor that they study was specifically designed to assess.

		By Recruitment Group				
Interviewee Types:	**Totals**	***"Pre-Law Retrofits"***	***"Post-Law Retrofits"***	***"Comply Only"***	***"Non-Compliers"***	***"Misfits"***
Individuals	**31**	2	7	7	9	6
Institutional Representatives	**7**	1	1	0	1	4
Managers	**5**	1	3	0	1	0
Totals	**43**	4	11	7	11	10

Figure 25. Breakdown of study participants by ownership structure type, using April 2009 official status behavior outcome groups.

Retrofit Status (None versus Permit OR Completed)			Group as Identified at Interview				Total
			"Pre-Law Retrofits"	"Post-Law Retrofits"	"Comply Only“	"Misfits“	
No Retrofit	Interviewee Type	Individuals			9	2	11
		Institutional Reps			1	2	3
		Managers			1	0	1
	Total				**11**	**4**	**15**
Retrofit Permit or Completed	Interviewee Type	Individuals	3	17			20
		Institutional Reps	3	1			4
		Managers	0	4			4
	Total		**6**	**22**			**28**

Figure 26. Breakdown of study participants by owner type and retrofit status, and compliance classification, using behavior outcome groups as determined at time of interview (N=43).

Finally, there also arose a set of issues about the best unit of analysis for different research questions within the overall study. During the interview recruitment process I encountered nuanced circumstances such as: (1) a single owner who owns multiple properties on the Soft-Story Inventory[20], (2) a manager who both owns and manages other properties on the Soft-Story Inventory, and (3) a manager that does not own a listed property but who works for several different soft-story owners, each with their own compliance status and experiences with the law. In all these cases, not all the buildings about which a subject could share information had the same compliance or retrofit status. For these reasons, categorizing interviewees by behavior group was more complicated than I originally anticipated and required a more explicit set of criteria and decision rules. To summarize:

- For all analyses of the total population, official statistics from *April 2010* are used.
- For analyses of the interview and survey data, the owner's self-reported status and official status from both 2009 through 2011 are compared and taken into consideration. Wherever a discrepancy arose, I noted it and attempted to verify the most current status, using that even if it differed from BID official records.
- A subject is classified as a Manager if they manage the property they were originally contacted about, even if they also own other property listed on the Inventory.
- A subject is classified as a Retrofitter if <u>any</u> of the properties on the Inventory that they either manage or own have been retrofit, even if it is not the primary property they were contacted about or if not all the properties have been retrofit.

[20] Due to an error made during randomization, owners who own more than one soft-story property were more likely to be contacted for this study. Their greater level of participation reflects this, but this could also be caused by people with more properties on the list having above average interest in participating.

Representativeness and External Validity

Overall, there are several potential sources of selection bias, given the study circumstances and recruitment processes used. Therefore, the resulting sample of interview subjects should not be considered representative of the overall population. Nor would it be reasonable to generalize directly from the sample to the sampling frame or to other populations of building owners in other cities and at other times. Following are some of the processes which are likely to make the interviewed group members different, on average, from the overall target population or from other similar population in different places and time periods.

- People who are willing to be interviewed or participate in surveys tend to be more open and agreeable on average than those who refuse. Even with 32 percent, which is a good response rate for a social science interview and survey study, the interviewees are likely to more agreeable on average than members of the target population.
- People willing to participate in *this particular* survey might be on average either angrier about the BSSO or more proud of their behavior in response to it than those who chose not to participate.
- The study methods made it less likely I would reach owners of buildings that have changed ownership since the law was passed, and some of the study's outcomes could be associated with wanting to sell the property. Similarly, it is less likely that I would reach owners of buildings that have changed their mailing address or phone number since the law was passed.
- Compliance and structural mitigation status could be associated with traits that would make it hard for me to identify a working phone or email contact information for that person. This is particularly true for investment partnerships as an owner type.
- Compliance and structural mitigation status could be associated with having a language barrier to either understanding the recruitment letter or feeling comfortable with responding to it.

As a check on the degree of difference between the target population and the sample on which I was able to collected detailed data, in Chapter 5 I will compare some potentially relevant variables for the overall population and the sample using the available administrative data.

<u>Protection of Human Subjects</u>

I completed the required University trainings for graduate students related to professional conduct and the ethical treatment of human subjects in the spring of 2007, with a refresher course taken in 2009. In January of 2010, I received official verification that the use of all publicly-available administrative source materials for the program evaluation is not human subject research and therefore did not require Internal Review Board (IRB) approval.

In February 2010, I conducted two practice tests using the interview and survey instrument with volunteers, followed by two pilot tests of the questionnaire in written form

with owners of soft-story properties who live in different cities. I identified the latter volunteers by contacting a San Francisco-based retrofit contractor.

I submitted application # *2010-01-555* for Expedited Approval of Human Subject Research in January of 2010 and received approval on March 11, 2010. That protocol covered the owner interview and survey study. The owner interview project did require review because it involves asking subjects about mildly sensitive or distressing topics such as personal behaviors that could have large financial, social and legal consequences for them personally.

I submitted application #2010-08-2053 for Approval of Exempt Human Subject Research and received approval and verification of exempt status on September 17, 2010. That protocol covered the key informant interview procedures.

Through all the interviews, I tried to maintain a neutral stance about both the policy and about the value of earthquake mitigation. I tried to emphasize that my interest was in documenting *what people are thinking and doing* rather than judging peoples' thoughts and actions. Furthermore, I emphasized the compiling of an aggregate picture or narrative about the law and its effects rather than emphasizing the role or thoughts of any particular individual. I promised not to quote any individual or mention any company name or property address unless I asked explicit permission first. Offering credible assurances of impartiality and confidentiality, as well as establishing trust in the research motivations and our functional independence from the City of Berkeley code enforcement apparatus, seemed particularly important to getting adequate participation from owners in the non-complying stratum.

Notes on Analysis Procedures

Qualitative Data

I paid two contractors to transcribe all the interview audio recordings. I then coded and analyzed both types of transcribed interview content using Atlas-ti 6.2.18[21], a leading Computer-Aided Qualitative Data Analysis (CAQDA) software program. I created two distinct hermeneutic units, one containing all of the owner, manager, and organizational interviews and one containing all of the key informant interview transcripts as well as key documents such as Council Reports and regulation texts. In both cases, I generated a preliminary codebook of about 200 codes and then adapted and added to it as needed during the coding process.

It took me approximately two to three hours, on average, to code each complete interview transcript. That includes time to assign the overall subject case to categories (by ownership structure, sex, compliance, and mitigation categories) and to compose a basic set of field notes and interpretative memos. I also spent time after each interview verifying or comparing the content of that interview against the administrative data provided to me by BID staff. As noted above, there were some discrepancies about the self-reported and official status of some properties on the Inventory. The owner belief and behavior study hermeneutic unit ultimately contained a codebook of over 500 codes. The policy history study hermeneutic unit contains a codebook of over 400 codes. I did not attempt to have another person independently code a sample of the transcripts to test for reliability.

[21] Further information available from: http://www.atlasti.com/

Quantitative Data

I tracked and analyzed the compliance data as well as the survey answers using a combination of Excel and SPSS (PASW18). I recoded the personality items on the survey into scales according to the procedures specified by each scales' inventor. I performed exploratory data analysis using visualization and summary statistics, but I conducted very few formal hypothesis tests owing to the small sample size, particularly given the large number of groups and measures under consideration. I used Chi-Squared tests for some the population level and demographic data in Chapter 5.

CHAPTER 4 – POLICY DEVELOPMENT HISTORY AND FINDINGS

4.A– The Policy Context of Berkeley's Soft-Story Ordinance

Seismic Safety through Building Codes

California's built landscape includes an organic, dynamic patchwork of buildings. Any given community will contain buildings that vary widely in type, materials, use, age, and condition – a complex, incrementally produced physical reality shaped by changing market conditions as well as demographic, technical, economic, resource, and political trends and the natural deterioration of materials over time. Every building is to some degree "unique" – if only because no other building occupies that same spot – and each can change greatly over its usable lifetime. Building codes are the principal means of standardizing construction practices for public safety purposes and to remedy the natural information asymmetry between builders, sellers, and buyers of buildings. Codes – which are generally produced and maintained by quasi-public professional associations – are dynamic by design, evolving systematically over time along with changes in construction practices, materials and building science, and tastes , in general on a three-year cycle.

New construction and renovation or additions to existing structures are governed by the California Building Code (CBC). Legally, every local jurisdiction in California is required to adopt the state building code and to enforce that code through a licensed building official. In practice, not all cities have their own building inspection or code enforcement staff. Those that do not – often the smaller, less well-off cities – are required to contract with their county to handle the task of code implementation and enforcement. Above and beyond this minimum, each jurisdiction has tremendous flexibility in the methodologies and administrative provisions they can adopt as long as those provisions do not contradict the state code.

In California prior to the 1970s, local jurisdictions had the freedom to decide when to adopt new versions of a code into use, leading to a patchwork of inconsistent code requirements across municipal boundaries.

> *"The Uniform Building Code initially was the methodology that everyone used to enforce. It wasn't until 1970 that it became one state code book that everyone adopted. Prior to that…Let's say San Ramon adopted a building code, and then Danville adopted a building code, but I might adopt a 1970 building code, and they might adopt the 1958 building code. So, here you are, two adjacent cities adopting code books that are much as 10, sometimes 20 years out of synch with one another.*
>
> *So, contractors and architects were having a nightmare trying to bid jobs, not knowing what they had to do. The state took that on through Pete Wilson; he was an assemblyman at the time, and he sponsored the bill to adopt the state building code and mandate all jurisdictions be on the same one. So, that's sort of how we got where we are." [KI17:9]*

Since that time, standardization has also occurred at the state or regional levels. Until about fifteen years ago, three different building codes were in use in different regions of the United States. The *Southern Building Code (SBC)* was used in the South and maintained by the Southern Building Code Congress International (SBCCI). The Standard Building Code or *BOCA-National Building Code,* used in the Northeast and some of the Midwest, was maintained by the Building Officials Code Administrators International (BOCA). Finally, the Uniform Building Code of the International Conference of Building Officials (ICBO), based on a Pacific Building Code that has been used in California since 1927, was used in parts of the Midwest and the West.

Building codes primarily promote seismic safety in new construction that occurs within the regulatory framework of building permits and inspection. Major renovations occasionally "trigger" requirements to meet contemporary codes, thereby leading to improvement of existing buildings. Supplemental codes, often referred to as "standards", are sometimes created for use in rehabilitation and upgrading of existing structures.

After the 1989 Loma Prieta earthquake in California, the Federal Emergency Management Agency (FEMA) implored the regional organizations to come together to agree on a single, unified code, which led to the ICC, or International Code Council. In 1994, the ICC released the first integrated "International Code", or I-Codes, as well as an International Existing Building Code (IEBC) that dealt covered rehabilitation standards. Ultimately, however, not all states adopted this model code and California opted to maintain its own code, the CBC.

A code book issued in any given year actually represents the accumulated state of knowledge regarding building safety up *until a few years prior*. There is always a lag between current thinking and adoption of new provisions into law and then practice. In general, building professionals place a lot of faith in these consensus documents that are thought to facilitate learning and maintenance of a minimum quality construction.

> *"It makes it a lot easier when you have a building code that's been adopted and maintained and fixed and worked on, since 1927. I have the advantage of thousands and thousands of building officials that went before me that have had problems and fixed them long before I ever knew about it. As long as I'm using the code book, I'm usually steered away from those problems because they've been resolved." [KI17:10]*

Among seismic experts, even the most recent universal codes are thought to contain problems, "flaws", inconsistencies, or gaps. One building expert I interviewed expressed that the movement to a new integrated code represented a step backward for Western states from well-established codes here that included more insights relevant to building for earthquakes:

> *"It's not just the earthquake issue…it's a whole bunch of other things that have been diluted by the fact that we combined the three codes throughout the country into one, and they used the lowest common denominator requirements out of all of those, which means that a lot of things that we used to do here are now*

diluted by this code, or in the amalgamation process, the language is not clear. [Fixing those issues is] a full-time job, by the way, for many people, not just me." [KI16:127]

As a practical matter, building professionals that want to reduce earthquake risk must divide their efforts between working on standards for repair of existing buildings by ensuring that new understandings of safe design are adequately incorporated in code updates, and making sure that those same insights are also clearly articulated in the codes currently being used for new construction. Furthermore, people must spend time advocating for the newest, best codes to be adopted and enforced by local jurisdictions. If resources are limited, developing improved *current* code for new construction is sometimes viewed as the "priority".

If we don't get the new buildings right, we're just creating another whole host of problems down the road for people to go, "Oh, we've got to fix this or that." So, I've gone back to… Let's get the new buildings done right. [KI16:126]

How the BSSO Builds on California's Tradition of Seismic Policy Innovation

Local jurisdictions are allowed to have code requirements or other building regulations that are more stringent than the state code, but it takes extra initiative and resources to pass those kinds of laws. Furthermore, often there is no technical or political consensus on which exact steps to take. These are key reasons why passage of proactive earthquake safety legislation is so rare, even in high-hazard, highly-exposed states such as California.

In 2005, the City of Berkeley passed a local ordinance that took seismic safety policy for existing buildings in a new direction. While clearly an outgrowth of past seismic mitigation efforts, the policy is also experimental and ground-breaking in important ways. The law includes several well-established policy features but also extends them into new terrain and adds new ones, making the law unique in the history of seismic safety policy. Additionally, the law combines mandatory and voluntary elements with the explicit goal of increasing market pressure on owners to invest in mitigation. Following is an assessment of the law's major elements along with a discussion of the precedents or origins of each.

1. *PUBLIC INVENTORY: Buildings suspected of meeting specific risk criteria are officially listed on a public "Inventory".*

Inventories of specific building types have formed the backbone of California seismic policy towards existing buildings since at least the 1930s, but it was the 1986 statewide Un-reinforced Masonry (URM) law that firmly established the precedent of using inventories to promote retrofits of existing seismically vulnerable buildings. Through this policy, sometimes referred to as Senate Bill 547, the State Legislature required all 366 local governments in Seismic Zone 4 (the highest hazard level) to inventory their URM buildings, establish some kind of loss-reduction or remediation program within 4 years, and report progress to the California Seismic Safety Commission (CSSC). The major metropolitan areas of San Francisco, Los Angeles,

and San Diego are all in Zone 4, which covers nearly 75 percent of the state's population. Each county or municipality was allowed to design its own program. Deadlines were later extended as cities struggled to comply with this "unfunded mandate". In general, four main types of local programs resulted: 1) mandatory retrofit; 2) voluntary retrofit; 3) notice to owners that the structure is a URM; and 4) others such as requiring posting of the dangers of URM buildings. When retrofits are encouraged or required, the local government sets the standards to be met.

Inventories are politically attractive because they are relatively inexpensive to create and provide valuable information about the extent of the problem, the affected parties, and what the implications might be if regulations were enacted. At the same time, they also don't carry any actual obligation or need to take further regulatory action, so they are perceived as a "safe" and conservative first step. Because of the state URM precedent, advocates for a soft-story policy in Berkeley were confident that creating an inventory would eventually be acceptable to owners and political leaders.

> *"The one thing that everyone felt was not really a big issue was the survey, [because] that's what the state did. The state said, 'Well, what we're going to mandate is that everyone's going to go out and find these buildings and prepare a list.' Everyone said, 'Well, that's pretty benign.'" [KI17:19]*

The state URM law had tremendous influence by spawning political and economic interest, policy experimentation, and practical experience with seismic policy implementation. It was the state URM law that initiated a tradition of preserving "local choice" of how to address the problems of seismically-vulnerable existing buildings. This law was also credited for generating awareness, capacity, experience, and policy innovation at the local level.

> *"Senate Bill 547, which required every jurisdiction in California to inventory their unreinforced masonry buildings…didn't tell them what to do. It said: 'decide what you're going to do'. That was the first time anybody was actually required to inventory anything but the process of doing those inventories for masonry got building officials thinking there are other vulnerable building types in my city. And depending on the city, I can think of building officials who said, wow, we have all these tilt-up buildings, we should be worried about those. Or we have all these non-ductile concrete buildings and we should inventory those 'cause we know those are going to be hazardous…I think the prompt actually came from…the URM ordinance, which then suggested that they had other hazardous building types and that they should think about that in their own locale despite the sort of politics of it." [KI22:7]*

In part because of relationships between the building officials in Berkeley and the cities of Fremont and San Leandro, California, those two cities both completed inventories of their soft-story properties in the early 2000s. Fremont had a small number of soft-story buildings

(approximately 35) and went on to mandate retrofits, with provision of substantial help (including financial assistance) to owners. San Leandro found approximately 350 properties and operates an exclusively voluntary program.

2. *MANDATORY EVALUATION: A mandatory seismic evaluation of all buildings on the Inventory must be completed, approved, and placed on file with BID within two years, following a six-month appeal and grace period.*

Several cities (most prominently Long Beach, Los Angeles, Santa Cruz, and San Francisco) had URM ordinances and programs in place prior to the state mandate. One of them, Palo Alto, passed a law just prior to state law that was the first to require owners of suspected URMs to have an engineer evaluate their property. Palo Alto did a comprehensive inventory of a wide variety of seismically-vulnerable building types and then engaged the community deliberative process to determine priorities among building types and policy approaches. Ultimately, high priority URM structures were required to file an evaluation (Herman, Russel et al. 1990; CSSC 2006). Not coincidentally, the consultant who worked on developing the Palo Alto URM law also was the person responsible for creating Berkeley's initial soft-story inventory.

3. *EXEMPTION: All buildings that are retrofit pursuant to the standards set forth in the law and therefore removed from the Inventory will receive a 15-year exemption from future retrofit mandates by the City of Berkeley.*

The idea of providing owners (and their mortgage holders) assurance of relief from future mandates for a reasonable period of time came about during the debates leading up to passage of the state URM law.

> *"The real test at the time was for retrofitting. Do you have to retrofit to current code, or can you do it to something less? The law allowed them to do it to something less. We argued that the law wasn't working. [Then the 1984 earthquake in] Coalinga had happened. It was a "nothing" earthquake, if you will, but we had some good, fresh pictures, and we showed pictures to the legislature and got [the state URM law] passed.*
>
> *It was amending that law where the 15-year business came about, because building owners couldn't get loans for retrofitting buildings when banks were afraid that the goal post would be moved after five years, then we'd need to do more work." [KI5:23-24]*

4. *MANDATORY SIGNAGE: All buildings on the Inventory are to be posted with a sign reading: "This building may not be safe during or after an earthquake."*

On-site signage was required of owners under a 1992 amendment to the state URM law. The idea of posting a warning on the outside of buildings especially made sense for commercial properties where people do regularly congregate near entrances or make frequent choices of which businesses to patronage. Prior to 2004, the required wording on a five by seven inch minimum sized placard was:

> *"This is an unreinforced masonry building. Unreinforced masonry buildings may be unsafe in the event of a major earthquake." [California Government Code Section 8875-8875.10]*

The signage part of the law was then strengthened in 2004 (by changing the wording slightly, enlarging the minimum sign size, adding enforcement and fine provisions, and adding a requirement that similar wording be added all new leases and rental contracts) following a URM collapse-caused death in the San Simeon quake. The current wording on an eight by ten inch minimum sized placard, with the first two words in much larger sized font, is:

> *"Earthquake Warning. This is an unreinforced masonry building. You may not be safe inside or near an unreinforced masonry building during an earthquake."*

5. *TENANT NOTIFICATION: Tenants are to be notified in writing of the building's status on the Inventory, with proof of notice by signature to be kept on file with BID.*

This element is adapted from the state URM requirement that all lease holders or renters of URM buildings must be informed in their contract that the building is a URM that might not be safe for occupants during a major earthquake. This provision was only added in 2005 following a death in the San Simeon quake in a URM building.

6. *NOTICE ON DEED: Notice is recorded with the County and remains on the deed in perpetuity or until an acceptable upgrade is done.*

This element is entirely new, and was included in the ordinance to further reinforce the impression among owners that being on the Inventory constitutes a stain on the property's reputation that might affect financing access, their ability to sell the property, or the price it could sell for.

<u>Why in Berkeley?</u>

> *"…Berkeley's a very unique city in that the intellectual basis of everything that goes on in Berkeley is very deep, and it has to do with the presence of the University and highly-educated, politically-active people. The [city has] 40 boards and commissions. Regardless of what topic it is, it's sliced really thin.*

It's very specialized in many ways, and topics like earthquakes are brought up." [KI5:17]

Every single person interviewed for this study expressed at one time or another that Berkeley is an exceptional, perhaps even singular place. Despite being a small city geographically (at just over 10 square miles) and in population (about 103,000 residents according to the 2000 U.S. Census), Berkeley is renown worldwide as a center of academic, scientific, political, and artistic innovation. That reputation is closely linked to the presence of two major institutions of research and higher education – the University of California at Berkeley, founded in 1969, and the Lawrence Berkeley Laboratories (operated with funding from several federal government departments; hereafter, LBL).

Berkeley is old by Western United States standards, founded in 1878. Many downtown buildings and nearly 50 percent of its housing stock were built prior to World War II. It is a demographically diverse place, except when it comes to education – over 85 percent of residents have or are in the process of obtaining a bachelor's degree.

Berkeley has a notable history of progressive politics and policy experimentation. It is regarded as the birthplace of the Free Speech movement of the 1960s. None of the city's energy is sourced from nuclear power. And, on the environmental front, it was the first municipality in the U.S. to ban food containers made with chlorofluorocarbons in 1988 and Polystyrene in 1990, and an early adopter of mandatory city-wide residential waste recycling. Berkeley also made history in 2008 when it created a tax-increment financing mechanism to help owners install solar panels and then pay off the costs over time through their property tax bills. The program, called Berkeley Solar FIRST (Financing Initiative for Renewable and Solar Technologies) later ran into technical difficulties but has been heralded as a national model.

Following the 1989 Loma Prieta earthquake, issues of public safety and disaster prevention captured some the city's progressive policy-making energies. A key part of that shift occurred when a local parent, Arrietta Chakos, became concerned about the earthquake soundness and state of preparedness of Berkeley public schools.

"I got involved about 20 years ago, just after the Loma Prieta earthquake. My daughter was just a kindergarten student then, and I asked her principal if the school was safe and got strange answers. After maybe a week or two of digging around, I found out that her school was a collapse hazard, so that sort of launched me into my seismic safety class at Berkeley." [KI1:7]

Ms. Chakos was not the only parent concerned about the issue, and together the parents made inquiries that unearthed a series of engineering evaluations conducted over a decade earlier by a highly reputable local firm. The evaluations suggested that many of the school district's properties were structurally deficient. Parent concern and outrage spread further. A community meeting was arranged.

"Dan Shapiro [of SOHA Engineers] had done an evaluation of some of the schools, and it had been buried. Somehow, somebody had

found it, and they got him to come to a Berkeley school board meeting. At the school board meeting, he sort of used the famous words, 'Well, I'd never let my grandchildren go to school in this school.' That really kind of started it off. Others joined Arrietta, and they convinced the school board they had to do something about existing schools." [KI5:14]

The District responded quickly and initiated a campaign to plan and fund the necessary upgrades or replacement structures. Lack of funding was a continuing challenge, but using a combination of bond measures and state and FEMA support, every public school facility in Berkeley was either upgraded or replaced by 2000 (Chakos, Schulz et al. 2002).

Around the same time as Berkeley started to address its public schools, the city was also starting to address its private building stock. Pursuant to the state URM law, Berkeley initiated an inventory of its URMs in 1989. A mandatory retrofit or demolition requirement for URMs was passed in 1991, although pressure to implement the program was minimal for several years. A total of 727 properties containing potentially hazardous URM buildings were originally placed on the list. As of 2008, 85 percent of those properties had been officially declared compliant.

Berkeley City Council Member Alan Goldfarb and others initiated a transfer tax rebate program for residential properties with one to four units. Starting in 1991 and continuing to do this day, building owners can apply for a rebate of up to one third of the amount of the transfer tax owed up to $1,500 (currently the transfer tax is 1.5 percent of the sale price) to the city for a property at sale for any qualifying seismic improvement expenditures made previously or within one year after transfer of title.

The program was immediately popular and eventually highly influential because it touched so many community members. It firmly established a tone that the city takes seismic risk seriously and will put its "money where its mouth is". Functionally, it meant that over half the city's residents had tangible experience either working with a contractor or with a do-it-yourself seismic mitigation project. Currently, over half the single-family homes and one third of the smaller rental buildings in Berkeley have claimed the credit.

"…[the transfer tax rebate] just seemed to be a stroke of genius in terms of public awareness. It was the single issue that people talked about. You would hear middle-class people looking for houses saying, well, if you live in Berkeley, you get this tax rebate to do seismic upgrading. I mean, it was amazing…" [KI22:3]

Goldfarb was a champion for seismic safety on the Council in other ways. He served as Berkeley's representative to the Association of Bay Area Governments (ABAG) and regularly attended BAREPP meetings. This brought him into contact with many of the Bay Area's leading thinkers and activists on disaster preparedness issues.

By 1995, it also became clear that the City Council and Mayor as well as the police and fire forces were housed in seismically inadequate, outdated facilities. Thus began yet another major campaign to arrange for public building retrofits and replacements. Plans for a City Hall

renovation in particular called for newer, advanced technologies that practicing engineers had little experience with, so city staff sought out the assistance of local academic experts.

Eventually, a small group of three professors was officially convened that would come to be known as the Seismic Technical Advisory Group (STAG). Their directive was to advise the city in creating a plan to retrofit City Hall and construct a new public safety building to house the police and fire departments as well as an Emergency Operations Center. It seemed like a win-win proposition: the city received extremely low-cost cutting edge advice from leading seismic safety thinkers, and the participating faculty members were at first more than willing to lend a hand out of a sense of professional duty for the cause of civic preparedness right in their own backyard.

> *"Base isolation was very new then. It wasn't in the building code. It still isn't in the building code…and so, the fortunate thing we have is that we have Cal here and we have the School of Engineering and we have some nationally known experts…The code requires that you have a peer advisory group anyway when you're doing special design like that." [KI12:68, 12:71]*

On paper and as far as the public were concerned, the STAG members were paid consultants, but in practice the small stipend they received – approximately $1000 every three months for a year or two – hardly covered a fraction of the time each person spent on the project. The STAG members felt like volunteers who were contributing to the community and building good will "out of the goodness of our hearts" [KI22:32-33]. Over time, the scope of the STAG's activities expanded and became politicized, so much so that one of the original members quit in 1999 after being harassed by disgruntled citizens [KI22:38].

Despite some minor controversy, the existence of the STAG did serve to formalize what was already a growing sense of the need for the University and city to collaborate on disaster preparedness issues. The University of California at Berkeley is a state-run institution and therefore not subject to the City of Berkeley's authority, but the two entities could not be more symbiotic. The city surrounds the campus, feeds and houses the majority of students and many of the faculty and staff. Both are subject to the same high seismic hazard. Beginning in the 1970s, campus leadership initiated various efforts to assess and improve the seismic safety of campus infrastructure. The 1990s saw a resurgence of interest in the issue, culminating in the Disaster Resistant University program.

The program was instigated by then-Director of FEMA, James Lee Witt, who took a personal interest in Berkeley. Tom Tobin, formerly of the CSSC, was doing consulting work for Witt in 1997 when then-Chancellor Robert Berdahl went calling to FEMA for help in addressing the problem with seismically deficient buildings on UC campuses including Berkeley. Witt subsequently visited the campus and toured various facilities with notable local experts in seismic safety and met with city officials. The realization of the interconnectedness between the University and municipality was clarified in everyone's minds.

With Witt's support, Berdahl announced the launch of an ambitious program to improve seismic safety on the Berkeley campus. Over the next seven years, more than $400 million in retrofits and renovations had been launched or completed on campus structures.[22]

> *"[As part of the Disaster Resistant University program] FEMA…insisted on community outreach. So, for cities they insisted that they get their business community engaged and… that we have an external advisory board, so we brought in some people from the city, people [from] corporations that were headquartered in Berkeley and we had a kind of an external board that talked to the University about … their own thinking and … how our thinking influenced theirs. So this was this very nice dialogue that went on between Bayer Corporation and city people and some other companies who probably don't want to be named.*
>
> *And it was actually a really useful sort of town-gown dialogue…it became this nice way to have this relationship between what the University [and city] doing, and they were learning from us and we were looking at what they were doing as well. And we learned a lot from some of those corporations because they had even higher kind of standards for themselves about [being]…operational very quickly. So that was an important relationship." [KI22:29-30]*

Berkeley already had a special relationship with FEMA. FEMA, in response to the wave of natural disasters, had established Project Impact in October 1997 with seven pilot programs. The aim of the program was to distribute seed money and technical assistance for communities to assess their hazards vulnerabilities and implement strategies to limit damage before disasters occur. Berkeley was among the group of cities selected for a second wave of funding in 2000 and ultimately received $300,000 for various emergency preparedness activities and programs before Project Impact was ended by the Bush Administration in 2001 (GAO 2002). In addition to the funding, being a Project Impact community lent considerable prestige and visibility to all of Berkeley's seismic safety efforts.

In summary, Berkeley is a city with an exceptionally proactive record regarding disaster preparedness and earthquake safety in particular, and an active, well-educated, and well-connected citizenry and local government. In other words, Berkeley possessed the ideal human and social capital resources and context to take a bold new step in earthquake safety policy.

A Brief Background on Berkeley's Rent Control

In discussing motivations of building owners in Berkeley with regard to earthquake safety, it is vital to be aware of the city's basic laws regarding tenant-owner rights and

[22] Information obtained from: http://berkeley.edu/about/hist/architecture.shtml (Accessed: Nov. 24, 2010).

responsibilities. Most residential units in Berkeley have been subject to rent control since 1980 (Berkeley Municipal Code Chapter 13.76). The ordinance is operationalized by the Rent Stabilization Board, a body of nine elected commissioners, and their appointed staff. Owners of rental property covered by the Ordinance are required to register their units with the Board by filing registration statements and paying annual registration fees, which cover the program's cost.

A major change to rent control laws statewide occurred in 1995 with passage of the Costa-Hawkins Rental Housing Act (CA Civil Code Section 1954.50). In effect, Costa-Hawkins suspends rent control following a qualifying vacancy and reinstates it for a new tenancy, a process commonly referred to as "vacancy decontrol". For tenancies beginning on or after January 1, 1999, owners may set a market rent for most tenancies and the rent charged the new tenant becomes the new rent ceiling. Owners must register new rents with the Rent Board and may increase these rents for a sitting tenant only by an annual general adjustment or an individual rent adjustment granted through the Board's petition process.

Provisions describing what are considered important to the habitability of rental units in this state are addressed in the California Civil Code Sections 1941 and Health & Safety Code Sections 17920.3 and 17920.10. Key physical conditions mentioned include waterproof roofing, adequate facilities for plumbing, heating, cooking, and trash, and safe ingress and egress. Also required are a lockable door, telephone wiring, and a lockable mail box (in larger buildings). If a tenant's proper notice and complaints about a violation of any of the above are not dealt within a reasonable amount of time, tenants can undertake and unilaterally deduct from their rent any expenditures made to fix the problem themselves in an amount up to one full month's rent.

Under Berkeley's current Residential Housing Safety Program, most rental property owners must annually certify that their units meet certain housing safety standards, on an official checklist, and to provide a copy of the certification to the tenant. The checklist mentions that the City of Berkeley recommends strapping of water heaters, but does not require owners to do so.

4.B – The Policy Development Timeline

This section outlines my findings about the overall history of Berkeley's soft-story policy. To give the narrative structure, I divide the account into chronological stages beginning with what motivated and made possible the initial policy development effort (Stage 1: Laying the Groundwork) and continuing with how the policy concept was adapted into an actual ordinance (Stage 2: Developing the Regulation). Following that, I discuss what happened during implementation (Stage 3: Program Activities and Implementation) and present information about the policy's legacy and antecedents (Stage 4: Beyond the First Five Years and Beyond Berkeley). Together these stages address how this improbable, novel policy came to exist and how the policy evolved from concept to regulation to program. Additional discussion of the challenges that arose during implementation, as well as recommendations and lessons for future policymaking, are presented in Chapters 7 and 8.

Stage 1: Laying the Groundwork

Why Target Soft-Story Buildings?

By the mid-1990s, soft-story wood frame construction was *the* most salient seismic risk issue among California housing and building professionals. The hazard and widespread presence of this building type were made evident by the dramatic collapses and fires in the San Francisco Marina District in the Loma Prieta earthquake in October 1989. Then again, in the Northridge event in 1994, widespread damage and several high profile collapses occurred. The Northridge-Meadows apartment complex collapse that led to 16 deaths captured media, public, and expert attention in particular. The cumulative effect was to bring front and center the potential social costs of failing to take action on the issue. Soft-story residential buildings were viewed as not just a threat to the owner's pocketbook – tenant safety and community stability and recovery were also at stake. Given their prevalence, the community-wide impacts after an event of losing hundreds of soft-story apartment buildings could be large.

> *"Well, the big change was actually after Northridge, 1994. The collapse of all of those soft-story apartment buildings in Los Angeles. We had this very localized problem in the Marina District in San Francisco but when you saw it on the scale at which it affected Los Angeles…it wasn't just old buildings anymore, these were buildings that were built to the early nineties building codes that were having these problems…*
>
> *So, very contemporary architecturally designed housing, not just old stuff, was having huge damage problems because of soft-stories and …that got everybody's attention…the architects and the engineers...I can remember engineers saying wood is fine. Wood is just not going to fail. We don't have to worry about wood buildings, and after 1994, nobody said that anymore." [KI22:4-5]*

Two large urban quakes in California were followed by a major urban quake in Kobe, Japan in 1995. The Oakland Hills firestorm in 1991 left 25 people dead and thousands without homes. Hurricanes Hugo (1989) and Andrew (1992) had recently caused massive damage and fear in the American southeast. For the public and community leaders, the salience of issues surrounding the security against natural disasters was at a peak.

Collectively, these events shifted both the personal and professional landscapes of local building safety practitioners. Building inspectors who worked on post-event –reoccupation inspections came away with indelible imagery and emotional impressions of tragedies facilitated by inaction. They got a clear idea of "what-if" and sharpened their goal of "not on my watch". The building professionals I interviewed recounted feeling that their communities had "dodged a bullet" or "gotten a free pass" in Loma Prieta but that it was no guarantee for next time.

At the same time, the practitioners I spoke with were filled with a new sense of professional empowerment and entitlement to take action. Recent earthquakes had established or reinforced their interpersonal network of professional support for and directly in doing so and bolstered their personal and professional motivations to act. Several had a new degree of contact and involvement with structural experts, many of whom were ready to volunteer advice to anyone they perceived as in a position to do some good. These Bay Area building officials came to realize that they had some capacity to act preventatively and that if they didn't, they'd regret it.

The soft-story issue was not actually new or complicated one to structural engineers. Also, potentially affordable, reasonably straightforward retrofit remedies were available. Complementing these trends was the very nature of the soft-story building threat. Soft-story buildings are relatively easy to spot; they "look" weak, even to lay-people. They can be highly visible from the street and are ubiquitous in many Bay Area communities that experienced population surges in the 1950s and 60s. That meant that soft-story buildings are frequently seen, which makes it easier to imagine how devastating it would be to a community if many of them were impacted simultaneously by a quake. In sum, these features make soft-story wood frame buildings the proverbial "low-hanging fruit" of existing building safety policy.

Counteracting the momentum towards policy action about soft-story issues were the obvious economic and political issues surrounding mandating a retroactive expense on a private building. Vulnerabilities in the existing building stock put politicians in the awkward position of having to say that the laws "we" once imposed on you (or a previous owner) were actually insufficient, unbeknown to us. It undermines faith in the existing regulatory system (building codes) that the public believes is adequately protective of their safety. It makes the political system and building professionals that create the codes look hopelessly flawed and uninformed. This is part of why the documented level of hazard needs to be high and exceptional before experts will push for a law to be passed.

A Secret Sidewalk Survey

As noted above, after Northridge, soft-story buildings were on the front pages of newspapers and at the front of many peoples' minds. Berkeley City Council members and planning department staff were no exception. One of those people was the City of Berkeley's Building Official at the time, Reginald "Reggie" Meigs. In 1996, Mr. Meigs commissioned an effort to inventory multi-unit residential buildings in Berkeley that might be potentially hazardous in an earthquake. His description of the idea to do a street survey is revealing of the *ad hoc* and personalized nature of this policy's beginnings:

> *"I went to the International Building Code conference…and I met up with an old boss/colleague …So, we hooked up that day and just started wandering around the city that we were in. I can't even remember which city it was now….We were just going around, taking pictures of beautiful buildings that clearly were landmark buildings for cities that were at risk [for earthquakes].*

One of the things we started noticing was that there were so many soft-story buildings, where they were residential up on top, commercial down below. They had removed out all of the structural walls below for a glass front, and these buildings are just sitting, waiting to collapse. It was just shocking to me.

I said, "You know, there are people sleeping in these buildings at night and have no clue that they have a risk. How can anyone just not do anything?" He was telling me, he says, "[Friend], we have them all over LA County as well. At some point, something has to be done."

That put it in my heart to say, "You know what? Whatever I can do, whenever I can do it, I'm going to do something." I got the opportunity in Berkeley, especially once I started seeing so many soft-story buildings in Berkeley." [KI17:27-28]

Mr. Meigs became convinced that soft-story weaknesses were important problem in Berkeley housing because he saw so many of them while driving the streets in the course of his work and commute.

"I was convinced, personally, that the soft-story issue in Berkeley was a serious, huge potential problem. I could just drive around the city and see hundreds of buildings that were potentially at risk. With Berkeley's policy of not eliminating housing, Berkeley's policy of trying to keep their housing stock up to a certain standard, I saw this as a serious potential risk to their own policies. I also knew that I was probably working for one of the most political type of cities that I had ever worked for in my career." [KI17:15]

My question to myself was, "If you really see a problem like this and you want to get it resolved, how do you do it?" The way you do it is to work through other people to do it. So, I had to build a fire under a lot of other people. I had to get them to know that it wasn't me, it wasn't my idea, but I had to get them to see what the risk was." [KI17:17]

Mr. Meigs surmised, and was ultimately correct, that the internal political resistance to doing a soft-story survey would be minimal. Indeed, concerns about vulnerable housing already being discussed by City Council members and people in the City Manager's office and building inspection department. The idea of conducting a discrete survey to inform city planners met little resistance.

"Everyone was telling me in Berkeley, 'Well, we don't have that big of a problem here.' I'm thinking they have no clue what they're looking at… So, I said, 'Okay, well, since they don't think there's a

really big problem with soft stories in Berkeley, they probably won't be too hesitant in having a survey. Why not have a survey if you only think a few buildings are going to pop up?'

The ones that did know how many there were, the only reason they would know is because they were seriously concerned about soft-story buildings as well, so they're not going to fight having a survey. So, I figured it was a win-win. I said, 'Okay, well, let's see how big the problem is.' Everyone felt that that was sort of like a benign thing to do. They'd already done it with unreinforced masonry buildings." [KI17:34]

That being said, Mr. Meigs felt that a survey would only be worth doing if conducted by someone highly experienced, level-headed, and credible. The name that came up was Jim Russell, who had done URM inventories for many cities throughout the state and had substantial policy and code development experience.

"…the only way that we can do this is if we get someone who I personally know has an impeccable background. So, I called up Jim Russell." [KI17:34]

Although they were not close friends, the two men knew one another from building inspection conferences and educational efforts over the years. Mr. Meigs recruited Mr. Russell based on the latter's experience and for his reputation for eschewing political entanglements. Equally important, Mr. Russell was someone in the building safety business that Mr. Meigs felt he could understand and trust because of their shared values and philosophy.

"[Jim Russell] always wanted to be in the forefront of whatever was happening seismically… which is one of the reasons why I wanted to hire him. He saw this as a way of getting a process documented, set up, so that other cities could see what the benefits of it would be. He has a similar passion that I have, where he wants to see buildings saved. He wants people going to sleep at night, knowing that they're in a safe building…I needed his help. He jumped in and created a great list for us, probably the only one at the time that would've been able to do what he did." [KI17:45-46]

A small budget for the project was arranged by using surplus funds created by another employee volunteering to do overtime plan-check work that saved the city nearly $150,000 in outsourcing fees. Jim Russell was tasked with designing a protocol for and then carrying out a sidewalk survey while also training and working side-by-side with a current employee, Margaret Hall. Part of the rationale for having Mr. Russell "train" Ms. Hall and having her conduct the survey alongside him was to provide an internal point of contact that would somewhat insulate

Mr. Russell, who had initially been reluctant to take the job for fear of getting involved in internal city politics.

The marching orders from Mr. Meigs for creating the Inventory were broad: identify all residential buildings with four or more units that are likely to have a high seismic risk owing to a soft-story condition or tilt-up concrete construction. Mr. Meigs instructed Mr. Russell that the scope of the Inventory should be inclusive, while at the same time he should use his best judgment to avoid listing "false positives". Above all, the effort should be well-documented.

> *"Me and [Jim Russell] sat down and set up the criteria of what would be looked at, what would not be looked at, how it would get on the list. I told him, 'My main thing is I want to not only having a defensible list, but I also want to catch everything.' I said, 'I don't want to put things on the list that are not [high-hazard]. I want you to catalogue it, find it and take pictures of it, so that we can actually justify what we've done.'" [KI17:40]*

Ms. Hall and Mr. Russell assembled all available paperwork about the properties, including Sanborn maps. Then, the team split up the territory and drove and walked the streets until they were satisfied that the list was complete. According to Mr. Russell, the effort took a few months at most.

It is worth noting and discussing briefly how a local Building Official managed to marshal the resources and time to initiate such an unusually proactive effort. Two factors seem important. First, that kind of bureaucratic creativity is not un-typical for Berkeley's staff. In fact, taking risks of that nature is often welcomed and rewarded. Berkeley is not a large city, but it is large enough to afford managers some flexibility in allocating resources. A second point is that the person who initiated the effort was a seasoned professional who considered himself "mobile" and therefore was probably more willing to take career risks. He also had a strong personal vision and sense of duty that he felt he could carry with him to other places. Even if the efforts in Berkeley did not pan out, he was confident he could continue working on similar issues for another city.

The result was a list of about 400 properties, and it was a "paper" list in the sense that physical file folders with documentation for each property had been created but there was no digital spreadsheet or database at first [KI6:76]. At the time, the creation and existence of the list was kept discreet in that very few people within the city apparatus knew about the effort. No official internal or public discussions were initiated about what to do with the list until much later. The existence of the list as well as which buildings were on it were kept very quiet for years for fear of arousing public concern or opposition. Furthermore, it was accepted that the existence of the list, as well as which buildings were on it, should remain un-disclosed until city leaders came to some conclusions about what, if anything, they were willing able to do with it. No process, as of yet, had been set in motion regarding how to arrive at those answers.

Into a File Drawer

About a year after the list was created, owing to unrelated internal matters the building official who initiated the street survey resigned from city employment. A four year delay then ensued until the beginning of a new coordinated effort to craft an ordinance to deal with the buildings on the Inventory. According to Mr. Meigs, he was confident that other key staff were aware of the list before he left. Mr. Meigs had felt he had left the list in good hands.

> *"I had already entrusted it to people. First of all, once Arrietta got a hold of it, it wasn't going to die and I knew that it wasn't going to die. There were a couple of other people that knew about the list." [KI17:58]*

Several factors contributed to this delay. One issue was staff turnover in the Building Inspection division itself. At least five people served as Berkeley's Building Official during that period, several of them officially temporary. The Planning Department also suffered from turnover and leadership difficulties as well, especially at the management level.

However, it would be an over-simplification to say that "lack of leadership" or "lack of interest" were the reasons why the Inventory lay dormant for so long. Overall, the city was active and not lacking earthquake safety champions during this period. Rather, existing high visibility public safety projects crowded the soft-story Inventory off the agenda. The languishing URM program, a major effort to retrofit City Hall (groundbreaking in 1999), and one new and one renovated earthquake-safe public building dominated internal attentions. Without a clear internal responsible party" or any outside stakeholder group urging politicians to devote attention and resources to the issue, the vulnerabilities that had been identified through the street survey remained subordinate.

<u>Stage 2: Developing a Regulation</u>

A Coalition of Champions

Action to revive the list came about once the department finally had three different types of "champions", each bringing some of the necessary political, technical, and administrative connections, knowledge, and skills. What it took was the coming together of (1) a motivated advocate/organizer with sufficient local political clout and savvy, (2) a respected building professional with enough formal authority and personal motivation on the issue who also was deeply connected to a network of expert colleagues who were ready to help, and (3) an experienced administrator, someone comfortable working with city management, outside stakeholders, and willing to do the internal administrative grunt work.

During the 1990s, Arrietta Chakos was commonly regarded as 'Ms. Seismic Safety' in the City of Berkeley. Since 1990, she had exerted skill as a private citizen in influencing the Berkeley city government to attend to disaster preparedness issues, and continued to do so from her position in the City Manager's Office from 1993 forward. Ms. Chakos was on staff when Mr.

Meigs originally commissioned the Inventory and she knew of the list's existence. Ms. Chakos explains when and how she first heard about the list:

> *"Everybody was worried about the liability of having the information, so I think [the building official] put the list away until he could figure out what to do with it, and that took about a year. Then, I heard about it." [KI1:15]*

But until major projects such as the renovation of City Hall and construction of a new public safety building were complete, there was little room on her agenda for tackling private building stock safety issues. In 1999, after a long courtship, Berkeley hired Joan MacQuarrie as its new Building Official. Ms. MacQuarrie describes herself as being at a career crossroads at the time. She felt ready to take on leadership of a division, but also wanted to work in a slightly smaller city that was closer to where she lived. She brought with her a decade of inspection and supervisory experience in San Francisco's Department of Building Inspection, including professional contacts forged during difficult times of crisis (Loma Prieta and Northridge) with some of the most highly-regarded building inspection and structural engineering professionals in California.

Ms. MacQuarrie started as the first-ever female building inspector for the City and County of San Francisco in 1985, after working as a mechanic and in general contracting and construction for many years. Ms. MacQuarrie had been working her way up in the department for four years and had reached a supervisory level when the Loma Prieta quake hit. Here are her recollections of the days leading up to and immediately following that transformative event.

> *"About a month before Loma Prieta happened, I had been to the very first ATC-20[23] training for the red tag, green tag, yellow tag. I had come back, and taken the brown envelope from the training with the placards in it-one of each color-and the manual, and stuck it on top of my desk in between the books.*
>
> *When the earthquake hit, I was down at Whittier, which is headquarters…for ICBO[24]-taking a course, a two or three-day course, on becoming a building official…So, I didn't get back to San Francisco until the day following. I got back to our building, went in… The power was off, and all the stuff on my desk had been… It looked like it had fallen down into a big pile. So, we were out of our building. We went down to the corporation yard, and I find out that Laurence went through my desk, looking for the placards.*

[23] ATC, or the Applied Technology Council, is a non-profit entity tasked with creating technical analysis and advisory documentation to aid professionals in the design, rehabilitation, and evaluation of buildings for seismic safety. Largely through contractors with government, ATC develops bulletins or other publications that often form the basis of local practices. ATC-20 presents a method for post-quake evaluation of structures for re-occupation.

[24] ICBO is the International Conference of Building Officials, a predecessor institution to the International Code Council.

I get down there and he's commandeered the Xerox machine and the cafeteria room. They didn't have any idea about an EOC [emergency operations center] or anything like that, right, or a dock. They are printing on white paper yellow tags, green tags and red tags, and we're writing 'red', 'yellow' and 'green' on the top." [KI12:5-6,8]

Her experiences inspecting damaged properties in the aftermath of that event had lasting personal impacts. Firstly, she forged strong professional bonds and friendships with numerous other California leaders connected with all aspects of building safety – inspectors, engineers, contractors, and public works personnel.

"There kind of have been career-long bonds actually…We see each other on a semi-regular basis, too, because of that bond. I think it was ten years after Loma Prieta, the core group of people that worked together…we met in the marina on the tenth anniversary and had lunch together and sort of kicked things around. So, those are the people who go way back." [KI12:12]

Ms. MacQuarrie was left with haunting emotional imagery and recollections: the state of her own office building right after the quake, inspecting numerous un-occupiable buildings, and phoning owners of buildings that needed to be demolished.

Loma Prieta also changed the dynamics of interactions between building inspectors and the community, and how Inspectors saw themselves as potential agents of community safety.

"Then when Loma Prieta happened, it was really…Our job a lot is enforcing regulations that people see no reason for, really, even though, obviously, there's a huge reason for them. Costing people money, that's how the public looks at it. So, it becomes a grind after a while when you're doing that, very adversarial. So, for the first time in four years in my career, people were like, oh, please, come inspect our house! Please, tell us everything's okay… We felt incredibly useful and needed..." [KI12:9-10]

Building inspectors started to turn those new motivations, professional connections, and positive reinforcement from the community into policy activism:

"…we worked on a lot of response. After you do that kind of response as basically a seat-of-the-pants operation… [Laughs] We're like, okay, this will work this time, but if we ever have another earthquake and we're this unprepared, we're in big trouble." [KI12:14]

Ms. MacQuarrie was more eager and capable of taking action on the soft-story issue than a typical Building Official, but she found herself unable to do much with the list at first. Ms. MacQuarrie described her first year or two on the job as focused on organizing, expanding, and training a department that had been in disarray for years. Fortunately, a surge of new construction and the booming dot-com Bay Area economy brought in needed revenues and a sense of possibility to the starved department.

> *"Arrietta comes with the message: 'You have to do something about this.' And she's working in the city manager's office, and I agree with her concept, but I'm like, are you kidding? I can't do that now. I don't have any staff to do it with. I have much more immediate and basic problems…the timing was terrible. So, it went very slowly at first…I had to staff-up the division. We had a very small staff at that point. We had an under-trained staff…and the workload doubled." [KI12:59, 12:65-66]*

An important step forward was achieved in 2000 with the appointment of Dan Lambert to head Berkeley's URM programs. According to staff that I interviewed, the URM program had fallen into disarray (or perhaps, rather, it had failed to ever take off), with tens of buildings still awaiting evaluation or repair years into the program's existence. With a good working knowledge of city politics and infrastructure as well as a background in both housing advocacy and construction, Ms. MacQuarrie felt Mr. Lambert was an ideal person to head the effort.

> *The first thing I finally did to get this thing moving was to hire a management analyst to work on both the URM program and the soft-story program, and that was Dan [Lambert]. In him, I found the right person in terms of the skill-set. Originally, the job was slated for an engineer. Well, most engineers are not good program managers, and I needed somebody to manage the program. Dan has an interest in housing, an interest in safety, he has a background in politics, and he worked in the city already--at that point for 15 years--so he understood the lay of the land, which I didn't really understand. [KI12:60]*

Lambert had been involved in seismic safety issues since around 1990, when he worked in the Planning Director's office on the transfer tax rebate policy and Alan Goldfarb's other projects. During the 1990s, he had participated in many of the efforts including the soft-story survey and the upgrade of the public buildings.

Gaining Momentum and Credibility by Involving Experts to Confirm the Hazard

Around 1999, this trio began discussing what do with the Inventory, and the idea of passing a mandatory retrofit ordinance was born. The trio had a strong ally in Tom Tobin, who had already helped bring the City of Berkeley together with FEMA and UC Berkeley. For some

time, Ms. Chakos had been working with the STAG, of which Mr. Tobin was a member, as its members advised the city on its seismic safety efforts. As the renovation and construction of the new city buildings wound to a close, Ms. Chakos and Mr. Tobin saw the soft-story housing issue as the next obvious thing to work on. In effect, the STAG transitioned at this point from assisting the city on retrofitting its public buildings to considering how the city could tackle the problem of vulnerable private buildings, especially *housing*.

> *"I frankly don't remember exactly how we started. Arrietta's the one who brought the list to my attention… We kind of revived a piece of the Seismic Technical Advisory Group. I think that [was when] Tom and Arrietta and Dan and I started talking about what the next steps were.*
>
> *At some point, we decided the next steps were to get some student interns in here and see if they could do a project and validate some of the data that we have, so we hired three graduate students." [KI13:1]*

The purpose of hiring student interns in 2000-2001 from UC Berkeley was to clean, digitize, and organize the data as well as to perform basic analyses. The students used tax assessment "property cards" to compile and update all possible administrative data about the buildings. While the students were successful in organizing what the city knew, this also led to a feeling that the city did not yet know enough in order to promulgate a mandatory retrofit law. More information was needed before a regulation could be crafted and supported politically. In particular, none of the parties had direct working knowledge of the original Inventory, namely, how it was produced or what kind of information it represented.

> *"Those were simply walk-by, sidewalk inspections, done very quickly by one person, and the data was old. So, we didn't really know how good it was." [KI13:8]*

As Mr. Lambert, Ms. Chakos, and Ms. MacQuarrie began to familiarize themselves with the Inventory and plan for precisely what the interns would do, they invited Jim Russell back to consult. He saw himself as in the position of educating the BID staff as to what he'd been looking for when he first made the list.

> *"I sort of helped them understand what was in the data, how I had crafted this form, what criteria we used. I think I took them out and showed them some buildings. I'm not sure that they fully appreciated all those things. They were still students, basically. Although they were all very bright students, they had really no experience of doing this. I remember going out with them on a couple of field trips." [KI6:79]*

Digitizing the data was a top priority, as it was stored in an unwieldy, paper format unsuitable for the purpose of policy analysis.

> *"The data was on paper…so, that was part of what the interns were doing. They were taking the paper data and trying to put it into some sort of database that would allow you to sort, cut and paste, look at things and figure out how you would… Clearly, when you have that large a number of buildings, you would have to have a phased approach to say, 'Okay, which buildings are the most vulnerable and most important, and which ones are the least? What sort of sorting mechanism do we used to put things in different bins?' That needed to be done." [KI6:73-4]*

The Walk-About: Verifying the Risk with a Second Street Survey

Eventually, an idea surfaced to expand the role of UC Berkeley students and to collect even more data, as well as validating and lending professional credibility to what the city already had. The idea was to bring in practicing engineers who were affiliated with either the Earthquake Engineering Research Institute (EERI) or Structural Engineering Association of Northern California (SEAONC) to walk around, view, and "evaluate" a large sample of buildings on the Inventory with groups of students as a volunteer event. The event is affectionately referred to by participants as "the Walk-About". By doing this, the city could advance multiple objectives all at once while also doing public service for an even larger group of students.

> *"Arrietta [Chakos], I think because she was a member of EERI, maybe Joan [MacQuarrie] was as well, they said, 'Why don't we get EERI to join forces with the City of Berkeley and do a little walk around on a Saturday, look at these buildings and help the interns understand more about it with some professional engineers?'...Tom Tobin was a member of EERI. I think that there was just an interest in getting that organization involved, so that there would be more benefits to City of Berkeley. If you could get volunteer time from very experienced professional engineers, that can't be a bad thing. I think that was the thinking.*
>
> *We spent hours and hours and hours developing how we were going to do that, what we going to do, what we were going to ask people to do, who was going to make the calls to try to get people to come. All of that, I think probably was worthwhile, but it was an enormous amount of effort." [KI6:80-81]*

Eventually, two Saturday events were held the fall of 2001. Twenty to thirty UC Berkeley master's students teamed up with volunteer practicing engineers recruited from among SEONC and EERI members. Several of the top structural engineers and engineering companies in the region participated. Each team paired at least one licensed professional with two to three

students, who then together walked the city streets looking at and categorizing a subsample of about 150 of the previously inventoried buildings. Detailed efforts were made in advance to establish a form to record and check each building's data, using ATC-21[25] as a model procedure. Also, the group decided to experiment with the use of Palm handheld devices as a navigational and data collection tool, a new phenomenon at the time in the profession of planning and building safety inspection.

Over the previous summer, the coalition developed a strategy to have the interns create and group the buildings into structural "prototypes" – eventually four or five in total – which could be evaluated along with a rough for estimate of how much a typical retrofit would cost. Partners in a major local structural engineering firm (Dames & Moore) volunteered to evaluate the prototypes.

To all participants, the Walk-About seemed like a winning idea. For the city, it provided a more recent, richer, and active understanding of the properties on the list. A number of key policy analysis questions could now be answered, such as how many of the properties might be un-usable after an event and whether mandating retrofits would lead to a large loss of parking (the data suggested fewer than two percent of the properties would lose parking). Second, the Walk-About increased the credibility and visibility of the entire policy development process. By getting a number of prominent academic and practicing engineers to participate in evaluating the risks posed by these structures, the Walk-About substantiated the less-transparent determinations made by Mr. Russell and Ms. Hall over five years earlier. In that sense, the Walk-About was redundant. But, even though not all the buildings were evaluated, the judgment of the professional volunteers and academics were viewed as more "independent". All were highly respected members of the earthquake safety community. The students all enjoyed and benefited from the field experience and close contact with practicing professionals. Several ended up getting hired at firms whose principals had volunteered for the effort.

Third, the Walk-About provided a new piece of information about the buildings which was absent from the initial Inventory: some conclusions regarding the relative risk posed by each of the properties. The original Inventory was never intended to distinguish degrees of risk, but it was becoming clear that some kind of risk assessment would enable the coalition to both justify and target a regulation.

> *"The recognition -- probably from Arrietta -- was that we've got like 600 buildings. This was four times as many as the unreinforced masonry, or thereabouts, roughly. So, it was going*

[25] The ATC-21 report, *Rapid Visual Screening of Buildings for Potential Seismic Hazards: A Handbook* (Second Edition, FEMA 154; published in 2002 but available informally prior to that) describes a procedure for identifying buildings that might pose serious risk of loss of life and injury, or of severe curtailment of community services, in case of a damaging earthquake. According to the Abstract, "The screening procedure utilizes a methodology based on a "sidewalk survey" approach that involves identification of the primary structural load-resisting system and its building material, and assignment of a basic structural hazards score and performance modifiers based on the observed building characteristics. Application of the methodology identifies those buildings that are potentially hazardous and should be analyzed in more detail by a professional engineer experienced in seismic design."

to be an enormous program, and they knew that they were struggling to get things done with the unreinforced masonry buildings. That program had run into a lot of resistance.

I think that they thought, well, we've got to chop this into smaller pieces somehow. We can spread this out over a longer timeframe, or we can say these buildings need to be first because...they're big, they have a lot of people in them, they have particularly bad configurations." [KI6:77]

Ultimately, the Walk-About allowed the coalition to project performance during a scenario earthquake for a large sample of buildings on the list. The results were articulated using the familiar "green tag", "yellow tag", and "red tag" monikers, describing whether the building would be usable immediately, usable with repairs, or un-usable following a major quake. This vulnerability assessment would come to play a prominent role in future communications both internally and with the public. It was one of the facts cited in the ordinance [KI16:3].

"[The Walk-About] was about getting some more information, but really we had the engineers 'rate' the vulnerability of the buildings. That became like the key thing, the key driving data that people had a hard time sitting back and saying 'no we're not going to do anything about this' when we showed that probably 90 percent of the buildings would have to be vacated at least temporarily." [KI2:16]

In retrospect, participants noted a few downsides to the Walk-About as well, primarily that so many resources went into duplicating efforts already made and the delay it created. In execution, one participant concluded that the effort to experiment with evaluation criteria and forms and the use of handheld (Palm) computers as a field data collection experiment may have been an unhelpful distraction.

Internal Politics: Sorting Out the City's Authority, Capacity, and Will to Act

The Walkabout did generate momentum towards passage of a regulation. It provided local specific data that built upon the already well-documented case that soft-story buildings are a real life-safety concern and the high probability of collapse or of not being usable for months or years makes them a serious issue for community character, economic stability, and recovery capacity as well. Economic resilience of the community and housing stock stability were also important factors – collapsed buildings would probably lead to blight, loss of affordable housing, and loss of community continuity. These were two main reasons why proponents felt deeply compelled both morally and professional to push the issue as far as possible towards a solution. Proponents also were arguing that retrofits would lessen the need for post-event emergency response and recovery resources. This gained them allies in the Fire Department and Disaster Commission. Various other city commissions (Housing, Landmarks)

react favorably to the idea of mandatory law but no obvious "champions" arise among these elected and appointed community leaders.

As discussions progressed towards the idea of an actual ordinance, many interrelated questions remained: how difficult would it be for owners to comply? How far should the law go? To what standard should owners be required to retrofit? Other stakeholders began to get involved, and the law's proponents in turn began to react, rethink, and try to troubleshoot around them.

Ms. Chakos, Ms. MacQuarrie and Mr. Lambert consulted the City Attorney's office. Their position was that the city had no obligation to act on the list but was authorized to do so under its mandates of police power and to uphold public safety. They did produce a "disclaimer" that in effect limited an owner's ability to sue for "slander of title".

Support for a law began to grow among Planning Department staff and at the management level. Since the early days of the effort, the planning department had been reorganized and was under new leadership. Despite a favorable view towards the policy concept, Department leaders felt it was their responsibility consider whether and how to find resources for administering a new program. Was there enough internal capacity, skills, and interest to make this issue a priority over other pressing concerns?

> *"In this case, we had to do a lot of convincing on the inside. On the positive side, our city attorney was never really worried about liability with these lists and about our city doing anything about them. That was extremely helpful, that they weren't nervous, because, on the policy side, the city manager and the planning director were very concerned about getting out in front on that. There was really not much or anybody to model on or anybody to point to. We were going to be sticking our necks out first. So, we basically did kind of an internal education process. We did some presentations to major department heads." [KI2:11]*

> *"I remember with the department heads, we did some things. I set up some tables. We set up some Jenga sticks in a conference room table and I made like a…I set up a little paper shear wall with some hard paper cardboard stock with two edge tape on it so we could just stick it on there and see how much more resistance was there. So the first thing was set up so they'd like touch it and it would fall over. And then you just take this piece of paper on there, and see how much more resistance there was. A little practical demonstration of what we were trying to accomplish." [KI2:18]*

The number one concern of everyone involved at the city was to minimize the burden to owners while still advancing public safety meaningfully. The trick was to determine a course of action that was feasible – politically, bureaucratically, economically, and technically – as well as and maximally beneficial relative to the city's many goals.

Proponents perceived the main limitation to be economic. If the law placed an excessive burden on owners, not only would such a proposal be unattractive politically, but it could also undermine a central aim of the law – namely, housing stock stability. Owners might turn to state laws that permit them to demolish their buildings in such cases, rather than do the repairs. Concerns about this were fueled by lack of information and uncertainty about how much a "good" retrofit would typically cost.

> *"We didn't have any reliable data on cost to retrofit for the owner…Cost was a critical part of the political formula because no council person would impose that on people without knowing what kind of burden it would be". [KI13:18-19]*

A closely related issue was lingering uncertainties regarding precisely what owners should be required to do. Scope issues included whether condominiums should also be included[26], how much of the building should be retrofit (i.e., just the first floor weaknesses or any and all seismic vulnerabilities that are identified) as well as what codes or standards should be referenced in the analysis of the building. These choices were seen as politically important, again, because they spoke directly to how much public good the law would do and to the burden on and inconvenience to owners. Proponents had a high level of concern that the law should not be excessively costly or onerous for owners.

In light of these hesitations, proponents came to view their two top priorities as: (1) justifying and documenting the risk and potential societal impacts, and (2) minimizing or otherwise address the economic burden that a mandatory retrofit law would impose on owners. In particular, proponents tried hard to find a source of funding or some kind of financial incentives or mechanisms to help owners pay for the needed upgrades. They had two main approaches. The first was to bring the issue to the Rent Stabilization Board (RSB), asking the RSB to consider the issue of how the Rent Board would handle owner expenditures for retrofits. At the time, the Executive Director was Jay Kelekian, who had (re-joined the RSB staff in 2001). The RSB was in favor of the idea because of concern for tenant safety but was reluctant to make special exceptions for pass-through of retrofit costs.

No Incentives for Owners Leads to Downgraded Policy Ambitions

The second ideas was to try to make a pool of funds available to owners through a transfer tax increase measure on the November 2002 ballot, but it failed to get the required two thirds vote. Participants in retrospect considered the campaign as "poorly run". But, the failure was interpreted from the outside as a signal that the political tides had turned away from supporting the mandatory retrofit concept.

---

[26] The City of Berkeley, as a policy matter, has discouraged condominium conversion of apartment buildings. Thus, there are not many older condominium buildings in the City. Ultimately, condominium properties were not officially included on the Inventory, though some apartment buildings were converted to condominium status in the middle of complying with the law.

"…Originally, we were trying to go all the way for a mandatory retrofit but we were hung up on incentives. We thought we needed some help for the owners, and, so we came up with the idea of increasing the transfer tax and targeting that for these retrofits. We put that on the ballot in November of 2002, and it needed 2/3 to pass because it was a special tax and it got like high 50s if I remember - more than a simple majority but not the super majority. So it didn't pass.

We went back to the drawing board. We thought we'd have a hard time, certainly getting accepted in the owner community, without the money, and maybe problems with the Council. Ultimately, we came up with the idea of dividing it into two phases. You know, we never said we were not going to do the retrofit we said we were going to do two phases. The first phase would be the study and the notices, and the second phase would be the retrofit program." [KI2:21-22]

Therefore, despite a successful effort to document the risk and to build a coalition of support for a mandatory retrofit law, the idea of pursuing a mandatory retrofit program was left aside in favor of a "two-phased" approach which would start with requiring evaluations, later to be followed with mandatory upgrades for any structures found to be deficient. The coalition felt that without a financing option for owners a mandatory retrofit law would excessively harsh and therefore infeasible politically.

This was a major shift in the policy concept that had distinct advantages, disadvantages, and implications. Backing off from the idea of imposing immediate mandatory retrofits had the obvious and immediate effect of diffusing internal resistance and boosting stakeholder support. The new proposal seemed easy to justify (and the retreat made it seem like a *concession*).

Another implication was that the aims and justifications for the Phase 1 law shifted and expanded substantially to focus on two nearer-term objectives: (1) creating market pressure on owners to do voluntary retrofits through a program of informing tenants and informing and intimidating owners, and (2) to collect information that would further justify a second mandatory retrofit phase.

"I think what [Berkeley's soft-story program] did was [rely] on the fact that typically people who have information about disaster risk will act in some way to reduce that risk. Having the requirement for an evaluation of the building-to clarify if it is or is not a soft story, and then to figure out what to do if it is a soft story-was the smart [way to go].

It also relied on, in a non-typical way for Berkeley, on market forces, so that people who owned these buildings would look at the necessity for protecting their investment once they have that information. That's what we were relying on as impetus for retrofit." [KI1:45]

"The other rationale for [requiring evaluations first] was it would allow us to get information on these buildings. By having these reports, we'd actually have information on these buildings, real information, which could help possibly inform the retrofit law. And it would clearly identify, from a political point of view…the people who were going to be affected. We wouldn't be having a broad sweep out there where every property owner in Berkeley is going to be like "Oh my god, they're going to make me retrofit my building." We were going to have more like 2 or 3 hundred buildings, and we've already got engineer reports that say there's a problem, and it should be fixed. So then there's no question, there's no argument – 'course, there always was with the URM program, where owners would say, you know, "it went through Loma Prieta so it's fine". That was part of the reason, the advantage, of the having a two-staged process." [KI2:22]

"The advantages of the phased approach were becoming evident, the fact that it helped you handle the uncertainties that were still out there, got you more information and started the city down the path that you knew it needed to be on." [KI13:62]

In some ways, this scaling back of the policy goals was problematic, because a mandatory study does nothing directly to further the original stated reasons to create a policy. Proponents wanted to increase tenant safety, reduce emergency response and recovery demands, and improve housing stock stability by physically reducing collapse hazard in as many buildings as possible. Mandatory evaluations are an intermediate step towards those objections at best, and offer no guarantees of any of them being reached.

This had implications for the level of RSB support for the program model. Prior to this point, the coalition had been negotiating with RSB staff about the possibility of easing the way for owners to claim special permission to adjust rents upward to help pay for retrofit costs. To RSB staff, the idea of helping owners re-claim costs from tenants for an evaluation that in itself does nothing to strengthen the building was a "non-starter".

To be clear, owners are permitted under both state and Berkeley rent control statutes to file an individual rate adjustment claim for monies invested in the seismic safety of the structure. However, because of vacancy de-control[27], turn-over, and the net-operating income cap which is linked to how much the property was earning back in 1980 when rent control was first established, most Berkeley landlords are not in a position to claim any additional adjustments, even for "eligible" capital expenses. Thus, they only way for an owner to receive financial help from tenants would require a change in statute by the RSB that would either

[27] Full vacancy de-control occurred by California state law in 1999. Owners are permitted to rent out vacated units at "market rate", which becomes the new base rent, then for the remainder of that tenancy rent increases are limited to the amount specified in the Annual General Adjustment allowance.

allow a special increase in rents on units that are now way below market rate, or to raise the net-operating income cap a little bit higher on this particular type of cost for a set period of time. In sum, it would take a change of law by the Rent Board to alter the financial equation for owners.

To summarize, proponents of the law targeted the policy features of Phase 1 at two near-term, intermediate goals: (1) fostering market conditions and an environment to promote voluntary retrofits, and (2) facilitating passage of a mandatory retrofit ordinance. In practice, these goals represent two different policy routes toward the longer term objective of completed retrofits. In turn, completed soft-story retrofits were envisioned to contribute to four ultimate community benefits: (1) increased safety (reducing the chances of injury and lives lost in future earthquake events), (2) increased local housing stock quality and resilience (through capital improvement and reductions in the likelihood of occurrence and severity of damage), (3) reduced need for city services during and following earthquake events, and (4) policy innovation and spread of the policy approach beyond the soft-story building type and beyond Berkeley's borders (proof of concept). Finally, in developing the policy, proponents thought carefully about how to balance the burden that the program placed on property owners and the city's use of resources against the social benefits that the program could achieve. Minimizing the resources expended by city staff and not making the law too onerous for owners were high priorities.

Figure 27 shows a diagram of the program logic model which links the overall policy goals, policy features and implementation activities with the desired intermediate and long term outcomes, thereby showing the approximate process through which proponents hoped those outcomes would be achieved. Note that this diagram was derived from the key informant interviews rather than something that the policy proponents ever drew or articulated at the time.

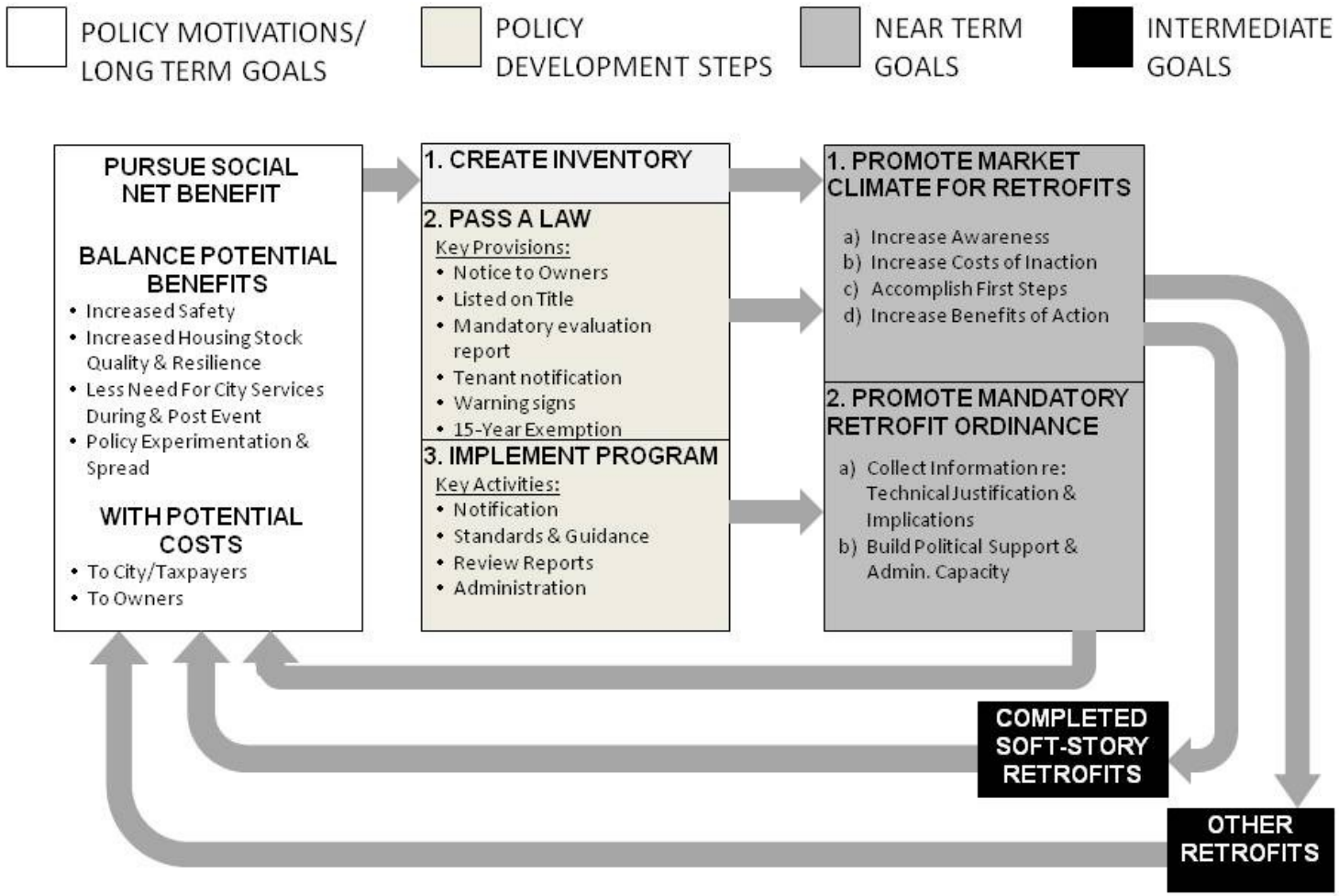

Figure 27. Program logic model for the BSSO, as derived from key informant interviews.

Taking It to the Community

City officials had along the way initiated discussions with owner groups such as the Berkeley Property Owner's Association (BPOA) and the Black Property Owners' Association (now defunct). However, stakeholders from the general community had previously played almost no role in the policy development process. Opportunities for public participation were limited to the public hearings of Berkeley's many commissions. Mr. Lambert spoke of the strategy and role of citizen education and involvement early on in the process as follows:

> *"…we were using the commissions. The Housing Advisory Commission, the Planning Commission, and the Rent Board, and the Disaster Council of course, became other advocates, so we worked with those commissions extensively. We went through the same kind of presentations with them, you know, here's the problem and here's what you can do about." [KI2:20]*

By 2004, the coalition found itself in a position where sufficient technical groundwork and political momentum had been achieved to take the program idea "public" via communication with politicians and other stakeholders. Once BID staff were ready to take the law to Council, their outreach efforts became more proactive and public. These activities culminated with a Community Forum that took place on February 24, 2005. The Mayor, Tom Bates, was invited and agreed to emcee the event, which was held at the North Berkeley Senior Center.

Participants recollect that about a hundred people attended, mostly owners but also some engineers. A small panel of experts gave presentations. Tom Tobin of the STAG gave a talk entitled, "Consequences of Earthquake Damage to Soft Story Buildings." David Bonowitz, a local structural engineer and expert on rehabilitation codes gave a talk about vulnerable building types and their prevalence, and how they can be repaired or upgraded. Ms. MacQuarrie and Mr. Lambert presented the policy concept. Figure 28 shows the program's stated goals, as articulated by program staff at the community meeting.

BERKELEY'S SOFT-STORY PROJECT GOALS

- To accurately and thoroughly assess vulnerability
- To raise community awareness of the risk
- To recommend a plan of action
- To retrofit buildings and protect our community
- To serve as a model for addressing other vulnerable buildings in Berkeley and to other communities

Figure 28. Program goals as articulated in a public presentation by program staff at a February 2005 community meeting.

Key informants recollected that owner responses at the meeting centered on concern for costs, rent control, and implications, with few objections regarding the need for action. At the time, the coalition took the meeting as a very good omen.

"I think the real turning point…was the community meetings that we had. [By 2004 or 2005] it was obvious the community was going to support some improvement ordinance of some sort, and that people were not going to be totally opposed to a sort phased-in approach on this…There was a great meeting that we had at the North Berkeley Senior Center when we had other colleagues from the hazards community. Tom Tobin and David Bonowitz, along with Joan MacQuarrie and the mayor made presentations about the risks involved with all of these buildings, and what we could be doing to make the community safer. It was at that point that I knew that the ordinance would go through, that the Council would support it." [KI1:43]

Stage 3: Program Activities and Implementation

After the successful Community Forum, the Berkeley City Council appeared certain to soon pass a mandatory evaluation law. BID staff worked to finalize the details of the ordinance's features and prepared a formal report to Council containing their recommendations. Practical concerns that had been lingering for some time now had to be reconciled in the light of the mandatory report focus. That August, Hurricane Katrina ravaged New Orleans and the Gulf Coast, keeping the issue of community vulnerability to natural disasters – as well as government ineptitude in areas of disaster prevention – on the front of everyone's minds.

Choosing the Standard and Ordinance Scope

BSSO proponents knew that practicing engineers would need very clear guidance on what kind of information should be included in the mandated evaluation report. In fact, the clarity and scope of that guidance would be a critical determinant of how much progress would be made towards their goals of collecting useful information and advancing seismic policymaking by creating an effective precedent. To begin with, the coalition had all along recognized the need to reference a code or *standard* for the engineers to use in assessing the soft-story condition as well as in their proposals for a strengthening program. Standards are a critical element in the traditional governmental approach for intervening in how owners build and maintain private property.

"Probably the most disconcerting part of the whole thing had to do with what do you retrofit them to -- I mean, all of my confidence in structural engineering said, "Oh, yeah, we can do that. [Engineers] could do it, and if I was hired by somebody to do that, I could fix their building for them… [but] you go to the building official. The building official says, "What is it that I require? What do I check against? How do I say yes or no?" It's a

whole different look…This is a police power, right? How do you exercise your police power? You need some standards. You need fairness. You need consistency." [KI5:82-83, 88]

Additionally, standards for retrofit are inherently different from codes for new construction. In many cases, it would be impossible to remodel or repair an existing building so that it complied with all new code elements without making the rehabilitation economically infeasible or possibly even forcing the owner to demolish the property and start over. There's a strong tradition in building regulation that buildings that meet the standards as of when they were built are considered acceptable to occupy until the owner initiates something like a change in occupancy, a major addition, or a renovation over a certain threshold dollar value that then triggers the need to make code updates. Proactive retrofit requirements are relatively rare. Standards, therefore, often reflect a "middle ground" level of assurance that the rehabilitation of a particular building feature is deemed adequate for the basic life safety and public welfare purposes that are the primary basis of the public's right to intervene.

Representatives from the Structural Engineer's Association of California (SEAOC) in their commentary to the ICC summarized the compromise aspect implicit in retrofit codes as follows:

"The provisions in [the] chapter are intended to reduce earthquake risks by preventing concentrations of drift and structural damage in the vulnerable first stories of typical wood-framed SWOF buildings. These retrofit provisions are not intended to provide structural performance equivalent to that provided by new construction built in accordance with the IBC. [emphasis added] Model building codes for new construction intend to safeguard against major structural failures and loss of life or, more generally, to safeguard the public health, safety and general welfare. Modern code-based designs can be expected to prevent structural collapse, limit structural and nonstructural falling hazards and provide safe egress. In addition, due to inherent conservatism, code-based designs can also be expected to offer some measure of damage control or repair-ability.

To meet such a standard, an existing SWOF building would require comprehensive investigation, testing and analysis, possibly followed by an extensive structural and nonstructural retrofit. Instead, the Chapter A4 provisions aim to 'reduce the risk' with significantly less design effort, construction cost and tenant disruption. Risk reduction does not take a comprehensive approach to life safety, does not aim to protect property or function and is not equivalent to new construction under the IBC. For many owners, tenants and jurisdictions, however, this risk-reduction approach represents an acceptable trade-off." (ICC 2009)

Staff researched and consulted extensively with local experts, and settled on Appendix Chapter 4 of the International Existing Building Code (hereafter, IEBC A4). The 2003 version was cited in the actual ordinance, although standard three-year updates to that code (i.e., 2006, 2009) were to be used once available. IEBC A4 is a document that evolved from a predecessor, the *Guidelines for Seismic Retrofit of Existing Buildings* (GSREB), which in turn was based on standards developed by experts for particular California cities (Los Angeles and Fremont, California) following Northridge. Importantly, the distinctions between the newest rehabilitation codes and those produced just five to ten years earlier were largely unknown to the average practicing engineer.

> *"…the IEBC A4, that was just coming into being at that time. UBC was still being used, [and] then the Uniform Code for Building Conservation, UCBC, also had some standards. They weren't the same. I mean, you could never understand what [the top experts were] talking about, what the differences were, why this was better than that or that was no good. Then, once you got one engineer to say, 'Okay, we'll use this,' then, somebody else saying, 'Well, that doesn't make any sense,' because apparently, [the existing codes] were flawed." [KI5:91]*

Choosing to use IEBC-A4 resolved some issues from the standpoint of meeting the need a specific set of analysis procedures and rehabilitation standards for owners and their engineers to follow. It was an "off-the-shelf", readily available solution to this need for a standard, and it represented the most recent consensus thinking among experts, which contained important improvements and insights gained after the Loma Prieta and Northridge events. However, it was also standard so infrequently used that most practicing engineers would be unfamiliar with it. Later on, this may have contributed to a steep learning curve and early difficulties in the report review process, a point I will return to elsewhere.

Another limitation of IEBC-A4 is that it only addresses soft-story buildings whose walls in the critical story are wood light-frame, not concrete or masonry. Staff had to debate whether and how the concrete podium, tilt-up, and mixed concrete and wood buildings on the Inventory would be treated. Evaluations for those buildings would need to reference a different standard, but the local experts that BID staff consulted thought the existing standards for concrete rehabilitation would not be a good fit for a program based on wood buildings and small budgets (in part because those codes were developed for large concrete buildings and often involving complicated analysis). Eventually, proponents decided to *delay noticing* the concrete buildings from the ordinance until a suitable solution for the retrofit standards problem could be found. That explains why the number of buildings noticed was 317, not over 400. To date, this issue remains unresolved.

> *"Although the buildings with concrete or masonry ground floors had been in the inventory, we decided just to work on the ones with the wood-frame walls and diaphragms, because those*

seemed to be the worst hazard. There wasn't an easy-to-understand standard for the concrete ones.

At some point, we also had a discussion with…[local experts]… about what standard we should use [for the buildings with concrete first floors]. There is a NEHRP[28] standard, actually, [which is], as I understand it, I guess you'd say a more elegant standard for rehabilitation, for retrofitting these buildings, but most engineers don't understand it. So, in order to make this work, we went with the IEBC standard." [KI13:21]

Producing the "Framework" and Planning for Technical Review of the Reports

> *"The Building Official shall provide guidelines delineating the standards for the use of IEBC Chapter A4, including amendments for buildings with concrete podia and non-wood-frame ground floors, and for filing the report required by this ordinance. The guidelines shall provide details for items required in the report, procedures to be followed, and a framework for both the assembly of the required information by the professional and for the evaluation of the report by the city." [Berkeley Municipal Code 19.39.030-B]*

As is typical for highly technical regulations, the actual ordinance assigns to staff the administrative responsibility to provide specific requirements and guidance. In the case of the BSSO, BID staff decided to hire an outside contractor to create a written "Framework" for their own reviewers and the owner-hired engineers to follow. They first approached a local plan check company with strong UC Berkeley connections – Linhart Petersen Powers Associates, or LP2A – that already held a plan-check contract with the City of Berkeley. When LP2A declined to take the contract, perhaps sensing that the task was slightly outside their business model, staff asked other local experts to recommend qualified persons or firms that could do it. Ultimately, the city awarded the contract to the firm of Ficcadenti, Waggoner, & Castle. Tom Castle was the principal engineer on the project.

> *"[Joan MacQuarrie] came to Kevin Powers [of LP2A] and asked him…to help write the ordinance. Kevin…decided he was going to hire somebody else to do it, so we subcontracted it out to Tom Castle at Ficcadenti Waggoner & Castle…Tom was the one that drafted it up, then that's where it kind of got removed from our company…[The City of Berkeley eventually] called us back in because Tom didn't want to do the reviews. He's a designer still*

[28] NERHP stands for the National Earthquake Hazards Reduction Program, a federal collaboration among several agencies to coordinate basic science, engineering advancement, and technology development and dissemination related to earthquake safety.

and he wanted to get on the design side of it. He figured that there would be business on the other end, that he would be able to do some of the upgrades and some of the reports and stuff.

[Tom] was still retained as kind of a consultant to the city as a third—not a disinterested—party, but somebody that was removed from the work that we were going to be doing versus what the engineers were submitting and the city.

About that time, we had a meeting, sat down. Tom was there, the city, some other people. We all went through and decided, here's the ordinance. This is what we're going to be requiring. They started laying out how we were going to process things and what we were supposed to be looking for." [KI7:2-27]

One of the key aims of providing a Framework was to guide engineers directly towards the type of analysis, the level of detail, and the specific content and format that BID staff desired. Program managers hoped that this would raise the bar for the "average" submittal and also minimize the variation in quality and details provided across all reports.

"…[program staff] expressed…their concern that they had done some previous retrofitting standards for unreinforced masonry buildings and that they were a little bit disappointed with how that played out, that they got a big variety of responses from short one-page letters and everything's OK… [to] a big report with some plans and there was no standard for them to judge what people should be doing and they didn't want to make that mistake again. So they wanted to be very clear with the owners as to what was expected of them to comply with the ordinance." [KI20:7]

BID staff – and the consultant hired to produce the Framework – were genuinely concerned about minimizing the burden on owners. They saw the Framework as the place to look for a balance between the desire to collect useful information and the owner's legitimate interests in minimizing costs and obtaining some value from the process.

"…The document that [the Framework] was based upon was the IEBC and that that code…it's an imperfect code at best and it was generally vague about how much of the structure you had to look at…so what we had to do was interpret it in a way that was less burdensome and so we concentrated on just the first floor of the buildings and gave a lot of outs to the owners so that they didn't have to investigate the upper floors which would have been more expensive to go through and do.

We also…had an eye towards not producing a complete set of repair plans but rather things on eight and a half by eleven sheets, sketches, conceptual but useful. It would be the kind of the

first step that we would take if we were asked to do a retrofit…kind of a blueprint as to where to go, without actually going there. So that was kind of a scaled-back version of a full set of repair findings.

So then…there was a little bit of talk about do we make the people bring in a contractor to get a price to do this and the thought process was, no, that was going to be even more burdensome cause then you'd have to bring in another professional that they would have to hire and that would drive their costs up. So we didn't do that. And what we did instead was to request that they say, well, how many square feet of plywood or how many pounds of steel that you added in the thought process that you could interpret that later as oh, we know, so many dollars per square foot for this." [KI20:18]

Another overtly stated goal was to obtain information about the buildings in a manner that would be helpful to proponent's ambitions to pass a mandatory retrofit law.

"…One of the pretenses to the ordinance, as I understood it, since it wasn't a mandatory retrofit, was to have the city gain an understanding of what was out there so that they could make a decision about whether or not to institute a mandatory retrofit." [KI20:15]

"We decided that we would just ask for the studies, in an effort to find out further if our sidewalk observations were valid and hopefully to get some information on retrofit costs." [KI13:23]

Two Laws Are Passed

City of Berkeley officials had some concerns regarding the city's empowerment under state law to require evaluation and eventual retrofit to standards that were "less than" current code. So, supported by STAG member Mr. Tobin, the City of Berkeley lobbied for passage of an amendment to state law allowing cities to enable that kind of local policy. These concerns were based in part on a rumor about the City of San Jose's experience with trying to pass a soft-story policy.

"San Jose had tried something like this because they had a red-hot emergency manager, Frannie Edwards, who pushed for San Jose to deal with its tuck-under parking kind of buildings… they have an inventory. They did studies. They had some FEMA money to do this. [They] had retrofit techniques, developed sort of standardized solutions, and things like that. Rutherford & Chekene did the work…The city manager at San Jose was afraid of the politics of it,

and basically, told her she'd lose her job if she didn't stop doing this, and went to the city attorney who basically came up with this completely unsupported opinion saying that the city lacked authority and could be sued for doing this." [KI5:112-113]

City officials approached and convinced Assembly Member Loni Hancock, former Mayor of Berkeley, to sponsor the legislation known as Assembly Bill 304. It passed in November of 2005. Among the persons I interviewed, opinions were mixed as to whether this step was actually necessary or helpful.

"When AB 304 was written, it basically said cities are free to adopt IEBC-A4 or some similar accepted standard or something like that. It authorized retrofitting to a standard less than a current code. Whether or not that was really needed, I don't know. We had wanted that originally to be kind of a mandatory thing that would require it to be done. It was that it be like a URM law statewide of some sort. We got a measure passed that at least got signed into law. Whether it did a lot, I don't necessarily know." [KI5:117]

"We got that state law passed…to put our law in context, but also to give some reassurance to our public officials that we weren't going off half-cocked, in terms of our standards." [KI3:38]

One stakeholder saw value in getting the law passed as a way to sensitize state lawmakers to the soft-story issue. Their thinking was that incremental legislative action might pave the way for stronger action at a later date.

"At the state level, one of the techniques we've used in the seismic safety community is to get advisory measures through the legislature, and then warm up the legislators for an actual law when a disaster happens." [KI1:63]

After all this build-up, the soft-story legislation had an uneventful first hearing with the Berkeley City Council in October 2005, followed by passage of the ordinance on December 5, 2005. The final vote was eight in favor, one opposed.

"We got a 9-0 vote in favor on the first vote. On the second vote, one councilmember who is a real estate agent/broker and -- we didn't know it at the time, a soft-story business owner -- voted against it. I can't remember at the time what details made him switch over in particular. So it was 8-1; 9-0 was better, but the original vote was unanimous, and the second vote was still good. My original goal was at least 7 - I felt we needed that just to have a program, to show that it had the support of both sides of the

Council and it wasn't just one side or the other shoving it through. [It was one] of the factors that made the program successful, that we had the strong vote on the Council. We did a lot of work leading up…feeding and caring for the Council, keeping them informed of what we were doing with off-agenda memos and things like that. Arietta did a lot of that and they were well-prepared." [KI2:82]

Program Roll-Out: Notifying Owners and Processing Appeals

The Planning Department budgeted for less than one full time employee to run the program, which in practice amounted to about 10 percent of the Building Official's time and 50 percent time, on average, for a program analyst. At the peak, the analyst devoted 90-95 percent of his time to the program while developing the program and first rolling it out [KI2:44].

The first essential task after the law passed was to prepare official Notice and Orders to be mailed to the owners of the 321 listed buildings. In that effort, staff had to overcome antiquated, inaccessible, and inflexible database systems within the department. Eventually, staff chose to use an Excel spreadsheet as their primary record keeping document rather than the Departmental database.

"So we've got this list of 300+ buildings and we [have] to contact everybody. We had had the interns put together the contact information - maybe from RealQuest[29]. All the data from the original files were put into our HTE[30] code enforcement module. But we decided not to really use that module as the active database for various reasons, because of its quirky nature, it's so behind the time. Clunky. It's an old IBM system that had been [only partially] updated...it's not friendly for turning out letters and so on. Plus, the data from the interns was already in Excel. So we had the names and addresses and we prepared the notice and orders and went through legal on that and started mailing them…[starting] in Feb or Mar. We did maybe twenty a week, it varied up and down. I did just about all of it, maybe a little help stuffing envelopes. Write, create, print letters, do address labels." [KI2:96]

Not surprisingly, the initial mailings resulted in few bounce-backs (e.g., different owners, bad owner addresses and so on) so staff had to do further research on those. "We had issues

[29] A proprietary source for local property parcel information.

[30] HTE is the City of Berkeley Planning Department's customized database system for property and planning information.

with the buildings too, different addresses, multiple buildings onsite, some are on corners, and getting those kind of things straightened out took a little bit." [KI2:98]

During the first weeks and months after owners were notified, several challenges were encountered, some of which were predictable while others caught BID staff by surprise. Initial angry reactions from some owners were not surprising. Despite the public outreach that had been done, some owners were shocked to receive a notice with two pieces of bad news; these owners had no idea that their building was vulnerable to earthquakes, nor had they heard of the forthcoming policy.

The law provided for a six month appeal period, after which the tenant notification and signage requirements were supposed to begin and the clock started on the two year grace period for filing a report. However, BID lacked a clear process at first for processing appeals and reconsideration requests. How much detail and supporting evidence needed to be presented in order to have the request taken seriously? At first, several owners sent short letters that they wrote themselves. Staff responded by offering owners a "form" (downloadable from online) for reconsideration requests. A small number of owners eventually had to hire an engineer to demonstrate that the law did not apply to them. At least one owner officially complained that the law was an unconstitutional "taking" of private property.

> *"[Right away after the notices went out we had] a lot of owner contact and engineer contact. We had some seminars for engineers to train them, after the law was passed, but after we sent out the owner notices. Suddenly I had to spend a lot of time…I was sending more [notices] out, but the more you send out, the more phone calls. Property managers, owners…a lot of them were [arguing] why it didn't apply to them. Some of which were true and some weren't. Some of them were 4 units not 5.*
>
> *We made them file. We had a form, but we didn't necessarily insist that they use it. We tried to research it and come up with a conclusion and give them another chance, if we disagreed, to prove [to] us otherwise. A lot of others said they are not soft. And I said…you have to prove it. It was sad, but as it turned out we did not have many people who showed their building is not soft. I think less than five. There were a few early on, where they came back and said it's not soft-story. I think there are maybe two reports where it said they were not soft-story. It's too bad those people had to do the reports, but overall that came out well." [KI2:109-111]*

BID policy was to base removals from the list on owner-provided documentation, not on staff assessments, but staff did consult City records and made a few site visits that contributed to determinations [KI3:28-30]. Overall, city staff took the attitude that their job was to help people comply. That meant a lot of hand holding and customer contact. Ultimately, the program manager spoke with the owner, the engineer, or both for "an extremely high

proportion of the people who've complied, got building permits, or were taken off the list. I talked to a lot, a lot of people." [KI2:121].

All that face- and phone- time put the program manager at the forefront of communicating to owners about the city's motivations for the program and about the degree of hazard they probably were facing. In essence, he probably served as another persuasion agent and "myth buster", reinforcing the opinion of the owner's engineer.

> *"I always tried to explain the benefits of doing the retrofits to people, and encouraged them. Helping them understand what we wanted was really a big part of it. Really, it was like, 'I went through Loma Prieta without a crack'. I had to explain why that wasn't the same as a big one on the Hayward fault." [KI2:124]*

Some owners asked for extensions on the basis of family circumstances including major illness, financial problems, or the recent death of the owner or a co-owner. Deaths and divorces, in particular, caused enough uncertainty or ambiguity in the ownership structure to paralyze some owners from responding. [KI13:38]

Eventually, when the appeal period ended, Mr. Lambert was also responsible for recording notices with the County. In general, BID staff were pleased with how quickly and eagerly most owners complied.

> *"To me, the surprise all along was how cooperative the owners were in this. That was a pleasant and good surprise. People who didn't want to comply -- yes, we did get that one constitutional one and one or two other nasty ones -- but most people just ignored it…so [my job] was more like helping people comply, helping engineers know what to do." [KI2:112]*

Training the Engineers and Managing Early Confusions about What to Report

The second critical implementation task was to communicate the law's technical requirements to the engineering community. Two official engineer trainings were held. At the first meeting, held in Spring of 2006, BID staff and consultants presented the Framework and took questions about it (it was also made available online). They also handed out a list of the addresses of the buildings that were being notified. Several engineering companies took that information and created a mailing list for sending out marketing letters. (Staff did not provide owner names, so each engineer had to manually find each address in whatever public ownership records they could access in order to take that step). The second training occurred several months later, and emphasized more trouble shooting around interpretation of the Framework. In the fall, the BPOA sponsored several evening workshops where selected engineers were invited to present about the process of obtaining a report.

The official trainings were advertised in local professional bulletins and by word of mouth. They were attended by a total of 56 engineers, all local, with five different firms sending two to three engineers. Afterwards, a list of attending engineers was made publicly available to

owners, many of whom called asking for recommendations on which they should hire. Program staff were careful not to endorse any particular engineer.

Program staff and their consultants who orchestrated these trainings did not recall much initial controversy over the Framework, but each of the three engineers I spoke with said they immediately had serious concerns. Their questions mainly related to the precise scope of the analysis that would be required; would it be: (1) only the major first floor weakness, (2) all weaknesses of the first floor, or (3) all weaknesses of the property. Another issue was the unconventional prescriptions and in some cases "extra" work that the Framework implied the engineer should be doing in their analysis. For example, the 2003 and 2006 versions of IEBC-A4 required engineers to fill out a checklist, a provision which was dropped in the 2009 version after bring criticized.

For engineers, there can be liability concerns when an engineer "touches" the building, no matter how narrowly the professional contract is written, so some felt uncomfortable being told to do their analysis in differently or to include steps that they do not generally take.

> *"I received an email from [the SEAONC Existing Buildings Subcommittee]. It wasn't an email that was sent out [en masse]. Then I forwarded it to people that I thought would be interested in it, some of my engineering friends that I thought would benefit from knowing what's going on and how to get involved. So, we went to that seminar, and it was very useful. By that time, I [had] access to the ordinance. I hadn't had any projects done yet, but I saw some potential problems in the language of the ordinance. I wasn't alone…*
>
> *The question was asked to the building official, and she deferred it to one of her plan-check engineers who said, "No, we just want you to take care of the problem," which we all took as something that we could use in our reports, and I did for approximately one year. We had done about five or six reports where we have limited the scope of work to those problem elevations [meaning outside walls] of the building. They were accepted." [KI4:44-47]*

A substantial fraction of the owners got going on completing the necessary report promptly after receiving the notice. Owners who contacted engineers to do evaluations for them right after receiving notice may have been advantaged by acting so early. Towards the end of the first year of the process, some of the engineers I spoke with felt that the criteria for review and acceptance began to shift, becoming more burdensome.

> *"On one of the projects, a medium-sized [building that] was unusual configuration-wise… the problem was very localized to one part of the building. It really had no effect on other parts of the building that had apartments on the ground floor. Yet, when the plan checker, who is a very good engineer, took his time and*

he read through the ordinance and through chapter A4 of the code that it references to, he essentially saw the same discrepancies we saw when we first went to the city to talk about it and said, "Well, the law requires that you need to make all of the walls of that ground floor compliant with these provisions of the code, which meant that…there was just no way that somebody would spend that kind of money, remove all the finishes, remove the tenants or remove the finishes from the outside, retrofit the foundations…It was just not feasible." [KI4:13]

This sense of change speaks to the fact that all parties – the owners, the engineers, the program staff, and their contractor review staff—grappled in the first year or two with how to translate the law into action, in practical form. From the start, despite having the Framework, many engineers were not clear about what they needed to address in the report or why they were being asked to include certain things that were listed. Ultimately this resulted in a steep learning curve both for the engineering community and the reviewers. At first, most reports needed multiple reviews in order to pass. Here are some of the critical comments about the Framework made by engineers I spoke with.

"To say that [the Framework] had problems was to understate the case. It wasn't internally consistent. It had all kinds of issues. Probably the most damaging part was some of the engineering mechanics was wrong." [KI18:40]

"The framework is a little bit open to interpretation, the way it was written…. It was really evident, when people started submitting the reports, that people were not looking, the engineers were not reading this exactly the same, in terms of what was required." [KI7:32-4]

"[Staff] felt really uncomfortable, when they were doing the ordinance, about not having a code to hang their hat on, that they needed to come up with…They couldn't just pull it out of the sky and say, "This is what we're going to do," because somebody might question it from a legal point of view or something. So, they went to the International Existing Building Code.

I think they tried to shoehorn that thing into the ordinance, and it didn't quite match up real well. There's some specific requirements about what you have to do in there versus what was required in the ordinance. [Staff tried] to justify some things by referencing that, and it wasn't really applicable sometimes. In some ways, they would've been better off coming up with just something right out of the sky and saying, "This is what we want." [KI7:107]

The program's goals were broader that what a traditional building owner client might ask an engineer to do. Thus, what the engineers expected to do for their clients was not necessarily everything that the city wanted from the report. The disconnect between those two things was confusing to both engineers and owners and created communication problems between them. Some owners were saying to themselves, 'why would the city make me do something that an engineer thinks is useless?' And the program staff and their reviewers were saying, 'Why won't the engineers just tell us what we asked them to?' Both sides were left puzzled.

One thing that engineers were particularly confused about was the scope of the analysis that was required. Did the assessment need to address all potential weaknesses of the property or just the soft-story condition on the first floor? Completely filling out the IEBC-A4 (2003 and 2006 versions) checklist required an engineer to analyze more than just the first floor, which in some cases seemed irrelevant to the soft-story condition.

> *"Engineers, myself included, we wanted to solve problems. So, there's a hole in the wall; let's fix the hole. You're only going to look at the first story? Let's look at the first story. The way the ordinance is written and the way the Framework is set up is that… Dan explained to me that they were actually after more than that in the reports; that they wanted to actually kind of come to an understanding about the other potential weaknesses in the building.*
>
> *On a three-story building, you're analyzing the bottom two stories, I guess. You don't have to do the upper one. Coming through, looking at a bunch of different stuff that basically isn't going to impact fixing the hole in the wall. So, you're doing all this extra work. These engineers, they couldn't figure it out. A lot of them were just submitting stuff and saying, 'Here's how I'm going to fix [the problem],' even in the report. [Then Dan] says, 'No, you've got to go back.'" [KI7:38-99]*

One engineer felt that there were large inconsistencies between what was considered acceptable for retrofit proposals submitted early versus later on.

> *"Since then, it depended which plan checker you would get. Some plan checkers were a little more flexible than others. I had some projects where plan checkers interpreted that rule as there should be at least some [load path] to this outer wall.*
>
> *So, if the walls are not bolted, they at least need to be bolted. While others were literally interpreting it and requiring [more]. So, that put a damper on voluntary retrofits, because people…were willing to spend a little bit of money, but not that*

kind of money. So, the types of projects that were voluntarily retrofitted had changed since then." [KI4:15]

Furthermore, the Framework requested that engineers use a specific engineering code that many did not have familiarity with; some felt it was a disadvantage to refer to a standard that was so new and still had a lot of "kinks" in it. It asked for some calculations, such as a demand-capacity ratio, which some engineers failed to include or were unfamiliar with. Reviewers said that was a very common review comment in the first two years [KI7:42]. Finally, it also surprised some engineers that the program stopped short of asking owners to provide actual plans for a retrofit. The Framework, ostensibly to "save" owners money while still gathering some information that would help establish the magnitude of the costs of the recommended repair work, asked engineers to provide extra information such as how many square foot of plywood would be needed and a few other calculations. But, as engineers quickly noticed and pointed out to their owner clients— if the owner was inclined to do a retrofit, it would save money in the long run to bundle together with the evaluation the full preparation of plans for a building permit.

"…we found out how much it was costing for the reports to be done, versus how much it cost to prepare a set of plans—a lot of it was some of the same work. Engineers…criticized [us] for that. 'Why are you having us do a report when we can do plans for practically the same thing?" [KI13:79-80]

Thus, the confusion seemed almost worst for engineers working for owners who wanted to do a retrofit in order to be removed from the list. Some of those engineers also perceived weaknesses in the IEBC-A4 to which they were required to refer.

"[That IEBC Chapter] was really never meant-to the best of my understanding-as a mandatory requirement. It was written as: If you have this problem, here's what would be nice to do in order to take care of-to make whole one first floor uniformly strong and stiff, not weak and soft. That's why all these requirements were there. So, when people started developing the law, and they were looking for a standard to refer to, that was their first choice, but they didn't do due diligence to go through and to understand. That's where they needed to involve people, other local engineers, engineering community, and have these discussions and seminars. If they did that, I think they would have a lot more retrofit buildings, have better building stock and happier owners and engineers. [KI4:68]

The degree of confusion among engineers filing the first reports was surprise to the reviewers and to program staff, who felt they had been very careful to provide clear directions.

"You've got to make things simple for people. If it becomes complex or they don't have clear directions, they often don't know how to do it, even people with that level of technical education. That surprised me, actually." [KI13:70]

"I started getting on a roll. I started understanding what was really required. Like I said, there was a lot of engineers at that point doing them, and so I had a lot of conversations on the phone, usually with guys after I'd kind of basically repeat what's in [the Framework] and say, 'Do this.'

Then they finally figured out that this thing's set up… Most engineers-it surprised me, but if you do the introduction and you just kind of go down the [list]… It's pretty straightforward to write a report, but they didn't see it that way, a lot of them didn't.

Anyway, [there's] still a lot of variability in what they [produce]… The engineers that really did go out and do a good investigation-actually go out and tear some things open and look-I'm assuming that they probably charged more for their time…than some of the other guys that…didn't get enough fee and they just said, "I'm just going to try to get the minimum through and do that." [KI7:43]

"I think that most of the stuff, especially with the reviews, is pretty straightforward. We usually get phone calls from people -- engineers and architects -- that are angry at us. They either want clarification or they're angry. The clarification ones are fine, but the angry ones aren't so good...our work product is very specific about what we're asking for. When we write the letter, it says, "Give me this, this, this and this." It's not a real vague kind of thing. No, I don't think the communication [between reviewers and engineers] was ever an issue." [KI7:103]

Essentially, some engineers or architects were angry because they'd gotten caught, professionally, between what they told the owner it would cost to prepare an evaluation and what the program ultimately required of them in order to get the report approved. Having bid the project based on expectations to provide less services than were eventually necessary, the professional now has to either absorb the added cost or go back to the owner to bill for more. That appears to have happened to a number of engineers, especially early on in the process. Some of these engineers chose to "absorb" the loss, while others went back to the owner for more, which in turn angered owners who felt they were being led on by a greedy engineer or who blamed the city for moving the goal posts mid-game. Some owners felt confused, duped, and disappointed by their engineers who originally underbid the work and then had to ask for extra expenses.

One engineer blamed some of the difficulty in accurately bidding the contracts early on to a lack of understanding of the review process that the city would be using.

> *"I wish they would've told us that [the reviews would be done by an outside plan check firm] because it usually means a lot more scrutiny and requires a little more time and money to be able to plan check because our fees… we kind of go based on certain assumptions. Even though my contract said that I will respond to the building department's plan-check comments, I didn't feel like I could go and demand additional fees just because I've got the order. The owners, they don't understand the difference. I didn't want them to feel like I'm taking advantage." [KI4:45, 4:69]*

Early Program Evolution: Steep Learning Curves and Administrative Limitations

Berkeley's SWOF program was set up as a one-man operation as a special function of the Building Inspection Division. This inherently exacerbated a lack of integration with other departmental operations. As noted above, at first the city had no in-house engineering expertise or support. Given the large number of technical issues that were coming up about what engineers needed to put in their reports, it became an issue that the sole staff person devoted to the program was not an engineer.

Program staff were caught off-guard by the number of owners who were interested in pursuing a voluntary retrofit. They first came to notice this through the kinds of questions engineers were asking about the Framework. In some ways, what the Framework asked for was less than what would be needed to file for a building permit to do a retrofit and in other ways it asked for too much or seemingly irrelevant details. Also, these owners were motivated not just to do a retrofit but to do a retrofit that would ensure their building would be removed from the list. The standards to which a retrofit would be held for one purpose (to obtain a building permit) were not necessarily the same with what the ordinance would require for de-listing, and engineers wanted additional assurances and advice about how to plan a retrofit which would accomplish both objectives.

Many of these questions were technical, and Mr. Lambert needed assistance in answering them.

> *"[Mr. Lambert] had the overall picture, and he could move it forward. The only thing he couldn't do was resolve the disputes between the engineers and the owners and the plan checkers. That's the toughest part. That's probably what [they] had the most difficulty with, resolving those issues." [KI17:92]*

> *"We didn't have a lot of engineering expertise at that time – we [have two in-house engineers] doing [report reviews] now; we hired [them] about 3 years ago. Had we had both had them here when we started this, certainly knowing what I know now, I would*

have been arguing to [review the reports] in-house, because… it would have made dealing with these kind of issues, disputes with engineers, it would have made it a lot easier to deal with those, and more consistency in doing the reviews. And from a customer service point of view. And just the idea of having internal people who are focused on it means it's going to get more attention, but also for the customer to have someone here that they can come in and see. I would have loved to have someone like [that] to be working with to deal with the technical stuff. It probably would have been better to have it on the inside." [KI2:87]

Tracking who was trying to do a retrofit, and coordinating the progress of those projects with permitting and plan check staff, became another administrative challenge. The department's databases were not set up to enable that kind of cross-program search. [KI2:127, 6:162] Owners who did retrofits expected to receive prompt and automatic notification of their change in status on the list, which did not always occur. Even for retrofits that were supposed to result in removal from the list, there were long delays between when a building permit was "finaled" and when Mr. Lambert would become aware of it.

"Dan was running this thing outside of the permit center, and so he was not using their computer system to track the reports. Conversely, if [the engineers] submit these projects for a building permit and there's a report component to that, I would review the reports, and then I would just shove them into the drawings, and we'd approved it. We'd stamp it and approved it, and we'd send it back to the city or back to the permit center, so they can do whatever they've got to do to issue a permit.

I don't think there was ever any closure, where somebody took those reports and said, "Oh, we should march that over to Dan's office so that he can put it into his database to see where things are." So, I don't know that there's closure…" [KI7:60]

The lack of easy data management systems or staffing for tracking program progress and outcomes made it difficult to discern and communicate to external and internal stakeholders about how well the program was functioning.

"What always bothered me was I always called and wanted a quick answer to, "How's it going?" I could never really get my hands around that. "How much are the surveys costing?" "Don't know." "How many have you done?" "A lot." "How many have you retrofit?" "Well, none yet, but I think there are some"--you know I mean, everything was vague, so I had no impression….

I think the lack of real strong staff support for it was a problem. I don't mean staff intention at all. I think the staff

meant well, but again, [were] distracted on other things." [KI5:128-129]

Existing administrative resources and support for implementation were quickly overwhelmed. Naturally, this had consequences including most importantly communication and customer service challenges and inattention to the signage and tenant notification requirements. Removals for retrofit were slow. Verification of retrofit required before removal from list. Removal letter might come many, many months later.

"It was a frustration why [the program] didn't move more quickly. The city [leadership] cares a lot about this sort of stuff, and kind of worked on it, but…had other things to do. The idea of carving time to really push on something just wasn't in the cards. We lost six months at one point in time because of union negotiations." [KI5:106]

The Report Review Process

Throughout this period, the plan check contractors who were doing the reviews were also struggling to reconcile their own understanding of the Framework with the understandings of the program staff and the practicing engineers who were filing the reports. The task at hand was no typical plan check. The contract called for a flat fee of $583 per report no matter how many "revisions" had to be looked at, so there were strong incentives for the plan check reviewers to be efficient and minimize wasted communications with engineers.

One of the issues that had to be resolved was how to treat owner claims that their building lack plans. The ordinance implied that owners were required to do destructive field investigations if no plans existed – this made reports much more costly to do, which made it hard for engineers to bid their contracts accurately at the beginning of the process, which made getting the report more aggravating as well as more expensive experience for the owners.

[One of the] big issues [was] that most of these buildings are old; they don't have drawings. An engineer, you ask them to do a report. This [law] specifically says you have to go to destructive testing, which means you go out and you rip open a ceiling, rip open a wall. Owners don't want to typically do that. They've got to get a contractor involved at that point. A lot of [engineers were] trying to circumvent that by coming up with some ideas about why they didn't have to do that and some other things." [KI7:36]

"A big turning point in the thing is if you can get drawings or not, from the city or from the owner. If you've got a set of drawings that you can use as your basis, then it sends you [the engineer]

down one path, in terms of the analysis you do and the amount of field inspections.

If you have no drawings, then you have to make a lot more field investigations, supposedly, and then it takes you down another path, in terms of the type of analysis you have to do, which is really confusing. Most of the guys, because the one path is actually a little bit easier, they just say, "I don't have drawings," and I don't know if they do or not. We make them put that in the report that [they] tried. Some of the buildings, they're old; they're not going to have drawings". [KI7:107]

Owners naturally perceived it as distasteful and even a bit ironic to do physical damage to a property in order to determine the type of materials, connections, and supports used. With destructive testing also comes a need to notify tenants to gain on-site access, potential income loss from temporary lack of access to tenant parking spaces, and long-term aesthetic impacts if the owner doesn't promptly re-seal and re-finish the exterior of the building. Anecdotally, one owner left the façade open for over a year while waiting for his report to be approved and while deciding whether he wanted to proceed with a retrofit, leading to a blighted appearance.

Another decision involved how strictly the city was going to hold owners to its other permitting trigger rules. Staff decided that retrofit projects would not be exempt from other triggered upgrades, such as fire safety (sprinkler), sewer laterals, or ADA improvements. This was more of an issue for the small number of mixed-use properties on the Inventory, namely where there were some commercial uses. In reality, there may have been "collusion" between permitting staff and owners to under-report the value of the work to be done, in part to directly save owners money on what was an upgrade in the "public-interest" and in part so that certain trigger thresholds would not be hit. This ultimately reduced the permitting fees collected in association with the seismic upgrade, which are assessed as a percent of the estimated value.

All of these factors were part of a natural evolution or learning curve in the communications between the program staff, the engineers, and the reviewers.

"There were obviously some things that I had to interpret, and I would discuss that with [TC] and try to be as uniform as I could in reviewing these things. Even looking back now, three years ago or four years ago-four years ago, almost five, when I started first looking at them versus what I do now… The ordinance is basically the same, but what I'm looking for is a little different. It's been adjusted a little bit to what the reality of it is." [KI7:86]

Over time, the "market" for engineering services to provide the evaluation reports also evolved. At first there were a lot of different engineers doing reports. Then, the market consolidated towards a set of more experienced engineers who had done several reports before. On average, this was a positive development for owners because a more experienced engineer could give a more accurate estimate of what the analysis would cost in advance and

assure a faster path from the start of analysis to job completion. Early on, some engineers offered a "flat fee service" with the promise of getting the building evaluation approved for a low, fixed sum that other engineers considered impossibly small for an appropriate analysis.[BSWFO 18:1]. However, by year three of four, only a handful of engineers were doing reports.

There was, however, also one major administrative event in the reviewing process that also added to confusion and a sense among engineers that the reviews were not all consistent. About one year into the report review period, the contracted company was acquired by a major international firm. This "merger" resulted in the departure of several key employees from the firm, including the very people who had been working on reviews for Berkeley's policy. However, the City of Berkeley was stuck in a two-year contract with the new merged entity, meaning that the program either had to continue using the firm, do the reviews in-house, or find a special reason to circumvent the contract to send the reports for review elsewhere. The city took steps to develop in-house capability to review reports and also subcontracted out several reviews that it deemed needed specialized reviewing services.).

The persons who had left the original contracting firm started a new company, but the city couldn't hire them to do reviews again until the old contract lapsed. In December 2008, the city moved the contract to the new, smaller company started by the same people who were originally doing the reviews. The interruption resulted in further inconsistencies in the report review process.

> *"Engineers are all different when we review things…My understanding, once I got back into it, was that…some things that were done a little differently at that point, so there was kind of a lack of consistency and continuity in the middle of it, for about a year and a half, I guess." [KI7:48]*

During this time, the national economy went into recession. An interesting new phenomenon was noticed about the review process -- a growing number of reports were now sitting for months in the "unapproved" column awaiting engineer responses to the reviewer's initial comments. Interviewees have suggested that some of these may have been because engineers were withholding final reports as they waited to be paid by an owner. Similarly, many permits for retrofits were still open and not being "finaled". This could be the result of owner indecision or of financing problems arising after the permits were obtained. It could also be a sign that some of the observed permitting activity was not actually intended to result in retrofits.

Compliance Outcomes and Enforcement

The official status of the 321 buildings on the Inventory, as of April 2010, is summarized in Figure 29. To summarize:

- About 44 buildings have been removed from list due to being ineligible or exempt for having fewer than 5 units or demonstrating the absence of a soft-story condition.

- About 43 retrofits are complete, with another 36 retrofit permits still pending and open.
- About 90 reports have been filed and approved, with another 37 waiting for revisions. No structure or plan is in place to assemble and analyze the info that was supposed to result from the reporting.
- Just over 60 owners have so far failed to comply.

Compliance Status	*Count*	*Percent*
No Acceptable Action Taken	63	20%
Removed from List, Exempt	44	14%
Pending Request for Removal	6	2%
Report Filed Only	127	40%
Report Filed, Retrofit Initiated	36	11%
Retrofit Completed	43	13%
Total	319	100%

Figure 29. Compliance status breakdown as of April 2010.

For the first several years after the initial appeal period had elapsed, program officers focused on pressuring owners to make progress in the report compliance process without using any of the legal enforcement or financial penalties that were available to them. Program staff continued to permit people to file appeals, despite the text of the law that specified: *"The building official's determination shall be final at the end of 180 days unless a timely request for reconsideration is filed as provided below."* They also essentially ignored the other elements of the law, the signage and tenant notification, to the detriment of the law's objective to create "market forces" that would influence owners to retrofit.

Fully two years after the initial compliance window ended, staff began to notify and threaten enforcement against owners who had failed to comply with the report requirement. Two waves of "non-compliance" warning letters were sent – one in Spring 2009 and one in Spring 2010. To date, no financial penalty has yet been imposed on an owner for non-compliance.

Owners, much like city staff, focused on complying with the engineering report requirement because there were clear deadlines and penalties attached to that provision. Many owners chose to wait until after the compliance period was over before considering how to comply. It is also true that the timelines for the other aspects of the law were not communicated well. Several owners I spoke with claimed they had no idea, had forgotten about, or otherwise set aside the issues of signage and tenant notification, whereas those are two very cheap things they could have been doing. Compliance with the tenant notification aspect of the law remains low; around 50 percent of the owners have ever provided evidence of notifications and many of these are now surely out of date. No apparent policy is in place to enforce this aspect of the law, although a reminder/warning was sent to all owners along with the example sign in Spring 2010.

Throughout this process, city staff gained valuable program management experience and knowledge, but much of this knowledge is being diffused or lost through reassignment of

key staff to different programs and retirement of key personnel. The BSSO is now run by a member of the BID administrative staff.

Stage 4: Beyond the Initial Compliance Period and Beyond Berkeley

Prospects for a "Phase II" Mandatory Retrofit Program

Although the RSB, the Disaster Commission, and some City Council members remain strongly in favor of implementing "Phase 2" of the program – a mandatory retrofit law—such a policy is indefinitely on hold. The first major blow to this effort came in summer 2009, when the Planning Department decided they no longer had sufficient funds to pay for the earthquake mitigation program manager position. The general economic downturn not only shrank the city's income from development and permitting fees, but it also decreased political will for a mandatory retrofit program, in part because little progress has been on the issue of how to cover the costs of retrofits. Imposing a costly mandate on owners in the current economic environment, in which it is harder to obtain loans, seemed extra burdensome. Another factor is that staff were too overwhelmed along the way to aggregate and analyze the information gathered from Phase 1 that was supposed to be used to justify and design Phase 2. Finally, many retrofits happened already, which took staff attention away from and somewhat diffused the justification for Phase 2.

All stakeholders agree that the lack of funding to help owners pay for mandatory retrofits is still the major barrier, along with the lack of city resources to continuing staffing implementation of the program. In 2011, the RSB revived discussions about Phase II, pressuring the City Council to fund staff to proceed. The RSB also agreed to consider changing Berkeley rent control policies so that the financial burden of retrofits could be shared with tenants is one possibility and did a financial analysis of soft-story owners to assess how much funding help would be needed.

> *"First of all you've got a whole bunch of tenants who are near or at market rate. I mean [the RSB] just can't arbitrarily say 'Share all your rents'…if you ask renters to pay more, they'll just move and the next guy won't necessarily be willing to pay more either. Then there's that other group, and within that group there's two groups: one who could afford to pay more and then there are others who are already at thirty or thirty-five or forty percent of their gross income. So, my feeling is, and this would have to be discussed with tenants and landlords…is how do we not constructively evict those people who are already paying as much as they can pay and then how much of the cohort is left that actually could afford to pay more?" [KI23:26-7]*

Policy Action in Other Bay Area Cities

Based in part on the tentative success of Berkeley's Phase 1 program, several Bay Area communities are considering policy action regarding soft-story buildings. The efforts of ABAG to publicize the soft-story issue and Berkeley's program were a major factor in this policy spread. Below is a quick summary of the state of soft-story programs in other localities.

City of Alameda, CA. Alameda passed an ordinance almost identical to Berkeley's in March 2009. The Alameda law establishes clear soft-story retrofit standards through the adoption of IEBC-A4 in the 2006 version of the International Existing Building Code. This gives owners a clearer signal of what they can do to remedy any identified soft-story weaknesses to be removed from the list.

City of Oakland, CA. Dr. Jeanne Perkins of ABAG, with support from FEMA, recently completed an inventory of multifamily wood-frame residential buildings with all or part of the first floor used for parking in the city of Oakland, showing there to be approximately 1800 potential soft-story properties. The main issue with this list is that she believes it may have a false positive rate around 30 percent. Unlike the Berkeley inventory that was produced by seismic risk professionals working for the city, the Oakland inventory was completed by volunteers who received minimal training and probably contains many buildings that are not actually highly hazardous or even soft-story.

In June 2010, Oakland City Council members Nancy Nadel and Jean Quan (who is, as of 2011, the Mayor) sponsored a law requiring owners of the residential buildings on the ABAG-created list to send their Building Inspection Department simple information about each building's ground-floor structural supports (e.g., dimensions, materials, photographs, and floor plan). It does not require any type of structural retrofit, or a full engineering analysis. Specifically, owners must submit a "screening" report certified by a licensed building professional (e.g., a contractor, engineer, or architect). Costing approximately $500, this is a significantly less thorough evaluation than what Berkeley requires. Additionally, Oakland charges owners a $78.60 filing fee for processing the screening form.[31] Those owners wishing to concede that they have a soft-story building may proceed directly to filing an engineering evaluation.

Owners of 2588 buildings were sent notices. As of the program deadline of July 29, 2011, 954 owners had completed their screening paperwork and another 1,176 had been found exempt (note that 670 of those exemptions were from properties that were noticed in error in the first place). Another 458 of the owners had either pending responses or had failed to respond. Plans to expand the Oakland screening program into a mandatory evaluation or retrofit program are currently on hold.

[31] Information obtained from: http://www2.oaklandnet.com/Government/o/CEDA/o/BuildingServices/o/Permits/DOWD008964, Accessed 1/4/10.

City of San Francisco, CA. The soft-story problem is particularly acute and salient in San Francisco, which has an estimated 4,600 wood frame soft-story buildings with five or more residential units. In January 2009, the Community Action Plan for Seismic Safety (CAPSS) project – collaboration between the Applied Technology Council and the San Francisco Department of Building Inspection – made public its analysis of a select subset of these buildings that have the largest ground floor openings for analysis (2,800 in total). In a Richter Magnitude 7.2 San Andreas fault earthquake, the CAPSS analysis predicts that one in five of this subset of buildings would collapse, thereby threatening lives as well as causing structure and content losses that could total over $4 billion dollars (ATC 2009). Eighty-three percent — more than 2,300 — would be "red-tagged", meaning residents could not use them until they are repaired or replaced, affecting approximately 24,000 residential units. Retrofit construction costs for this building type typically range from $9,000 to $28,000 per residential unit. A 2008 report by the San Francisco Policy & Urban Research Association, or SPUR, a local non-profit think tank, highlighted the need for city-wide discussion of what level of risk the community is willing to tolerate with regard to SWOFs and other vulnerabilities (SPUR 2008).

With the departure of San Francisco Mayor Gavin Newsome, former City Administrator and now Mayor Ed Lee is now charged with following up to the CAPSS project (which officially ended in December 2010). In November 2010, a bond measure that would have developed a financial assistance program for low-income and city-owned soft-story properties failed to get the necessary two thirds approval of voters. However, the Mayor appointed a small staff to develop an implementation plan for the CAPSS recommendations, which includes a mandatory evaluation and then phased-in retrofit requirement for soft-stories. Prospects appear favorable that San Francisco will pass such a law in the near future.

City of Richmond, CA. In 2011, the City of Richmond, just northwest of Berkeley, created an inventory of its soft-story properties. A community meeting was held in August of 2011 and all owners on the Inventory were sent a letter urging them to consider taking voluntary action. City planners there currently have no active plans for legislative action.

City of Fremont, CA. In 2007, the City of Fremont implemented its soft-story ordinance which required owners of 22 apartment buildings to perform an engineering analysis and retrofit of vulnerable portions of the structure. Condominium owners were exempted from the mandatory retrofit requirement, but were encouraged to voluntarily participate. Because there were a small number of soft-story buildings in the area, Fremont was able to subsidize mandatory retrofits for all soft-story buildings.[32]

Santa Clara County. The Emergency Preparedness Council of Santa Clara County and its cities hired the Collaborative for Disaster Mitigation at San Jose State University to count and map soft-story buildings. Their inventory defines a multifamily building as one containing 4 or more units. They identified 2,630 buildings containing 33,119 units.[33]

[32] http://www.fremont.gov/index.aspx?NID=377

[33] The full report is available at: http://www.sjsu.edu/cdm/public/EPC-Report.pdf

4.C – Summary of Policy History Findings

1. Earthquake policy movement is triggered by policy entrepreneurship, not just earthquakes.

Deadly quakes *are* important to explaining major shifts in earthquake policy, but not necessarily in the way that many people think. The Loma Prieta and Northridge events did solidify public perceptions that earthquakes are a serious concern, but that alone was not enough to counteract the many obstacles to personal and community preparedness. Rather, the secret to policy progress on soft-story buildings in the Bay Area seems to be the impact that these events had on the thinking, behavior, and degree of interconnectedness among building professionals and seismic safety experts. In particular, a handful of individuals found themselves not only with new justifications and motivations to advocate for policy change but *also new ideas and expanded capacity to act* based on the collective learning and camaraderie fostered by recent events. When such individuals decide to organize and take action, they became *policy entrepreneurs*, something voluntary and extracurricular to their paid employment that they had not previously imagined themselves doing. The BSSO case shows that activism by a few individuals in a local government setting can be far more important to policy innovation and progress than a brief but widespread post-event honeymoon of media and political attention.

The damage and deaths in Loma Prieta and Northridge also solidified the policy justification for action and solidified personal motivations and a professional support network among building officials that was able to outlast and counteract the natural barriers to mitigation policy passage. Berkeley's soft-story policy originated in the personal relationships and professional insights produced and shaped by Loma Prieta as well as other events and policy milestones in California's long, slow struggle to tame its earthquake risk. A coalition of three different types of "champions" – technical, political, and administrative – was crucial to developing a feasible policy concept, sustaining interest over time, and overcoming inevitable resource shortages and implementation challenges. The core players were aided by countless volunteer hours from both practicing and academic engineers, which was made easier by the proximity and interdependence between the city and the University. Now that a precedent has been established, other cities without those direct ties and resources can benefit, as several have already.

Another important lesson is that elected officials don't need to lead this kind of policy change effort. It worked for Berkeley's seismic safety advocates to "bring them along" in the process, as long as they could make the argument that the city had the authority and the net benefits of taking action were positive. Throughout the process, it was city staff that kept the issue alive and moving forward despite lackluster support from the appointed Commissions and elected leadership. Also, there appeared to be little opposition to the law, or at least whatever opposition there was not politically voiced or particularly persuasive.

> *"The commissions weren't as much supportive as they were interested. The planning commission wasn't all that interested. It was not a direct planning policy issue. But they were supportive.*

Certainly the Disaster council was an advocate. The Housing Advisory Commission was supportive." [KI2:45]

"We didn't have great support. The city manager, basically, would let Arrietta do whatever she wanted to do, as long as it didn't cause him too much trouble. He wasn't terribly supportive, but not unsupportive. I think what finally happened was Arietta was leaving. We just had to get it done before she left. I think that was more of the trigger." [KI5:106]

Overall, the program advocates moved persistently and slowly on this issue, carefully building the case for public intervention, pushed for legislative action when economic conditions were right and most sources of doubt about the program were resolved. To resolve doubt, city staff solicited and received assistance from the best people along the way, working with top engineering experts and experienced consultants that lent credibility to the effort and provided political cover, leading to the successful and cheap public-private partnership event of the "Walk-About". It was also important that Berkeley based its program on a relatively "clean" list – the low false positive rate was important to sustained political support for the program. Deference to and concern for owner impacts led to a conservatism that also kept the law politically palatable.

To summarize, several factors led to the successful passage and development of the policy. Berkeley, for a municipality of its size, is remarkably suited to support policy entrepreneurship on this topic. The community identity is proactive, protective, and progressive. The City of Berkeley has exceptionally well-connected personnel. In particular, it hired staff with personal motivations to work on seismic safety issues and plenty of local expert contacts. Its government culture rewards creativity at working within the bureaucracy. Proximity to UC Berkeley and other Bay Area sources of engineering talent translated into access to experts with personal time and motivation to help and cheap talented student labor to work as policy development "grunts".

Even though Berkeley is exceptional in these ways, this kind of policy may now achievable by other cities that do not have these same features or resources. Now that Berkeley has established the basic precedent, other cities can follow up and adapt the policy to their own settings and needs. The minimum resources required, however, are still political will and a budget to staff the program, and those conditions may be rare during economic downturns or in less-well off communities. Policy changes can occur long after motivating earthquake events, but capacity and support for policy entrepreneurship is important, because earthquakes don't cause policies to change, people do.

2. *Berkeley's soft-story policy progressed through four developmental stages, each involving different key actors, activities, and decisions.*

I identified four stages in the development of Berkeley's soft-story program. Figure 30 summarizes the key actors, events, decisions and processes during different stages of the law's development.

The first stage – "Laying the Groundwork" – involved fundamental questions about the public nature of the problem as well as the city's capacity and authority to take action. On a practical level, policy advocates needed to collect data about the scope of the problem and develop a case that government intervention was warranted. The activities of policy entrepreneurs at this stage were conducted largely outside of the view of stakeholders.

The second stage – "Developing a Regulation" – involved establishment of a coalition of advocates whose main activities were about fostering support for placing the issue on the public agenda and shaping specific feasible action proposals. In this case, the coalition of advocates became policy entrepreneurs who were trying to resolve obstacles and doubts and involve as many proponents as possible. Along the way, they had to make difficult trade-offs between their policy objectives and the reality of what types of policy change various stakeholders would support.

The third stage – "Early Program Implementation" – commenced once it became clear that a law would be passed and what its basic features would be. The advocacy coalition evolved into a program management team that now was empowered and responsible for developing specific administrative procedures associated with implementation in the context of active stakeholder involvement and resource constraints. This was the most intense period of program management, and many operational decisions had to be made on fly with little time for reflection.

The program is currently in the fourth and final stage – "Program Maintenance, Diffusion, and Learning." Once the basic pieces were in place to carry out the regulation and most owners had taken steps to comply, it became possible to operate the program on a smaller budget. However, this made it more vulnerable to budget limitations, staff turnover, and issue fatigue.

	Stage 1: Laying the Groundwork	***Stage 2: Developing a Regulation***	***Stage 3: Early Program Implementation***	***Stage 4: Maintenance, Diffusion, and Closure***
	What issue needs to be addressed? *Why that issue not others?* *Who is affected and how?* *What are the policy options?*	*What are the goals?* *Which is the best feasible policy option?* *Who can lead the effort (with sufficient authority)?* *How can concerns be addressed?*	*Who needs to do what?* *Are incentives aligned with goals?* *What resources are available?* *How can resources be used efficiently?*	*What progress is being made towards the goals?* *How are program goals, activities, & resources evolving?* *What are we learning about how to work smarter?* *How can we remember and share what we've learned?*
Actors	• Building Official • Consulting Engineer • Planning Department Management • Deputy City Administrator	• Building Official • Deputy City Administrator • Earthquake Program Manager • Commission Members • City Council • Rent Stabilization Board & Staff • STAG Committee • Other Expert Volunteers • Student Volunteers	• Building Official • Earthquake Program Manager • Plan Check Staff • Commission Members • City Council • Practicing Engineers • Consulting Engineers • Property Owners • Contractors • Property Managers • Tenants	• Building Official • Earthquake Program Manager • Administrative Staff • Practicing Engineers • Consulting Engineers • Property Owners • Contractors • Property Managers • Tenants • Rent Stabilization Board & Staff
Events	• Loma Prieta Earthquake • Northridge Earthquake • Kobe Earthquake • Sidewalk Survey • Building Official Resignation	• Building Official Hired • Earthquake Program Manager Hired • City Completes Other Major EQ Projects • STAG Involvement • Student Interns Hired • "Walkabout" • Transfer Tax Amendment Rejected by Voters • State Law Passed • Internal Campaign • Community Meeting	• Passage of Ordinance • Framework Produced • Engineer Trainings • Notice & Orders Sent • Presentations to Owners • Appeal Period • Compliance Period • Engineers Produce and revise Reports • Consultants Request Revisions and Approve Reports • Owners Initiate Retrofits (or Not) • Annual Non-Compliance Warning Mailings	• Consultation with Other Cities • Retirement of Key Staff
Decisions	• Produce an Inventory • Minimize False Negatives • Hire Experienced Outside Contractor	• Mandatory Evaluation Only • How to Get City Leadership on Board • Which Technical Standard • What Information to Collect	• Who Will Compose the Framework • Who Will Review the Reports • What Will be Required of Retrofit Projects • What to Do with Information Being Collected	• Whether & How to Enforce Non-Compliance • Involving RSB in Verifying Signage • Whether to Pursue Phase 2

Figure 30. Table summarizing key actors, events, and decisions for each of the four stages in the policy development timeline.

CHAPTER 5 – FINDINGS REGARDING OWNER & BUILDING CHARACTERISTICS

This is the first of two findings chapters that address possible explanations for the observed differences in retrofit status and responses to the law among Berkeley soft-story owners. The aims of this chapter are to describe the set of owners and the buildings affected by the BSSO and explore possible relationships between their retrofit choices and a series of background variables that might be reasonably be assumed to link with precautionary attitudes and behavior. Previous studies have found that preparedness behaviors are sometimes associated with basic traits such as sex, owner age, income, and education. In doing so, I alternate between the administrative data (which covers most, but often not all, of the properties in the original BSSO Inventory) and the detailed demographic information and personal histories I recorded through the survey and interviews.

5.A – Who Owns Soft-Story Apartment Buildings in Berkeley and Who's Retrofit?

Types of Berkeley Soft-Story Apartment "Owners"

Three hundred and seventeen properties received notice in 2006 as listed on the original Inventory. In actuality, however, there were only 291 unique "owner entities" represented on the Inventory because about 30 owners at the time owned more than one listed property. Owner entities vary in type from individuals to formally incorporated investment partnerships to non-profit institutions. Using 2005 publicly-available Alameda County Property Ownership and Tax Assessment data, I categorized the 291 unique owners according to the following mutually exclusive and exhaustive set of ownership types (as defined below). Figure 31 shows how the population is distributed.

- Individuals – only one person's name is listed as the owner.
- Joint Ownership– two or three persons named as co-owners (e.g., spouses, parents, children, or other family members).
- Trusts – a legal trust is listed.
- Partnerships – a formal corporate entity or investment partnership (e.g., LLC, LLP, Inc.).
- University-related Institutional (e.g., religious training institutions, fraternities, dormitories, cooperative housing).
- Non-University Institutional/Public/Non-Profit (e.g., retirement or affordable housing, motels).

	All Listed Properties		Unique Owner Entities Only		Study Participants Only	
	Count	Percent	Count	Percent	Count	Percent
Individual	127	38%	115	40%	13	30%
Within-Family Joint Ownership	126	38%	111	38%	18	42%
Trust	42	13%	34	12%	2	5%
Partnership/LLC/LTD/Inc.	22	7%	20	7%	4	9%
University-Related Institutional	9	3%	6	2%	3	7%
Non-University Institutional	5	2%	5	2%	3	7%
Totals	331	100%	291	100%	43	100%

Figure 31. Descriptions of the total affected population of buildings, unique owner entities, and study participants by ownership type.

Figure 32 shows the breakdown of ownership structures by retrofit status. There is suggestive evidence that retrofit status may differ across ownership types, $\chi^2(10, N = 291) = 16.98$, $p = .08$. The table is interpreted by observing how the percentages in each retrofit status category vary by ownership type relative to the overall percentages shown in the bottom (total) row. For instance, about 80 percent of Partnerships and Non-University Institutions represented on the Inventory have never initiated a retrofit, while the overall percent of owners who have never initiated a retrofit is 73 percent. However, these two types also are among the highest fractions of pre-law retrofits.

The only ownership type with no *pre-law* retrofits is the Trusts, but they were the most likely group to retrofit after the law. Perhaps this ownership structure tends to diffuse responsibility and any incentives to retrofit that existed before the law, but reinforce new motivations resulting after the law. The only ownership type with no *post-law* retrofits is the Non-University Institutional type, which may face particular barriers to financing and thus cannot initiate retrofits with the same speed as the other types. Because of the small numbers of owners in each type it is unwise to draw firm conclusions, but the relationships between ownership structure and retrofit decisionmaking may warrant further study.

Ownership Structure		When (If Ever) Retrofit, 2010 Status or Interview			All
		Never	Retrofit Prior to Law	Initiated Retrofit After Law	
Individual	Count	88	4	23	115
	% within row	77%	3%	20%	100%
Within-Family Joint Ownership	Count	78	5	28	111
	% within row	70%	5%	25%	100%
Partnership/LLC/LTD/Inc.	Count	27	4	3	34
	% within row	79%	12%	9%	100%
Trust	Count	12	0	8	20
	% within row	60%	0%	40%	100%
University-Related Institutional	Count	4	1	1	6
	% within row	67%	17%	17%	100%
Non-University Institutional	Count	4	1	0	5
	% within row	80%	20%	0%	100%
Totals	Count	213	15	63	291
	% within row	73%	5%	22%	100%

Figure 32. Retrofit status by ownership type for all unique owner entities.

Next, I turn to the relevance of owning multiple soft-story buildings on the Inventory. Collectively, the 34 owner entities who owned more than one listed soft-story property in 2006 controlled 74 properties, or about 20 percent of all listed and potentially listed properties. The average number of soft-story properties owned among this group was 2.24 buildings. Only one owner entity owned four listed soft-story buildings, and just five owners owned three.

Owners of multiple listed properties may have been more likely to retrofit in the wake of the BSSO, $\chi^2(2, N = 291) = 8.73, p = .01$. Over a third of these owners have done a retrofit to at least one of their listed properties, several of them before the law but even more after it. Some have seismically upgraded more than one listed property. This is suggestive that the law may have especially affected these owners' decisions, but we cannot tell whether it was because these owners received multiple notifications, because they have a larger value portfolio affected, or because of a combination of these or other factors associated with owning multiple properties and the tendency to respond to the law by wanting to retrofit.

Own Multiple Listed Soft-Story Properties			When (If Ever) Retrofit -- 2010 Status or Interview			
			Never	Retrofit Prior to Law	Initiated Retrofit After Law	Total
	No	Count	195	11	51	257
		% within row	76%	4%	20%	100%
	Yes	Count	18	4	12	34
		% within row	53%	12%	35%	100%
Total		Count	213	15	63	291
		% within row	73%	5%	22%	100%

Figure 33. Ownership of multiple soft-story properties and retrofit status for all unique owner entities and among study participants only.

Data on official mailing addresses (shown in Figure 34) suggest that a majority of Berkeley soft-story owners are based in the community or live relatively nearby. Only five were located out of state back in 2006, and over 70 percent had an official mailing address in Berkeley itself or within 15 miles. Note that in the County records I was able to access, about 23 owners list their official mailing address as their property management company (located in either Berkeley, El Cerrito, or Oakland). One might expect that the farther away an owner lives, the less involved she might be in managing the property and the less salient the risks facing it might feel (out of sight, out of mind). However, few of these owners can be described as an "absentee" landlords and retrofit status does not appear to be systematically associated with mailing distance category, $\chi^2(6, N = 291) = 6.6$, $p = .35$.

Owner Mailing Address Distance Category			When (If Ever) Retrofit -- 2010 Status or Interview			
			Never	Retrofit Prior to Law	Initiated Retrofit After Law	All
	Out of State	Count	3	0	1	4
		% within row	75%	0%	25%	100%
	In California but not within 15 Miles	Count	65	3	15	83
		% within row	78%	4%	18%	100%
	Outside Berkeley but within 15 Miles	Count	65	2	17	84
		% within row	77%	2%	20%	100%
	in Berkeley	Count	80	10	30	120
		% within row	67%	8%	25%	100%
Total		Count	213	15	63	291
		% within row	73%	5%	22%	100%

Figure 34. Location (by 2006 official mailing address) of Berkeley's 291 unique soft-story owners.

Qualitatively, I was able to speak with at least one owner from all these distance groups. Among the owners and managers I interviewed, about a fourth lived more than 15 miles away, and all but one reported taking an active interest in managing the property. Figure 35 shows the breakdown of official mailing distances by retrofit status among study participants.

Owner Mailing Address Distance Category (Count)	When (If Ever) Was a Building Retrofit – 2010 Status or Interview			All Study Participants
	Never	Retrofit Prior to Law	Initiated Retrofit After Law	
Out of State	0	0	1	1
In California but not within 15 Miles	3	0	7	10
Outside Berkeley but within 15 Miles	5	0	5	10
In Berkeley	7	5	10	22
Totals	16	5	22	43

Figure 35. Table showing where Berkeley soft-story owners that participated in this study receive their mail by retrofit status and timing.

Personal Owner Characteristics

In this section, I review some basic demographic traits of the subgroup of interviewed owners and explore potential associations with retrofit behavior.

Age, Family Life, and Community Ties

Not all the owners I spoke with reported their age, but among those that did the mean age was 58 (σ=13.1, N=32). The "typical" respondent, if there was one, was an older adult male of about 60. Figure 36 shows mean age by retrofit status, and Figure 37 shows a histogram of age by retrofit status. Age did not appear to be overtly associated with retrofit status.

It is interesting to observe the large range of age groups involved in managing these properties. The fact that a majority are in their 50s and 60s probably reflects something not only about people who have the time to participate in research but also about the patterns of rental property ownership in Berkeley; for a variety of reasons discussed further below, Berkeley rental owners tend to hold on to their properties (or trade-up but remain owners in the local market) for a long time. I spoke with two persons over age 80, one of whom was himself involved in the design and construction of the building some fifty years earlier. At the younger extreme, one of the people I spoke to (under age 40) was representing a parent who is the actual legal owner of the property; the son now plays a significant role in the property's day to day management and anticipates inheriting the property eventually.

	When (If Ever) Retrofit -- 2010 Status or Interview			
	Never	Retrofit Prior to Law	Initiated Retrofit After Law	**All**
Mean Age	60.4	61.3	56.5	58.2
Valid N	10	3	19	32
Standard Deviation	12.6	3.1	14.4	13.1

Figure 36. Mean age of study participants by retrofit status.

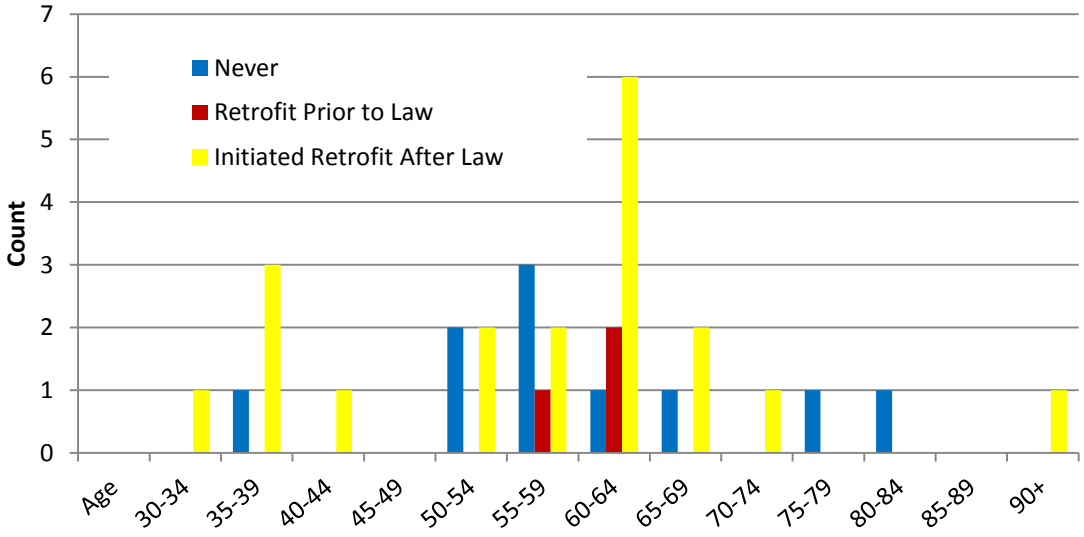

Figure 37. Self-reported age at last birthday among study participants by retrofit status and timing (N=32).

In total, I interviewed six women, two of whom were organizational representatives. Figure 37 shows a breakdown of study participants by gender and retrofit status. I did not expect to be able to address this factor in this study, but it is interesting to observe that women do play notable roles in property ownership, management, and as investment partners in the study population. One of the reasons why is the co-ownership of properties by husband and wife teams. Eighty percent of reporting study participants (N=40) said they were currently married or living with a domestic partner. Over half of the properties are owned jointly with a family member or in a trust. Another reason is the involvement of children (both sons and daughters) in the real estate investments of their parents.[34] Eighty two percent of study participants report being a parent.

[34] Some of the higher experience group of interviewees reported being first introduced to property ownership through their parents or other family members who either owned or repaired buildings as a profession or hobby. A few worked as children doing odd jobs or light maintenance in their family's properties. However, because many of these owners and managers are now older adults, several reported starting to do their own investing as early as

	When (If Ever) Was a Building Retrofit			
	Never	Retrofit Prior to Law	Initiated Retrofit After Law	Total
Male	14	3	20	37
Female	1	2	3	6
Total	15	5	23	43

Figure 38. Study participation by gender and retrofit status.

Consistent with these notions of family ownership, many study participants mentioned the desire to eventually pass their properties on to their children and some were already doing it. Although the average age was close to 60, 40 percent reported having one or more children under age 18 living at home. This could be testament to having children later in life or having grown children living at home with them and grandchildren living there as well.

Nearly all of the owners and managers I interviewed have strong ties to the local community. All but three own their own home, and the interviewees have been in their current residence on average for about 19 years (σ=14.6, N=40). The average number of years living the Bay Area was 42 (σ=17.8, N=40). Only two survey respondents reported not living in the Bay Area when the Loma Prieta earthquake occurred in 1989.

Anecdotally, many interviewees volunteered to me that Berkeley was their hometown. Others mentioned being born in Oakland, San Francisco, or someplace nearby. For those owners who were not born in the Bay Area, they either came here for college, work, or emigrated from abroad (choosing the Bay Area because of economic opportunities here as well as direct ties to family already living here). About 30 percent of the interviewees noted some kind of personal connection to UC Berkeley. For instance, I heard stories about a relative or they themselves attending Cal as either an undergraduate or graduate student. Two persons reported that a parent had been Cal faculty.

Education, Career, and Professional Experience

In terms of education, this study's participants are fairly representative of Berkeley's well-educated citizenry. Figure 39 shows the study participants by self-reported highest

---

the 1970s. Most of the individual owners and managers had a decade or several decades of real estate investment experience.

That being said, the individual interviewees varied in the types and degree of involvement they have as an owner in property management and maintenance. Also, the degree to which they have delegated management tasks to others may have changed over time. A typical story was that the owner was more involved in managing their properties back in their early days in the business, whereas now they outsource more tasks to others associates or a property management company. Virtually all the individual owners reported using a Certified Public Accountant or similar professional to handle their taxes.

Several owners worked with a spouse, parent, or other family member as a partner. Others had their adult children working for them or manage the building on behalf of an elderly parent. In several instances, a parent (the previous owner) had recently died and the owner had inherited property. Sometimes, this was an unwanted responsibility, leaving the owner with responsibility for perhaps a poorly maintained property, without any longer term desire to be doing property management.

educational level attained. Seventy three percent of the interviewees report receiving a college degree or higher, and 54 percent report having a graduate degree of some kind. The data suggest that attainment of a college degree or higher, as shown in Figure 40, may be marginally associated with retrofit status, $\chi^2(2, N = 41) = 4.6, p = .10$.

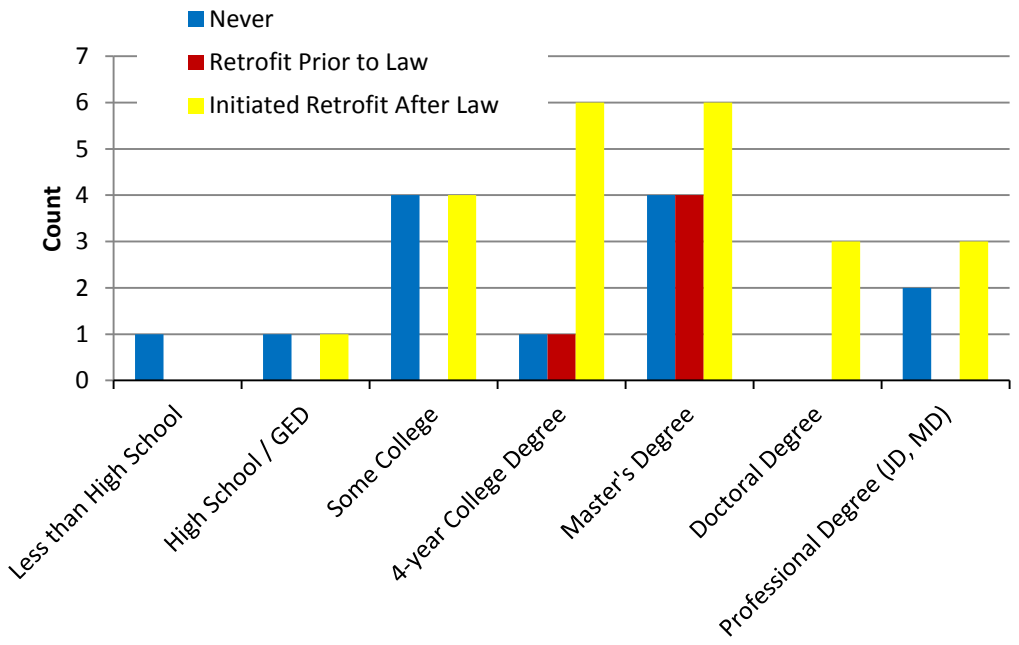

Figure 39. Self-reported highest level of education completed among study participants.

Educational Attainment Level			When (If Ever) Retrofit -- 2010 Status or Interview			
			Never	Retrofit Prior to Law	Initiated Retrofit After Law	All
	Less Than 4-Years of College	Count	6	0	5	11
		% within row	55%	0%	45%	100%
	College Degree or Higher	Count	7	5	18	30
		% within row	23%	17%	60%	100%
Total		Count	13	5	23	41
		% within row	32%	12%	56%	100%

Figure 40. Retrofit status by college or higher educational attainment among study participants.

Study participants were roughly split between persons who did (60%, N=25) or did not (40%, N=17) report having significant experience and knowledge about building construction and/or real estate investment. I define as "Experienced" those persons who qualitatively described construction, housing, or real estate investment or management as their main

profession or as a major activity in retirement. Reasons given for investing in real estate in this experienced group included: primary source of income, extra income, or as a savings or income vehicle for (or unofficial vocation during) retirement.

Five study participants were full-time property managers that also owned several rental properties of their own. Another two were fully licensed real estate brokers that occasionally built buildings and owned a significant portfolio of properties as part of a larger partnership or business. One was a professional facilities manager for a non-profit scholarly institution that owns a large number of residential properties for their students. Among those with professional experience or training in a building-related field, I spoke with two architects, five persons who have or had a general contractor's license, and two civil engineers. Some of these owners reported doing most of the hands-on, on-site maintenance for their properties themselves.

The other half of the study participants have or had a career in something other than the construction trades or real estate investment, management, and development. Their professional ranged widely from artists, restaurateurs, a telephone technician, and a dental hygienist to teachers, lawyers, and business consultants. These persons invest in real estate for extra income or as a savings vehicle for retirement but only own one or two properties. This less experienced group was more likely to rely on a professional property manager to handle minor maintenance and other on-site issues at the property, but a few of them did handle most property management and minor maintenance issues on their own. A few of the less-experienced interviewees had a business partner – in some cases a brother, uncle, or father – that had direct construction or contracting experience. Two persons mentioned a significant military background with the Navy.

It appears that the owner's level of real estate experience might matter to whether and how the law affected owner retrofit decisions. Figure 41 shows a breakdown of retrofit status among study participants by degree of real estate experience. Interestingly, most of the pre-law retrofitters were in the less experienced category. Also, a high fraction of experienced real estate persons decided to retrofit after the law.

Degree of Real Estate Experience	When (If Ever) Retrofit -- 2010 Status or Interview			
	Never	Retrofit Prior to Law	Initiated Retrofit After Law	Total
Less Experienced in Real Estate	4	5	8	17
% within row	24%	29%	47%	100%
More Experienced in Real Estate	9	1	15	25
% within row	36%	4%	60%	100%
Totals	13	6	23	42
% within row	31%	14%	55%	100%

Figure 41. Breakdown of retrofit status among study participants by level of real estate experience.

Attitudes about Buying, Owning and Selling Rental Property

In general, this group of owners, and particularly the Individual owners, articulated that they enjoy having a hands-on role in shaping their own daily lives and financial future. They feel that being a landlord puts them in control of their own destiny and they like that. Rather than shying from responsibility, owning real estate gives these individuals a domain where they can "do it yourself" and operate with relative independence. As one owner put it:

> *"We [owners] tend to be pretty independent operators…what we all like about being a landlord is that we're the boss. If something's wrong, we decide how to fix it. If you're invested in stocks and bonds and you don't like the way the company is going, they couldn't care less about your opinion…All the landlords I've ever known feel like I do…It's nice to have people bring you money every month but emotionally the nice thing about it is, if something goes wrong, you get to fix it. That's [a] very comfortable feeling." [OB2:85]*

By nature as a small business, owning rental property can be very "hands-on". Several interviewees reported that they lived in the first rental property that they bought, then later moved out and continued being a landlord from afar. Some report visiting the building often, even if they have an on-site manager (which is required by law in Berkeley if the building has 15 or more units). Some described the real estate business as their "passion", that "they love it," or that "it has enabled me the freedom to do many things I wouldn't otherwise be able to do."

Other kinds of things people mentioned that attracted them to the business or that they like about being an owner included:

- Income potential;
- Being in-charge, being their own boss, and having independence;
- Constant challenges, being the "go to" person;
- Having unstructured time;
- Satisfaction in doing things themselves; and,
- Pride in fulfilling the important public need for good quality housing.

Several owners discussed the specific benefits and downsides to owning rental property in Berkeley. As a university town, owners are assured of a steady stream of renters and the market is unlikely to ever dry up, plus there is likely to be unit turnover every two to four years. Since vacancy de-control went into effect in 1999, rents can be regularly raised to market levels. Some mentioned that personal connections to and familiarity with the area and the University made it feel like a less risky place to invest – or at least the risks here are more "familiar". Willingness to work with and tolerate the rent control laws is essential. Because those laws can be onerous and intimidating, this can make it more affordable to buy in Berkeley than elsewhere or than it otherwise would be. It is a comparative advantage for an informed buyer.

The unwanted challenges of apartment ownership that interviewees mentioned included:

- Drugs & crime, other problem tenant issues;
- Resentments about and nuisances of rent control;
- Regulatory constraints (e.g., their sheer number and degree of intrusiveness or coercion; and *regulatory creep*[35]); and,
- Unpredictable city policymaking as a business risk.

Property Purchasing Decisionmaking

The owners I spoke with generally did not consider earthquake safety when searching for or purchasing their properties. Nor did I hear much evidence of their considering earthquake risk when assessing the financial status or potential long term "performance" of any particular property. As a group, these owners did not see any overt signs of hazard or have any concerns about earthquake vulnerability. They also interpreted the absence of concern on the part of their family, friends, professional associates, and the government (as evidenced by the absence of any public education or action campaign) as endorsement of the codes under which their buildings were originally built.

> *"It was after Loma Prieta, so everybody knew but nobody was concerned because when you buy something you think that some engineer draws the plan and…some city approve[d] it, so you figure out it's got to be OK. Knowing other friends and other people in the industry, nobody ever had it in its mind that he buys something that approved but would be changed later." [OB10:10]*
>
> *"It seemed to be well maintained when I looked at it. There was no major problem with it and being…a real estate investor, I look for real estate and this happened to hit the parameters." [OB14:8]*
>
> *"There was no warning of anything." [OB33:5]*

In contrast, a few of the Individual owners with real estate experience (mostly manager-owners) and two the non-profit managers I spoke with did consider earthquake safety when shopping for properties. One or two managers even saw it as a business opportunity because they regarded themselves as more willing to take on that kind of project or able to do it more cheaply than other buyers. Not all of the higher real estate experience owners and institutions that considered earthquake risks in their purchases actually did a retrofit, but they did report consciously use earthquake safety as a purchase criterion and tried to use it to their advantage.

[35] Regulatory creep is a term used to describe the propensity of regulators to broaden the scope of a regulation over time, using a series of small incremental changes to gradually widen the number of behaviors being regulated and/or the degree of the requirements.

"I knew a little bit about Soft-Story issues and I factored how much I thought it might cost at some point in the future and, in fact, when the price dropped down to what I thought was reasonable, given that, then I went forward with that." [OB38:3]

"I didn't buy in an area that has landslides…something that's on a hillside…[or] that [would] liquefy…I didn't buy something that was high up above the ground. So, for example, the apartments are slab-on-grade construction. So, they shouldn't fall off of their foundation per se. Whether they wobble and fall that way, I don't know, but they shouldn't fall off their foundation. They shouldn't slide off of it. So, yeah…I did give some consideration to that, but it was mainly in terms of what type of construction was used and where was the location." [OB3:20]

As one Institutional Representative put it:

"Since the Loma Prieta earthquake, all of us have become a lot more conscious about the need to have emergency preparations in place and the need to improve buildings." [OB35:22]

The majority of interviewees described their purchases as motivated primarily by financial considerations, including property features that might advantage the property as a long term investment. Immediate financial considerations were paramount. When asked about why they would pick one property over another, one owner stated:

"It's totally financial." [OB5:1]

A major financial benefit of owning rental property is the tax advantages, which fall into several broad types: (1) tax sheltering of real estate-related capital gains, (2) depreciation of the building's value over time, and (3) the ability to deduct business expenses from taxable income. On the first point, several owners told me they purchased their soft-story building as part of a "1031 exchange" where the owner has a limited window of time to reinvest their sales profits back into another piece of real estate or face federal capital gains taxation. Thus, tax-related time pressures can be a large factor in purchase decisions. One owner mentioned that the property was a good business opportunity because it had been distressed, poorly-managed, or poorly-cared for by the previous owner [OB2:13].

Location mattered to these real estate investors primarily for financial reasons. Overall, it was a major reason for investing in Berkeley, because the University is seen as a perpetual draw and assures some measure of tenant turnover even though it is a rent-controlled city.

For organizations, location matters even more critically, as does the specific criteria of needing to house a certain number of students or clients or the exact configuration of the spaces.

"[We chose this property] mostly just seeing something down the street…" [OB12:6]

"We need[ed] to house eighty people…and fairly close together, so we got three apartment houses and three fraternity houses." [OB13:19]

As described to me, owners approach their purchase decisions with self-confidence, single-mindedness, or even casualness and haste. Several mentioned "availability" as the main reason they chose the property (apartment buildings generally do not come up for sale very often in Berkeley, meaning there is limited inventory if an owner specifically wants to own in this University town). Several expressed regret in hindsight at their naivety or careless decisionmaking.

"I was looking at it from a financial standpoint which is probably cash flow, and it was all basically financially based. In fact, I bid on several properties without ever actually even seeing them based on their finances." [OB3:3]

"I had seen it in the paper one day and when I drove by and the numbers worked. I liked how the down payment and how the cash flow out of it." [OB20:3]

"It was available for sale, and…I was unemployed and had nothing to do. I was looking for work. So I figured I'll buy it. I used to be a builder…I was pretty dumb. I didn't know what would make sense. [OB18:1-4]

Another theme was the involvement of and reliance on the advice of other business partners. In these cases, reliance on personal connections and the advice of others may have contributed to a purchase decision they later came to regret.

"I was at a real estate breakfast and a friend of mine asked if I was interested in buying a building in Berkeley and I said, 'Yeah, possibly.' So he forwarded me all the information on it. I looked at it, did the analysis and thought, 'You know, looks like a good investment.'" [OB14:6]

"…the agent was a friend of ours…" [OB11:7]

"[We thought about] location for one, the price for another. My brother's a contractor, my father's a contractor, and they both had invested in Berkeley before. So I sort of relied on their analysis of cost per unit and location and the rent control issues that were

there…We looked at several properties, but I pretty much relied on their analysis of the economics of it and I certainly agreed with the location…" [OB17:2]

"My family people, they said there is a building up for sale. They don't have money so I said I'd borrow…from [an]other building and I bought with that down payment." [OB26:3]

Because earthquake hazards were largely a non-factor in both owner and organizational purchase decisions, Berkeley's law came as a *surprise* to most soft-story owners.

"No one knew anything about [soft-story]…I don't think any of the owners knew this was coming." [OB32:38]

"We were totally unaware…I grew up around here, lived through Loma Prieta, and generally speaking, a lot of the buildings you're looking at they've been through earthquakes, they're just fine…basically any building you look at went through Loma Prieta and is probably fine, except for newer buildings. So, we were not aware of it." [OB37:3]

These quotes highlight some the psychological challenges to making accurate inferences from past experiences with earthquakes. Owners tend to assume that if their building did well in a past quake it will also perform well in all possible future quakes. Furthermore, if one building they own performed fine in a past event, other "similar" buildings they own will also perform well in all possible future quakes, thereby failing to account for differences across buildings, sites, and distances to the epicenter, as well as event magnitude and many other potential sources of variation.

Future Ownership Intentions

Well over half of study participants (59%) stated (either verbally or in a survey question) that they have *no intention* of selling their property. From that, I conclude that by and large these owners feel relatively content with the economic returns they are getting from owning these properties in comparison to the burdens of ownership (including the burdens placed on them by this new law). In further evidence of this, most (83%) rated their building as being in above average physical condition relation to neighboring or similar properties, most rated their building as being relatively easy to manage (71%) and a good business investment (75%). Most (75%) expressed that finding tenants was not a problem, and that they have either a below average vacancy rate or relatively low tenant turnover. In sum, the owners and managers I talked to did not generally perceive their buildings as problematic from a business point of view, other than the issue of being listed on the BSSO Inventory.

5.B – Characteristics of the Affected Buildings

Physical Characteristics

Year Built, Number of Stories, Size and Use

Among all buildings affected by the BSSO, the mean year built is 1951 and the median year built is 1960. The oldest property was built in 1900 and the newest one was built in 1972 (when the City of Berkeley added new zoning restrictions that essentially prohibited new apartment construction in residential areas). About two thirds of listed properties were built between 1955 and 1965.

Figure 42 shows the breakdown of all 321 originally listed properties plus the 13 identified pre-law retrofit properties by number of stories. It reveals two major groupings of property types by age. This suggests two clusters by age that may represent distinct building technologies. The 1920s buildings are more likely to have plaster walls and ceilings, and perhaps board sheathing, but not wood structural panels (WSP) which were not yet invented. The 1950s and 60s buildings are more likely to have gypsum board walls and ceilings and perhaps WSP shear walls. These differences can have implications for the structural system and seismic performance as well as retrofit costs and difficulty.

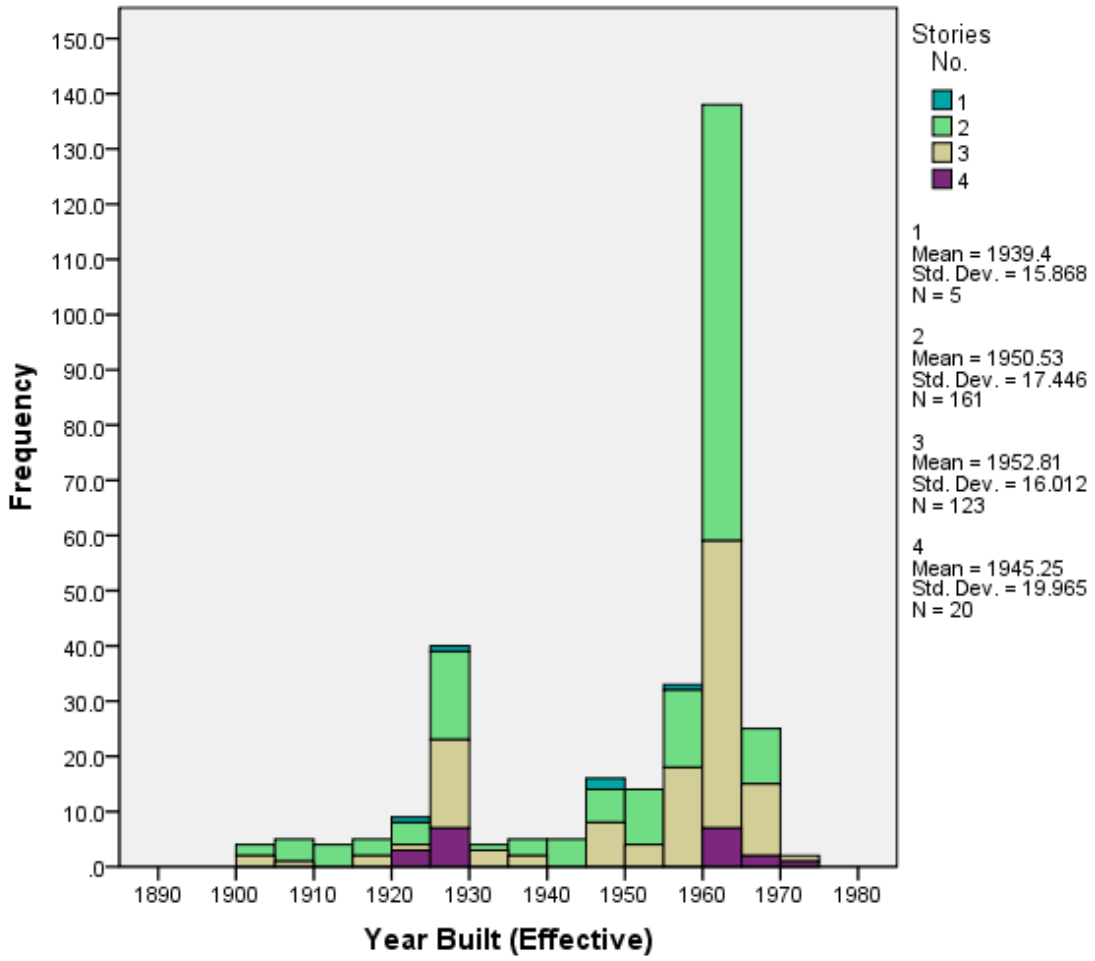

Figure 42. Effective year built for suspected soft-story buildings in Berkeley, CA by number of stories.

The average age of retrofit properties was slightly older for properties retrofit prior to the law (mean year built=1942) than after it (mean year built=1954). A one-way ANOVA test suggested that differences in mean year built across the three retrofit status groups were marginally significantly, F (2, 306) = 2.71, p = .068.

Figure 43 shows some general statistics about the size, units, and on-site facilities of the buildings in the study population. The average Berkeley soft-story rental property has 11 units. The majority of the buildings are under 20 units, which is not very large by apartment building standards –just barely "commercially viable" in size according to some of the owners I talked to. The vast majority (92%) have either two or three stories. Apparently, eight buildings were put on the Inventory even though listed in city records as having less than five units. Also, five one-story buildings were included on the Inventory in error. Although data was only available for 75 properties, the average number of parking spaces provided on-site was 7 and the median number of parking spaces was 5. Although I have no direct data on this point, the small number of parking spaces relative to the size of the buildings and unit totals implies that there is ground-level occupancy in some of these buildings. This has implications for tenant safety in a first floor collapse.

There did not appear to be relationships between these variables and retrofit status except for possibly the number of parking spaces in the buildings. There is an average of thirteen parking spaces in buildings that have been retrofit compared to seven in buildings that have not been retrofit, but I did not test this difference for statistical significance because the number of buildings about which I have parking data is so small.

	Mean	Std. Deviation	Minimum	Maximum	Valid N	Missing
Number of Stories	2.5	.64	1	4	309	12
Number of Residential Units	11	9.4	1	112	303	18
Total Living Area (Sq. Ft.)	7,846	5,434	883	61,896	309	12
Number of Parking Spaces	8	7.1	2	38	77	244

Figure 43. Size and on-site facilities statistics for Berkeley's soft-story buildings.

Figure 44 shows a breakdown of the study population of buildings by official use. By definition, the ordinance was targeted at multi-unit residential properties. Eighty-four percent of the originally listed properties directly met that definition. The Inventory listed five dormitories and fraternities, a low-income hostel, and a nursing home. Fifteen properties involved commercial uses somehow (e.g., motel, light industrial, or mixed-use apartments with store or office space) but if five or more residential units existed on-site, the ordinance still applies.

Officially, condominiums and tenancies-in-common (TICs) could also be subject to this law, but apparently there are almost no condominiums in Berkeley of this building type. In my interviews, I encountered two owners who had undergone or attempted a condominium conversion (which is highly discouraged by the city) in the years right after the ordinance. Both decided to retrofit, and their experiences were distinct from those of other owners, as will be discussed in Chapter 6.

Use Type	Count	Percent
Multifamily Residential	271	84%
Store(s), With Apartment Units	27	8%
Store(s), With or Without Office Units	11	3%
Fraternity/Sorority/Dormitory	5	2%
Motel	3	1%
Public	1	0.3%
Quadruplex	1	0.3%
Nursing Home	1	0.3%
Lodge/Clubhouse	1	0.3%
Light Industrial	1	0.3%
Condominium	1	0.3%
Commercial	1	0.3%
Totals	324	100%
Unknown	7	

Figure 44. Berkeley soft-story buildings by use (if known).

Location/Neighborhood

The properties on Berkeley's soft-story Inventory are spread throughout the central and western parts of the city; very few (2%) are located in the Berkeley hills where the slopes essentially preclude this building type (Figure 45). Forty-two percent are in West Berkeley (which tends to include the city's poorer areas) and 56 percent are in the Central/University districts (which tends to be dominated by students). As to possible relationships between the ZIP code the buildings are in and their retrofit status, a lower percent of identified soft-stories have been retrofit in Berkeley's western-most ZIP code (94710) and the highest fractions of retrofit properties are found in the two ZIP codes located to the immediate north of the UC Berkeley campus (94709, 94707).

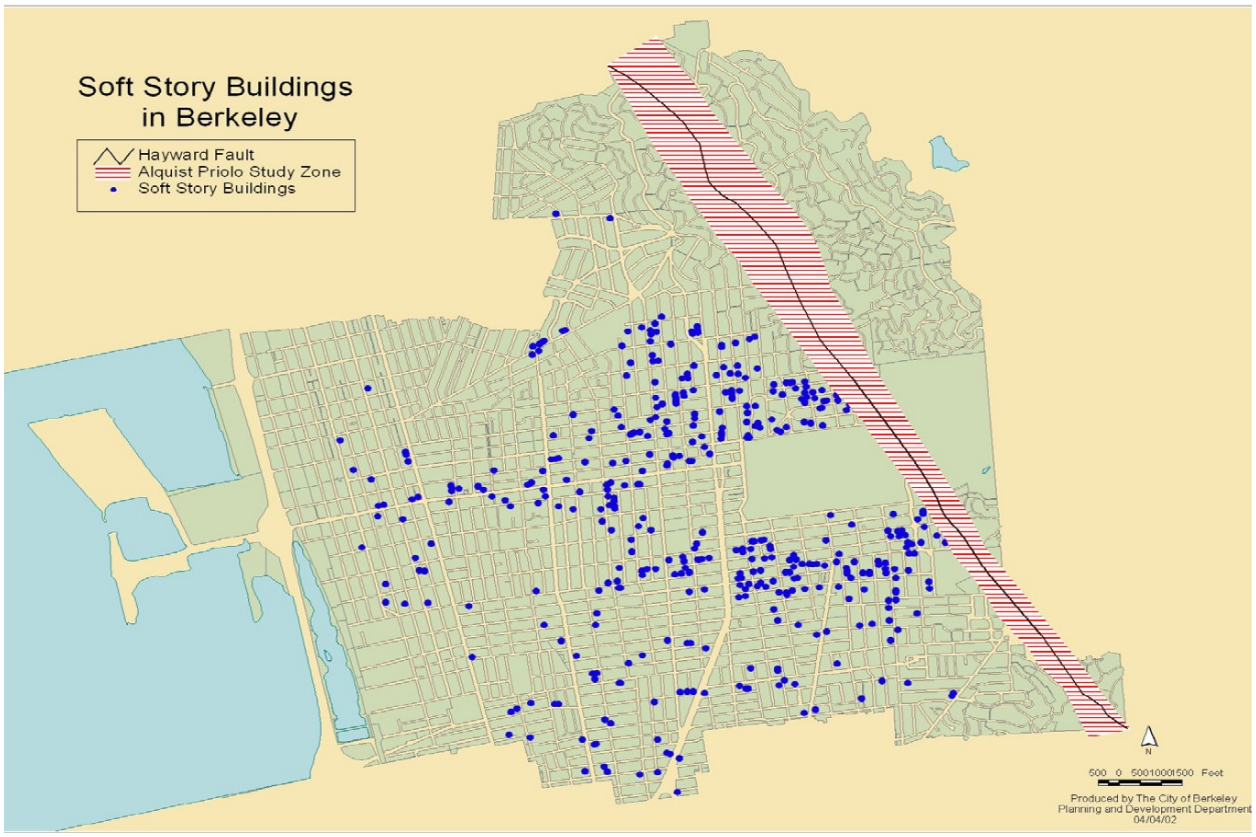

Figure 45. Map of listed soft-story properties in Berkeley and location of the Hayward Fault Special Seismic Studies Zone. *Map provided by the City of Berkeley, Joan MacQuarrie, April 2009.*

Berkeley Zip Codes			When (If Ever) Retrofit -- 2010 Status			
			Never	Retrofit Prior to Law	Initiated Retrofit After Law	Total
	94609	Count	1	0	0	1
		% within row	100.0%	.0%	.0%	100.0%
	94702	Count	30	2	5	37
		% within row	81.1%	5.4%	13.5%	100.0%
	94703	Count	66	3	14	83
		% within row	79.5%	3.6%	16.9%	100.0%
	94704	Count	57	0	9	66
		% within row	86.4%	.0%	13.6%	100.0%
	94705	Count	20	0	4	24
		% within row	83.3%	.0%	16.7%	100.0%
	94707	Count	4	1	2	7
		% within row	57.1%	14.3%	28.6%	100.0%
	94709	Count	61	6	27	94
		% within row	64.9%	6.4%	28.7%	100.0%
	94710	Count	14	1	1	16
		% within row	87.5%	6.3%	6.3%	100.0%
Total		Count	253	13	62	328
		% within row	77.1%	4.0%	18.9%	100.0%

Figure 46. Location of Berkeley soft-story properties by zip code and retrofit status.

Finances & Sales History

The average number of years since a property last changed hands is just under 19 years, meaning that in general the group of owners in 2006 was not new to the business. Most of the properties on Berkeley's soft-story Inventory have been held as long-term investments, and this was supported by the storied I heard in the interviews. Furthermore, many properties were acquired from a family member or the owner told me they want to transfer the property to their children some day.

That being said, twenty five percent of the properties had changed hands in 2002 or later. There is some evidence to suggest that a surge in sales occurred in the two years immediately preceding the law's passage; over 50 properties changed hands in 2004 and 2005 alone, and the vast majority of those had not been retrofit as of 2010.

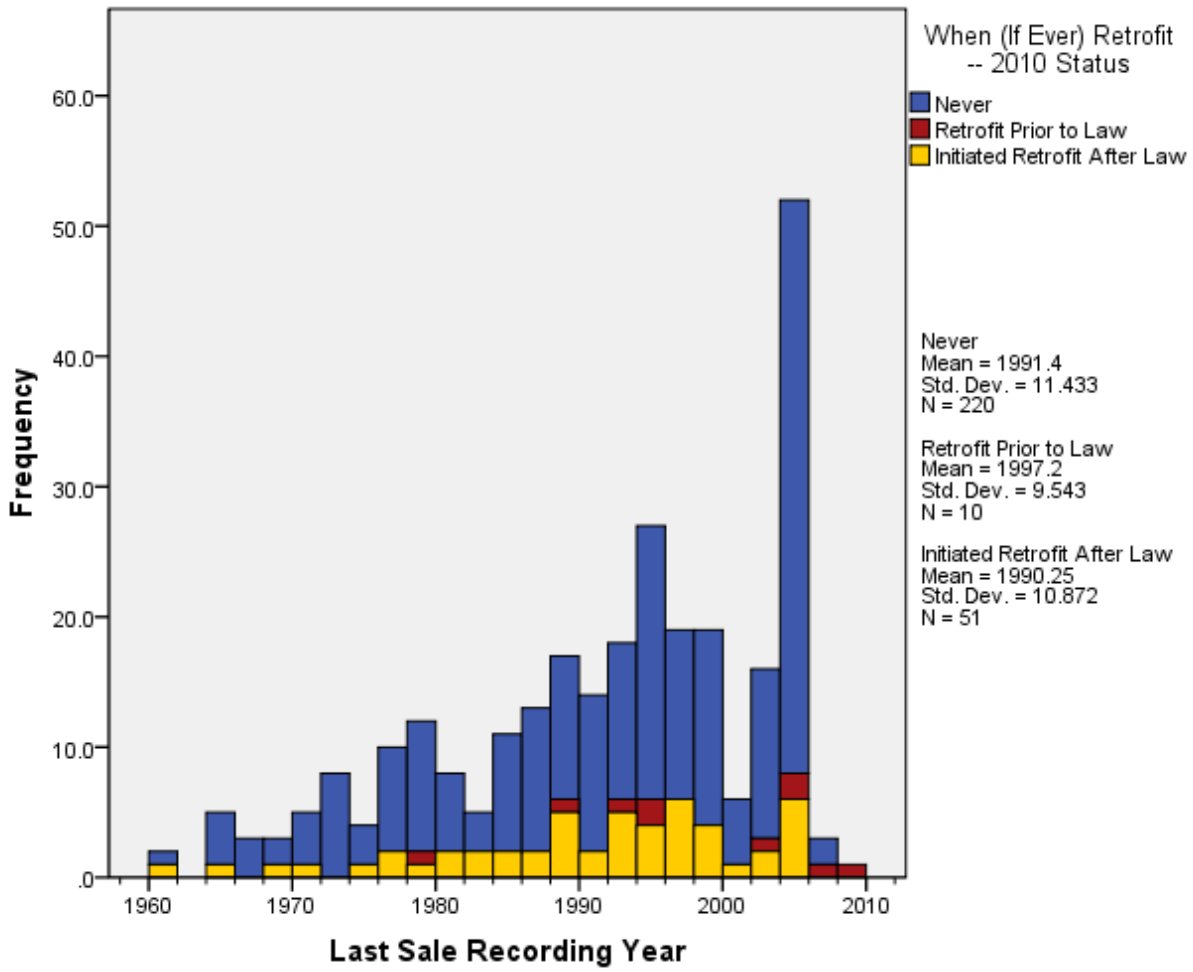

Figure 47. Histogram of all Berkeley suspected soft-story properties by year of last sale.

Freely available data about the price at last sale and property value of Berkeley soft-story properties was very limited. I obtained last sale price values for only 176 of the 331 properties in the study population, and some of the reported values did not make sense (note the low price per square foot minimums in Figure 48). Furthermore, property tax data is limited in its usefulness by California's Proposition 13, which caps the yearly increase in the assessed value relative to the base year sold at two percent. Therefore, properties which have been held a long time will be assessed tax on a very small amount of value relative to their probable current market worth.

Therefore, I report here only a few narrower statistics to give some sense of the magnitude of property values at stake. For instance, among the 19 properties for which I have data that were sold in 2005, the mean sale price was $1.3 million (σ=$489,076; minimum=$720,000, maximum=$2.1 million) or $233 per livable square foot (σ=$54; minimum=$149, maximum=$344). In 2005 the local housing market was at a high, but as noted above, awareness of the soft-story law had already permeated into the local housing community. The net effect of those two forces is not known.

	Mean	Std. Deviation	Minimum	Maximum	N
Total Value (Taxable)	$786,680	$640,967	$123,371	$3,480,000	151
Sale Price at Last Sale	$807,542	$820,076	$53,000	$7,772,720	158
Price per Sq. Foot (Last Sale)	$112	$85	$10.60	$392.84	158
1st Mortgage (at Last Sale)	$541,690	$400,445	$20,000	$1,837,500	114
Land Value	$280,695	$233,762	$32,630	$1,350,000	155
Total Assessed Value (2005)	$799,885	$644,178	$123,371	$3,480,000	155
Property Tax (2005)	$15,243	$10,665	$761	$55,991	155
Valid N (list wise)					111

Figure 48. Tax and sale price descriptive statistics for suspected Berkeley soft-story buildings.

5.C – Summary of Findings about Berkeley's Soft-Story Owner Population and Buildings

1. *Berkeley soft-story owners tend to be local small business people; however, they are not easily categorized into a single type.*

The "typical" Berkeley soft-story owner – if there is one – is a 60 year-old male or a couple in their 60s who own rental property for a living or for supplemental income. Most Berkeley soft-story owners live within or near the City of Berkeley and have owned their property for decades.

A large range of ownership structure types are in place. Ninety percent of Berkeley soft-story properties are owned by individuals, couples, or as a trust managed by a trustee who might be either a family member or guardian such as a lawyer. A small number are owned as a formal business partnership and a handful are owned and operated by a non-profit or academic institution. About a fifth of properties on Berkeley's Soft-Story Inventory are owned by people who manage and/or own more than one building on the list. Many owners use a professional property management agent to whom they delegate big decisions.

Among study participants, additional commonalities emerged. These owners tended to be older, male, well-educated, and have strong community ties. As a group, they value the income they get from being a landlord, but also the sense of independence and control that comes from owning rental property. When there's a problem with their properties, they like to tackle it head on. About half of people I was able to interview had substantial real estate or building trade experience while the other half had some other primary career.

2. *The BSSO caught most owners by surprise, as they were unaccustomed to incorporating earthquake risk into their property purchase and management decisions prior to the law.*

Buyers and sellers of rental property in the Berkeley market operate in an environment that contains little to no external cues to consider earthquake hazards. Furthermore, the

absence of discussion or concern about earthquakes on the part of family, friends, professional associates, and the government (as evidenced by the absence of any previous laws or public education or action campaigns) is taken as evidence that the codes under which their buildings were originally built provide a reasonable level of safety. The law was a negative surprise for many owners who had no idea – despite broad earthquake awareness and long term personal experience living in earthquake country – that they owned a potentially risky property.

It was simply not customary to consider earthquakes when making rental property purchase and management decisions. Almost no participants considered earthquakes in their past actions related to rental property purchase and management. This was true even among persons with high real estate or building trade experience, which is a bit surprising considering the high stakes for these mom and pop owners.

Most of the interviewees I spoke with still feel that their building is a good investment and want to hold it for a long time, regardless of being impacted by the BSSO. Those that didn't seemed to be at a transition point with the property anyhow for additional reasons (divorce, death in family, other major repairs needed), and the law was merely "the last straw." Even though Berkeley's rental housing market has low turnover in general, there was a substantial sell-off of soft-story properties in the year or two surrounding passage of the law, suggesting that some owners knew about the law before it was passed and wanted to avoid dealing with its downsides.

3. *Ownership structures, educational attainment, ownership of multiple listed properties, and level of real estate and building trade experience are potentially related to retrofit behavior.*

My assessment of the administrative, interview, and survey data suggest that ownership structure might be associated with higher rates of retrofitting after the law. Post-law retrofit rates were higher than average among Individuals and Within-Family Partnerships and lower than average for Partnerships and Institutions. Trusts showed a post-law retrofit rate of double the average for all ownership groups, which could be a sign of eagerness on the part of empowered custodians to respond conservatively when new information about a financial risk is revealed.

Among study participants, I also found that post-law retrofitting may be positively linked to having college or higher educational attainment, ownership of multiple listed properties, and the owner's level of real estate and building trade experience. These traits are all relate to the individual's status within the social environment, how skilled they might be at assessing mitigation as a business opportunity, and how much information they have (and how much it costs to search for more information) regarding what can be done and their peers are doing.

Distance from Berkeley to where an owner receives their official mail did not appear to be associated with response to the law in terms of retrofitting. The data about age, marital status, and being a parent that I had were so limited I was unable to assess relevance of those traits.

4. *The soft-story buildings on Berkeley's Inventory cluster into two age groups – 1920s and 30s and 1950s and 60s – that might relate to the degree of earthquake hazard or ease of repair. Overall, building characteristics do not appear to be associated with retrofit status.*

Suspected soft-story buildings in Berkeley appear to have been built largely in one of two different eras, roughly in either the 1920s or in the 1960s. Because building age correlate with the materials and structural system employed, this may be important in terms of the degree of hazard they actually pose and/or how expensive it might be to upgrade them.

There were no easily distinguishable differences in terms of year built, number of stories, total livable square footage, number of units, or sales history between the soft-story buildings in Berkeley that have been retrofit or not either before or after the law. In the limited set of data available about parking spaces, it appeared that retrofit properties had twice as many parking spaces on average as non-retrofit properties.

The most important take-away message from this chapter is that none of these straightforward variables about the owners and the buildings point to clear reasons why owners either decided to retrofit or not either before or after the law. I proceed, therefore, in the next chapter to assess more detailed personal background data, perceptions of risk, mitigation, and the social context, and several personality measures that may relate to the observed variation in owner behavior.

CHAPTER 6 – FACTORS INFLUENCING MITIGATION BELIEFS & BEHAVIOR

In this chapter, I explore further into the detailed survey and interview data provided by 43 Individuals, Managers, and Institutional Representatives who were either affected by Berkeley's Soft-Story Ordinance or who retrofit their soft-story property prior to the law. The first objective is to richly describe the relevant beliefs of this group of property owners. I cover their perceptions of earthquake risk, structural mitigation, and changes in the social setting created by the law, as well as a variety of individual difference traits ranging from past experiences to personality factors. The second aim is to explore potential differences these measures in relation to the retrofit status and timing of their properties. Throughout, my strategy is to make comparisons between persons who initiated a retrofit before the law, after the law, or not at all.

6.A – Past Experiences and Perceptions of Earthquake Risk

It is reasonable to believe that people who have had particularly negative or more frequent experiences with earthquakes in the past might be more sensitive to the problem and willing to take action. In this section, I discuss the specific earthquakes effects that study participants report experiencing and anticipating.

<u>Awareness and Past Experiences with Earthquakes</u>

As noted in Chapter 5, almost all of the study participants are long term Bay Area residents and most were born nearby. Among those who immigrated from overseas, most came from natural disaster-prone regions like Eastern Europe, China, India, and elsewhere in Southeast Asia. Furthermore, the interviewees generally reported having life-long awareness of earthquake as a threat. Eighty-three percent report personally experiencing a "large earthquake event" – in most cases, the 1989 Loma Prieta event.[36]

The data in Figure 49 suggest that these experiences with past earthquakes were not necessarily fleeting or without memorable consequences. Five study participants reported knowing someone (such as a friend, relative, or colleague) who had been injured or killed in a past earthquake. Surprisingly, the relationship with retrofit status is opposite than one might expect: the proportion of non-retrofitters answering that question affirmatively (23%) was over twice as high as for post-law retrofitters (9.1%).

Overall, about one in four respondents reported *personally* experiencing property damage in a past earthquake event, with post-law retrofitters and non-retrofitters in approximately the same proportion. Furthermore, about one in two reported knowing *someone else* whose property was damaged in a past earthquake event. More Managers (100%) and Institutional Representatives (71.4%) than Individuals (34.5%) reported knowing someone who has experienced past earthquake property damage.

[36] Thirty-one people described this event accurately by year and/or region, and 18 people of those were also able to name it accurately. Four persons more or less precisely referenced the Magnitude 5.3 Daly City event in 1957, near San Francisco. Two persons mentioned experiencing the Northridge 1995 event.

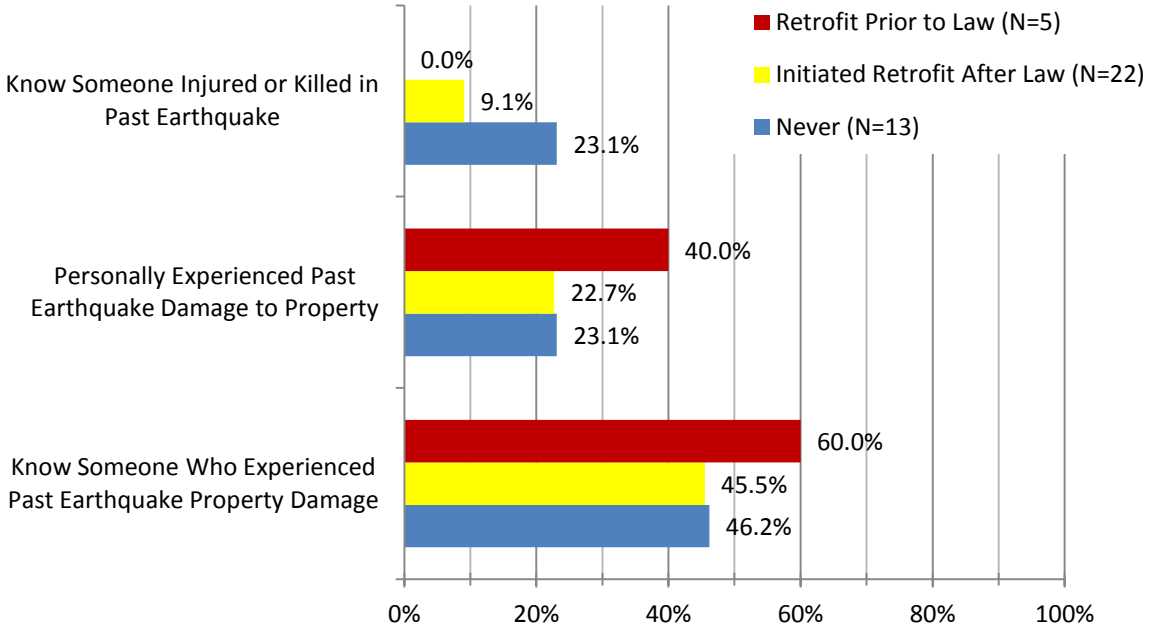

Figure 49. Percent of study participants who report experiencing any property damage in a past earthquake, knowing someone who was either injured, or knowing someone who experienced property damage in a past earthquake by retrofit status and timing (N=40).[37]

General Attitudes and Knowledge about Earthquakes

Risk Perceptions

Perceived risk is a multi-dimensional and context-specific impression, and therefore is not easily measured. The survey for this study contained questions about the likelihood of both regional and localized "large" or "major" events, defined as earthquakes sufficiently large to cause severe economic damage and loss of life. From that basic definition, respondents were free to interpret for themselves what the question meant in terms of earthquake severity. I also asked about the likelihood of property damage in the community and to the respondent's own properties, how serious those damages would be, and about the potential for themselves or others to be injured.

Figure 50 shows mean ratings by retrofit status on a series of general questions about earthquake risk. Although the number of pre-law retrofitters in this study is quite small, it seems evident that this group has a greater degree of pessimism and heightened risk perception. Post-law retrofitters and non-retrofitters overall agreed less strongly about the likelihood and severity of a major earthquake in the East Bay. Post-law retrofitters in particular did not seem to feel an event is imminent. Of the three interviewee types, Institutional

[37] Note: This figure displays ALL study participants, mixing managers together with individuals and institutional representatives because there did not appear to be important differences by interviewee type.

Representatives appeared to perceive earthquakes as more serious and imminent than did Individuals and Managers.

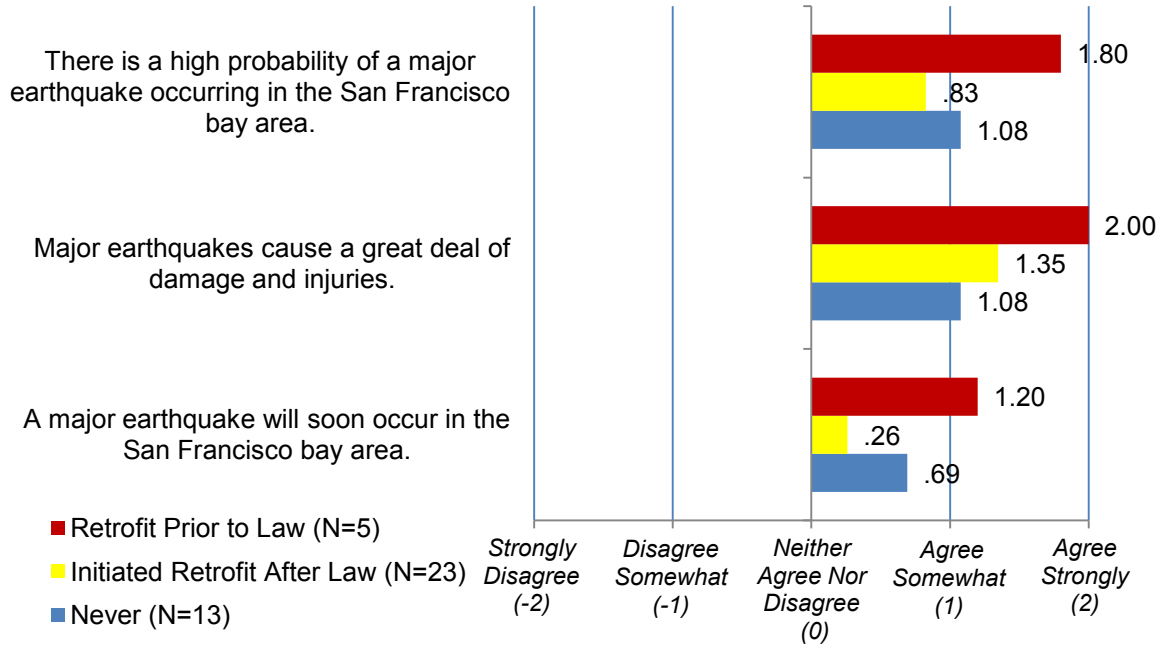

Figure 50. Level of agreement with general statements about earthquake risk by retrofit status and timing among study participants.

Figure 51 shows what respondents communicated about the likelihood of Berkeley and the San Francisco Bay Area specifically being affected by a major earthquake in the next ten years. On average, participants described such earthquakes as "moderately likely "to "likely". However, pre-law retrofitters again stand out as having the highest risk perceptions. Post-law retrofitters reported slightly lower likelihoods on average than did non-retrofitters, perhaps in part because retrofitters are considering their own mitigation status making that assessment. Among the three interviewee types, Managers had the lowest mean rating ($\mu = 2.75$, N=4) of earthquake occurrence and significant damage likelihoods.

With regard to the likelihood of specific consequences, study participants reported on average that significant damage to their rental property in a major East Bay earthquake was "somewhat likely" (Figure 52). Study participants on average thought that injury to themselves or others was between "not very likely" to "somewhat likely". On these measures as well, the pattern of pessimism and heightened risk perceptions among pre-law retrofitters is evident.

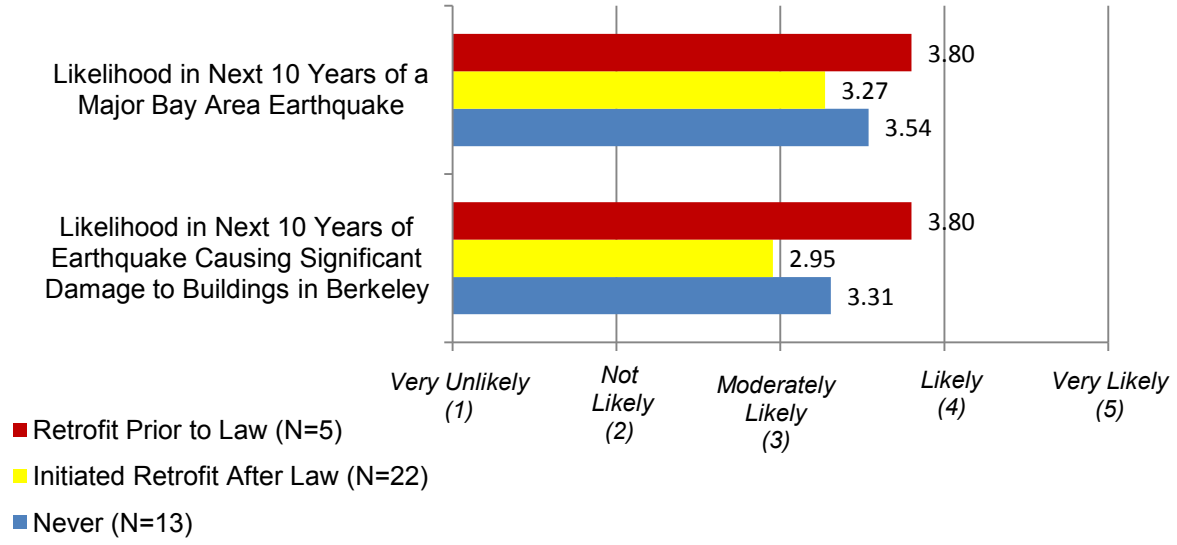

Figure 51. Mean ratings by retrofit status of likelihood of major damaging earthquake events.

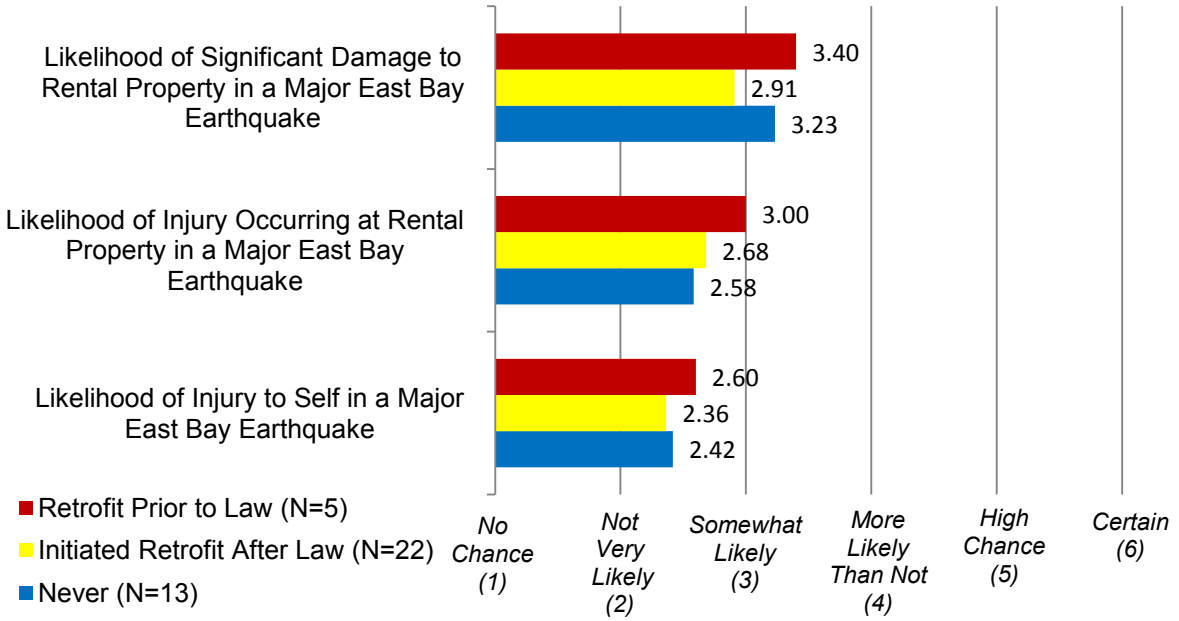

Figure 52. Mean ratings by retrofit status of likelihood of various consequences of a major East Bay earthquake.

About half (42.5%) of the respondents felt that a major earthquake in the East Bay would result in "serious" or "very serious" damage to properties in Berkeley, while 45 percent thought the damage would be "moderate" and 12.5 percent thought the damage would be "minor". Figure 53 shows how study participants rated the potential seriousness of damage from a major East Bay earthquake to buildings in Berkeley, their rental property, and to their current residence. Pre-law retrofitters expressed the highest expectations of damage

seriousness to buildings in Berkeley, while non-retrofitters rationally had higher damage expectations on average about their rental properties.

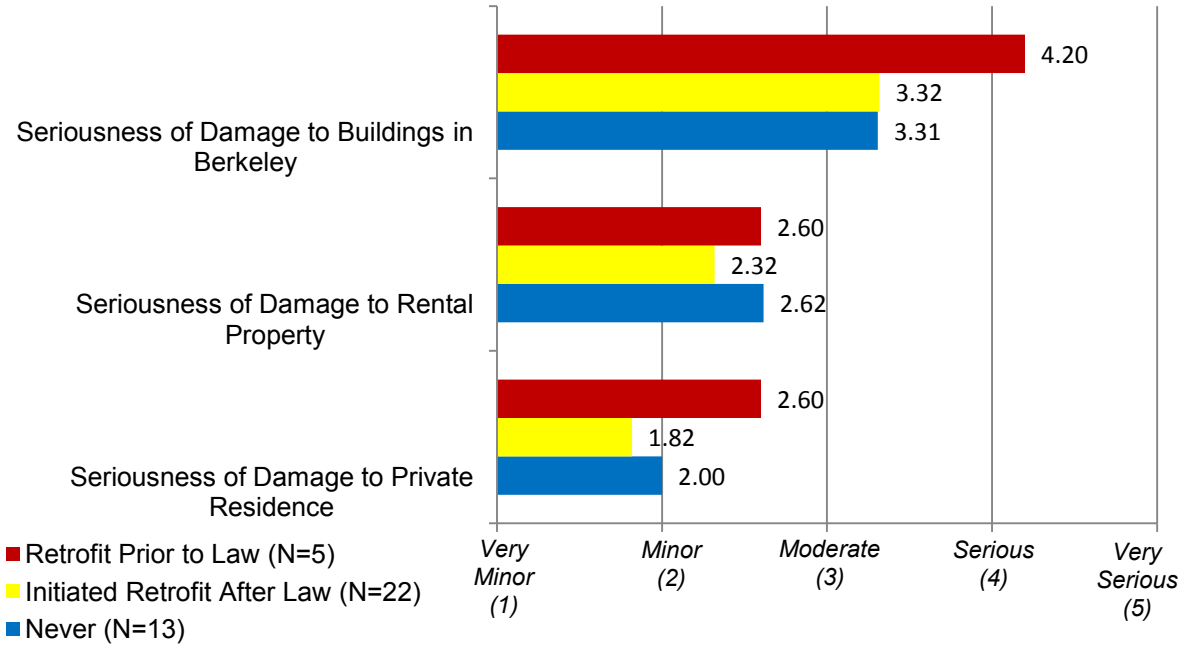

Figure 53. Mean ratings by retrofit status and timing among study participants of the resulting seriousness of damage to community, property and current residence in a major East Bay earthquake.

Degree of Concern

Qualitatively, only a few study participants expressed feeling any *dread* about earthquakes. Rather, as a group these property owners and managers seen to view earthquakes as an inevitable but vague and un-personalized threat that is accepted to the point of being ignored. Below are a selection of quotes that represent this view.

> *"[The idea of living where big earthquakes happen] didn't bother me. There's only one way to heaven." [OB6:20]*

> *"I went into quite a few earthquakes. Some people from out of state never knew what an earthquake, they're scared so much, you know, what's an earthquake? I'm really calm." [OB21:21]*

> *"It was never a concern to me, not even slightly." [OB41:9]*

In the survey, participants reported a modest degree of concern about a local large earthquake (Figure 54). Non-retrofitters on average report about the same overall level of concern as retrofitters, as shown in Figure 55. An additional thing to note is the higher spread (variance) in degree of concern among retrofitters, with nearly as many retrofitters reporting

they are “slightly concerned” as reported being “very concerned”. This could mean that the act of investing in a retrofit reduces concern for some people, but not for others. Or, alternatively, that some retrofit actions are associated with concern while others are not. Retrofitters and non-retrofitters alike tend to see themselves as more concerned about earthquakes than other local landlords.

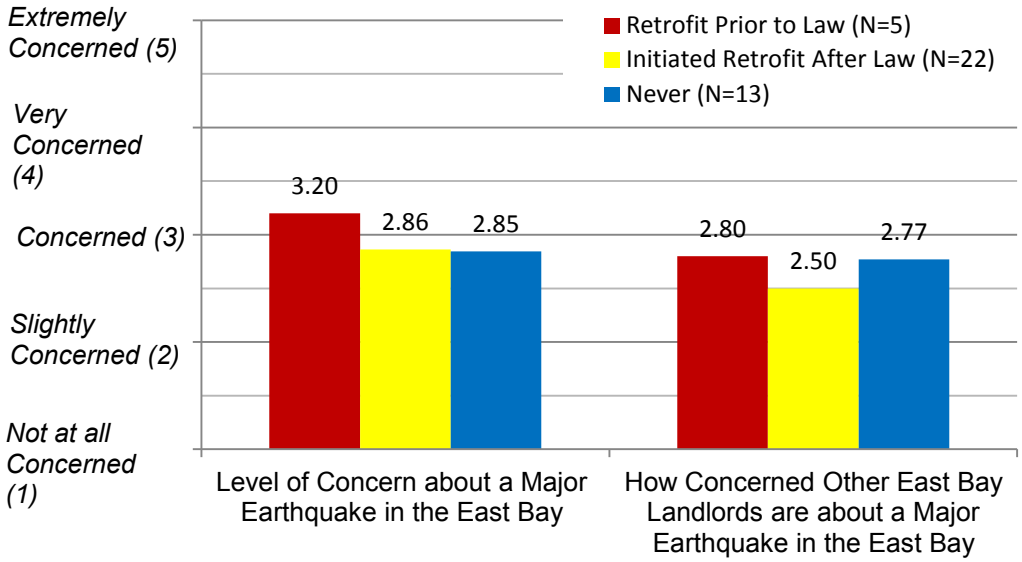

Figure 54. Mean rating by retrofit status on a 5-point scale regarding of degree of concern about a major local earthquake.

	How concerned are you about a major East Bay earthquake?		***How concerned are other landlords about a major East Bay earthquake?***	
	Non-Retrofitters (N=13)	All Retrofitters (N=27)	Non-Retrofitters (N=13)	All Retrofitters (N=27)
Extremely Concerned	0	0	0	0
Very Concerned	1	9	2	3
Concerned	10	8	6	11
Slightly Concerned	1	9	5	11
Not At All Concerned	1	1	0	2

Figure 55. Table showing answers by retrofits status regarding self and others’ degrees of concern about earthquakes.

Some study participants qualitatively expressed their concern about earthquakes in relative-risk terms. As one interviewee put it:

> *“[My family has] been here for a long time and it’s a lot less riskier than dealing with the life in India…so that’s…how [my family] figured. It’s like, why not live here instead of living in India where there’s risk everywhere? So this kind of life (laughs) [is] a step up compared to what life was like [there].” [OB29:9]*

Risk-risk comparisons were also made by some interviewees regarding the degree of effort a landlord should be putting into earthquake safety relative to other safety aspects of their building. Overall, owners were struggling for a baseline measure of reasonableness for their level of precautionary action.

> *"We put deadbolt locks on the doors…and a little viewer. Those things probably do as much, if not more, for a tenant's safety than [the retrofit I] did because that's a day in and day out [thing]…That little peephole probably does more for their safety than doing [a retrofit]. I mean, …this may be the ultimate safety factor if there is a seismic event and the building's fine, but day in and day out, little things like that I think protect them more." [OB14:79]*

Thinking and Discussion with Others about Earthquakes

How much someone reports thinking or talking about earthquakes is often regarded as a proxy for *hazard intrusiveness*, or the overall salience of the topic to that person (Lindell and Perry 2000). Overall, the survey data show that even in the context of Berkeley's proactive law, apartment owners and managers are not thinking about earthquakes very often and are talking about them with other people even less (Figure 56). Again, pre-law retrofitters report slightly more frequent thoughts and talking to others than post-law and non- retrofitters.

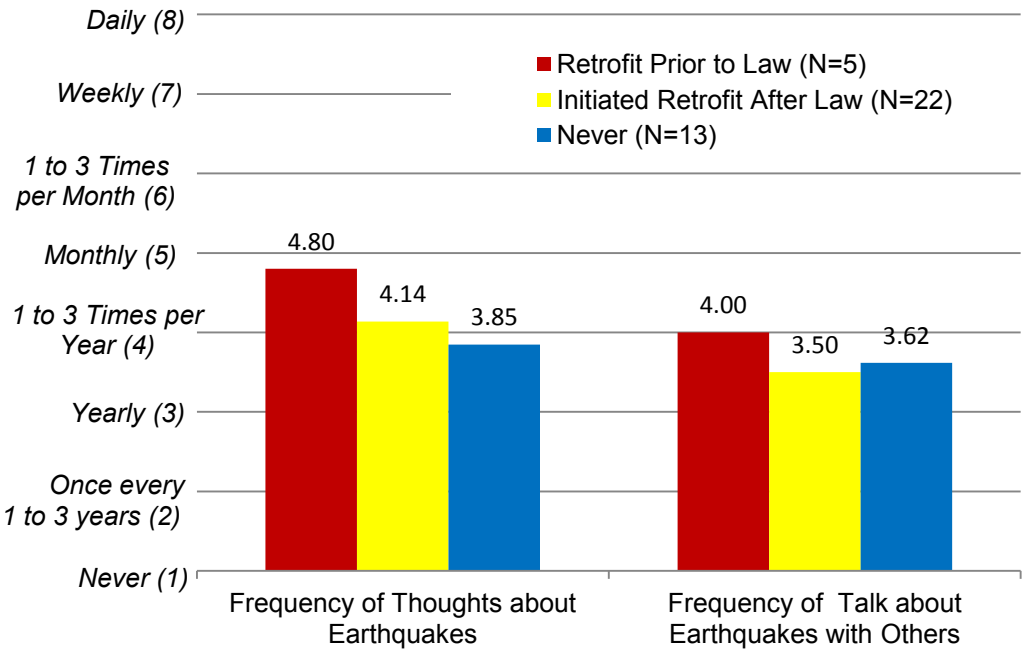

Figure 56. Mean ratings by retrofit status for study participants on an eight-point scale of frequency of thinking about earthquakes and talking about earthquakes with others.

Information Seeking Behavior

Sixty-one percent of respondents overall reported seeking out general information about earthquakes in the past, with a higher proportion of non-retrofitters answering yes to this question than post-law retrofitters (Figure 57). Among study participants, therefore, information-seeking does not appear to be associated with retrofitting behavior *after the law*.

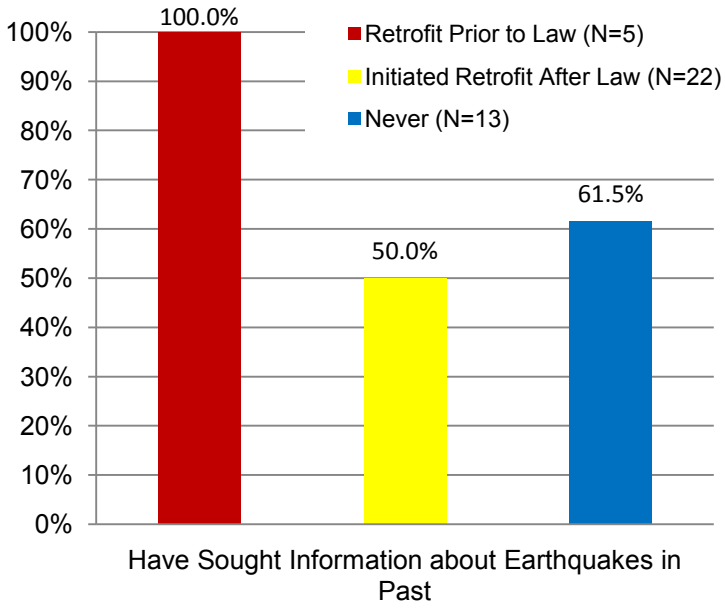

Figure 57. Percent of study participants, by retrofit status and timing, that report past information-seeking behavior about earthquakes.

The sources study participants report turning to for information (when asked to choose as many as apply from a list of ten options including "other") were: building professionals (72%); the internet (60%); newspapers or magazines (56%); books (40%); television (40%); and public presentations (36%). Figure 58 details the other sources that study participants have turned to in the past. There is no doubt that the BSSO is the reason why consultation with a building professional was the highest rated information source among the interviewees.

Other Possible Responses ("Choose All That Apply")	Affirmative Responses (Count)	As % of Those Who Reported Seeking Information	As % of All Respondents
Sought advice about it from a general contractor, engineer, or architect	18	72%	45%
Internet	15	60%	38%
Newspapers or magazines	14	56%	35%
Book	10	40%	25%
Television program	10	40%	25%
Attended a public seminar or presentation	9	36%	23%
Spoke about it with a real estate agent or broker	7	28%	18%
Spoke to someone at a government agency (e.g., USGS, FEMA)	6	24%	15%
Spoke about it with a financial services provider (e.g., a loan officer or insurance agent)	5	20%	8%
Other	3	12%	13%

Figure 58. Reported sources of information (participants were asked to choose as many as apply) among persons who sought information about earthquakes in the past.

Knowledge and Familiarity with Earthquake Hazards

In general, study participants rated themselves as moderately knowledgeable about earthquakes. Study participants that did or did not retrofit after law on average felt about as informed about earthquakes. However, four out of five pre-law retrofitters rated themselves as knowledgeable (Figure 59).

Please select the answer that best describes your level of knowledge about earthquakes:			When (If Ever) Retrofit -- 2010 Status Plus Interview Corrections			
			Never	Retrofit Prior to Law	Initiated Retrofit After Law	Total
	I know almost nothing about earthquakes.	Count	0	0	1	1
		% within row	0%	0%	100%	100%
	I know one or two things about earthquakes.	Count	7	1	9	17
		% within row	41%	6%	53%	100%
	I am knowledgeable about earthquakes.	Count	5	4	9	18
		% within row	28%	22%	50%	100%
	I am very knowledgeable about earthquakes.	Count	1	0	3	4
		% within row	25%	0%	75%	100%
Total		Count	13	5	22	40
		% within row	33%	13%	55%	100%

Figure 59. Self-reported level of knowledge about earthquakes among study participants by retrofit status and timing.

These survey answers subtly contrasted with the interview conversations, however, in that only a few study participants could verbalize any specific thoughts, concepts, or images regarding the ways that earthquakes could potentially affect them or their buildings. When I asked owners what would happen to their rental property in a major nearby quake, either with or without mitigation, very few had anything to say. Many shrugged their shoulders, perhaps because they were searching through their own past experiences for relevant information and came up empty.

> *"I have no idea of what would have happened. The buildings have been there a good long time and there have been big earthquakes, well, fairly large earthquakes. I've lived in Berkeley for a long time. Lived through some big shockers in the seventies, well in the sixties, particularly. So they've been around a long time without terrible damage. So I don't really know what would have happened. [OB27:52]*

Some interviewees did express an understanding that Loma Prieta was not a very significant local quake. Two or three reasoned that Loma Prieta occurred many miles away and that the shaking lasted for a short amount of time in comparison to what could be expected from an event on the nearby Hayward fault. As one Institutional Representative stated:

> *"Loma Prieta wasn't that big a deal here, in this environment. But, the Hayward Fault would be pretty significant, I suspect that [had our building not been retrofit] it would have collapsed and possibly killed the staff." [OB12:19]*

As noted in Chapter 5, most property owners and managers I spoke to reported being unaware that their building might be earthquake vulnerable prior to receiving notice about the building. Study participants might have been motivated by the social and legal benefits of projecting prior ignorance. Those who did report some prior awareness all possessed some related professional experience either in real estate, architecture, urban planning, construction, or a similar field. In only two cases, however, did this prior knowledge lead the owner to do retrofit work prior to the law. Here is how a local real estate broker described the thought process associated with retrofitting:

> *"When we bought [our rental property] in December of '94, I knew that it was a soft-story issue. There were a lot of garages on the first floor. Anyone who's ever played dominos and built one of those serpentine things knows you have an issue there. So I made plans immediately to straighten that [out] and, in fact, the former owners…had already contracted with an engineer to do a study on it. I liked him so I went ahead with them and completed that." [OB8:14]*

At present, study participants rated themselves as moderately familiar with how earthquakes can affect apartment buildings like the ones that they own (Figure 60). Those who had been through the process of doing a retrofit reported feeling slightly more informed on average, but there was a range of replies in all groups. Several were able to link the concept to tuck-under parking or large plate glass windows. Collapse hazard, and the resulting threat to life safety, was the most salient consequence. Here are two typical descriptions reflecting how study participants understand the hazard:

> *"Soft-story [is] basically the idea…that if you got a building that [is] standing on stilts and cars are parking underneath it that, if come earthquake time, that building is more likely to fall over, as was witnessed in the Marina in San Francisco." [OB3:32]*

> *"If the building just happened to have a…like a carport area, or some kind of overhang where it's hollow underneath, their theory is if a big earthquake came, the whole building would collapse because of that hollow area." [OB32:35]*

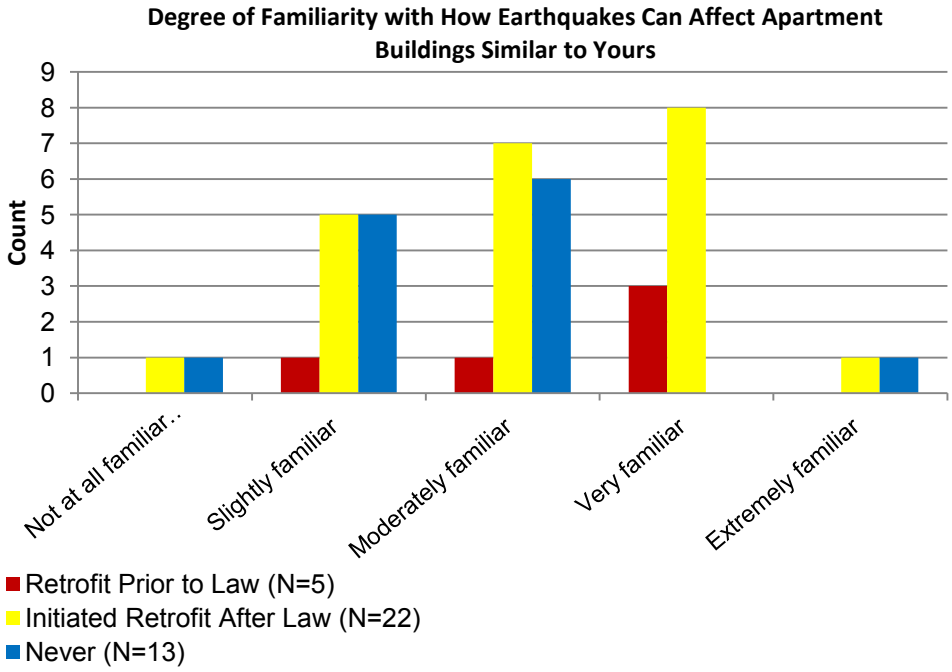

Figure 60. Self-reported familiarity among study participants with how earthquakes can affect apartment buildings by retrofit status and timing.

In this section, I have described the earthquake experiences, risk perceptions, concern, information seeking, and knowledge of study participants and looked for potential differences in these measures across the three retrofit status and timing groups. Overall, I find minimal support for the idea that retrofit behavior is being driven in this context and population by past experiences with earthquakes or differences in perceptions about the hazard.

6.B – Past Experiences with and Perceptions of Mitigation

I now move on to explore ways in which the retrofit behaviors of study participants might be associated with beliefs and past experiences regarding the behavior itself. This is a classic prediction of the Theory of Reasoned Action (TRA).

<u>Attitudes Regarding Earthquake Preparedness, Mitigation, and Insurance</u>

General Beliefs about Mitigation

Respondents overall reported neutral to favorable attitudes towards preparedness and mitigation. Figure 61 shows mean ratings by retrofit group of participant reactions to four general statements related to earthquake preparedness. Pre-law retrofitters had the most extreme views across all four questions, and there was broad agreement on all four questions as to the valence of each groups' mean answers. Retrofitters were slightly more in agreement that preparing for earthquakes is important and effective. All groups disagreed that preparing is

easy to accomplish. Finally, all groups agreed that insurance is *not* a superior strategy to mitigation, with retrofitters feeling that most strongly.

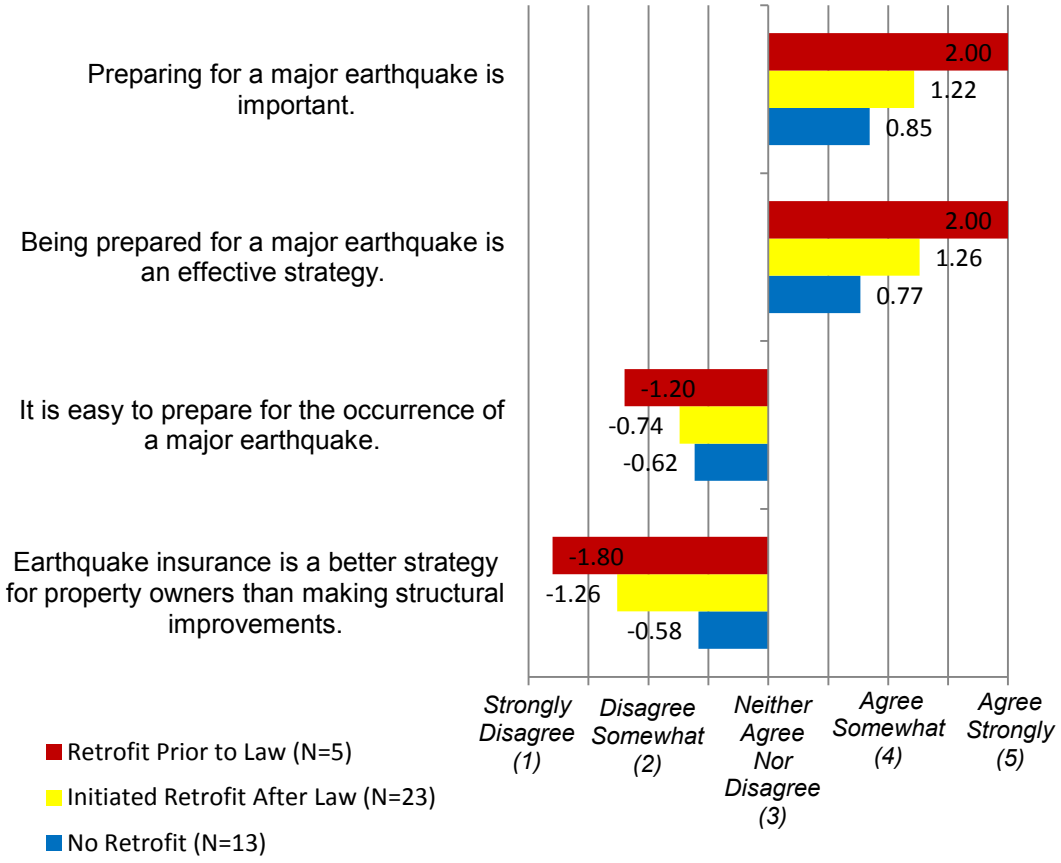

Figure 61. Comparison of general perceptions about earthquake preparedness among study participants by retrofit status and timing.

Figure 62 shows a breakdown by groups of the level of agreement with the statement: "*Being prepared for a major earthquake is an effective strategy*." More than half the survey respondents (24 out of 41) somewhat agreed and another 13 agreed strongly with that statement." This again suggests that study participants regard mitigation favorably overall. A pattern is beginning to emerge with pre-law retrofitters seemingly the most enthusiastic followed by the post-law retrofitters and then the non-retrofitters. However, this may not reflect cause – persons who have already invested in preparedness may express stronger support for it simply to avoid expressing an opinion that contrasts with their own behavior. However, it is interesting that all five of the pre-law retrofitters strongly agreed that mitigation is effective strategy while the post-law retrofitters on average only somewhat agreed with that statement.

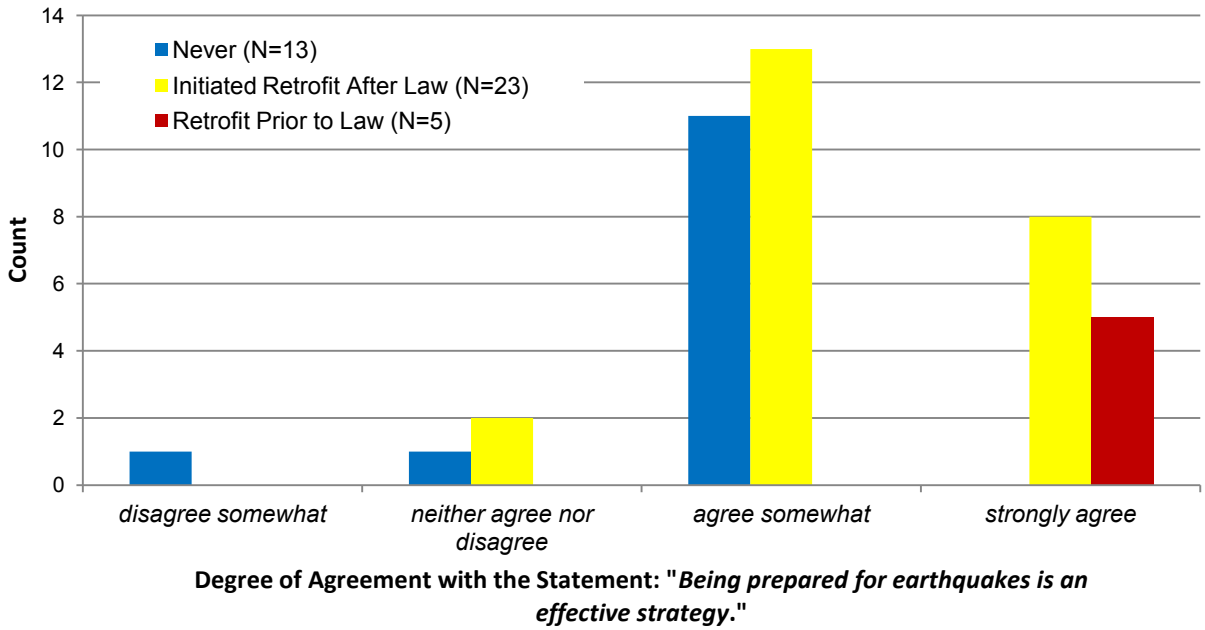

Figure 62. Counts showing degree of agreement among study participants with the statement, "Being prepared for earthquakes is an effective strategy," by retrofit status and timing.

Perceptions about Mitigation: Specific Up-Sides

In the survey, I asked participants to rate structural mitigation on the eight hazard-related (benefit) and resources-related (cost) attributes proposed by Lindell and Prater (2002) as well as four more. Figure 63 shows the mean ratings by retrofit status of respondents' opinions about structural mitigation on the hazard-related attributes. Overall, retrofitters rated mitigation as easier to accomplish and as more effective and beneficial for the community as a whole, for tenants, and for themselves than did non-retrofitters. The same overall pattern seen before holds here, with post-law retrofitters on average express views in between those of the pre-law retrofitters and non-retrofitters.

An important caveat in considering these questions, however, is that people generally find it easier to rate an action favorably after they've already done it. Thus, we cannot discern from this retrospective type of data whether these positive attitudes towards structural mitigation led to or resulted from taking the action, or both.

Two other interesting things to note in Figure 63 are the low level of belief in benefits to the community among non-retrofitters and the lukewarm views that post-law retrofitters and non-retrofitters seem to share regarding the effectiveness of mitigation in protecting property and its usefulness for multiple purposes.

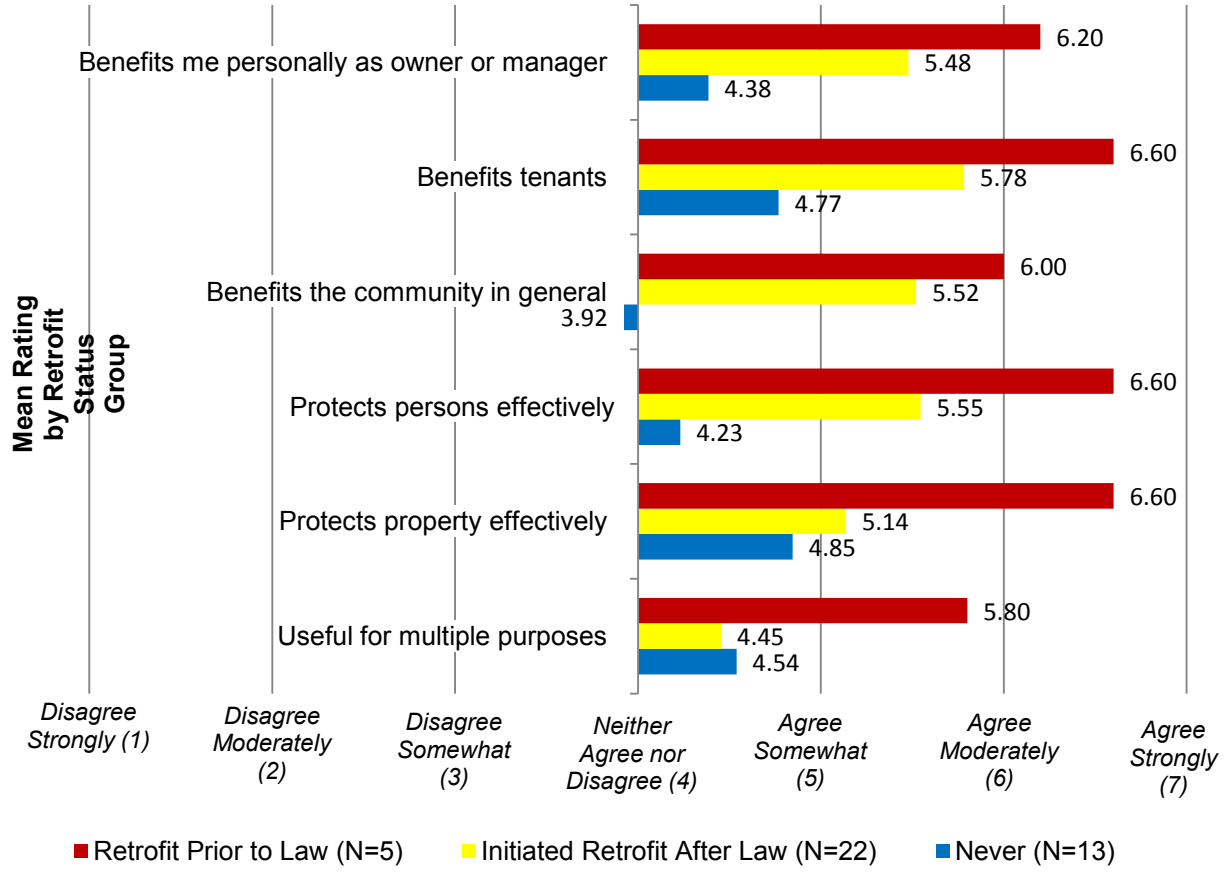

Figure 63. Mean ratings of structural mitigation beneficial attributes by retrofit status.

Perceptions about Mitigation: Specific Downsides

Figure 64 shows the mean ratings by retrofit status of structural mitigation on the resource and cost-related attributes. The three groups expressed similar beliefs about mitigation costs, where costs are broadly defined to include non-monetary resource needs such as time, effort, skills, and assistance. In general, the study participants agreed "moderately" with the statement that a great deal of effort is involved in pursuing a structural retrofit. Non-retrofitters rated structural upgrading as something that can be done with less help and without as much specialized skills or knowledge as did the retrofit groups. The largest area of disagreement appeared on the question of whether mitigation is a "risky investment", with non-retrofitters viewing it as more risky than those who have done it.[38]

[38] I did not explicitly define what a "risky investment" was for the participants – they were free to answer according to their own interpretations of that phrase. A retrofit could be "risky investment" because the building has to be vacated in order to do it, leading to uncertainty about when and for how much a new tenant may be able to rent the place. Or, it might be perceived as risky because a very large earthquake could still render the property un-usable, even though they've invested in seismic upgrades.

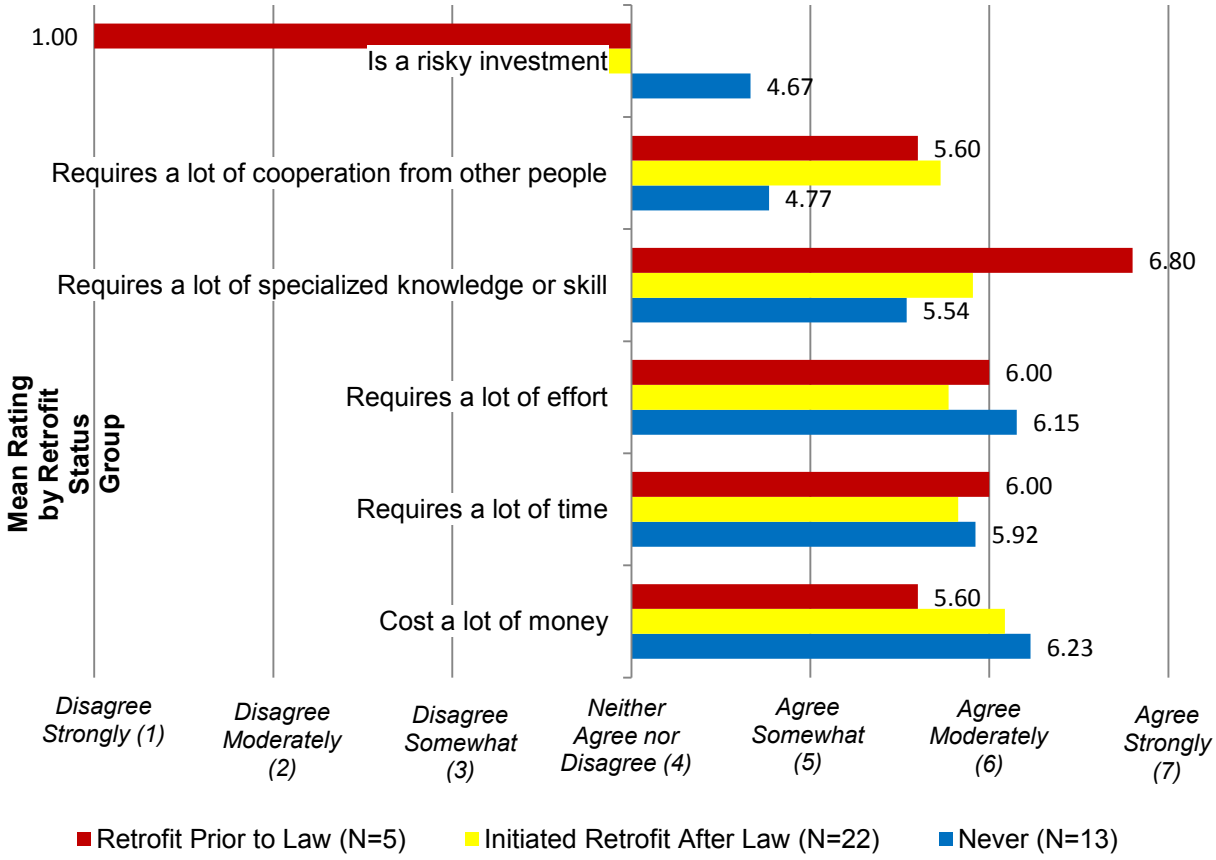

Figure 64. Mean ratings by retrofit status of cost and resource-related attributes of structural mitigation among study participants.

Mitigation and Preparedness Experiences

The generally favorable views about mitigation seen above are somewhat reflected in past actions. Many of the Berkeley soft-story owners and managers I interviewed had previous practical experience with structural earthquake mitigation. Overall, a majority (56%) reported making structural improvements for earthquake safety to their own home or residence in the past. The left-most panel in Figure 65 shows that the proportion that has done seismic work on their own home was higher among non-retrofitters (62%) than post-law retrofitters (43%). Even more study participants overall (79%) reported knowing someone who's made structural improvements to a home. Interestingly, although about the same proportion of non-retrofitters as post-law retrofitters know someone who has made structural improvements to a home, many more non-retrofitters have also done so for their own home. Overall, these statistics are consistent with the high rate of structural retrofit for earthquakes in Berkeley single family homes owing to the popular transfer tax rebate program in place there since 1991.

While all five pre-law retrofitters answered affirmatively that they have done and know people who have done seismic work on a private residence, only two reported knowing someone who made structural improvements to *a rental property* (Figure 65, right-most panel). Although the sample size is small, the latter statistic gives some indication that the behavior of

peers did not play the same influence role for pre-law retrofitters as it may have for post-law retrofitters. If the data from this study are representative of the overall population, the majority of soft-story owners in Berkeley now know someone who retrofit their property, something that is not true of people who retrofit before the law.

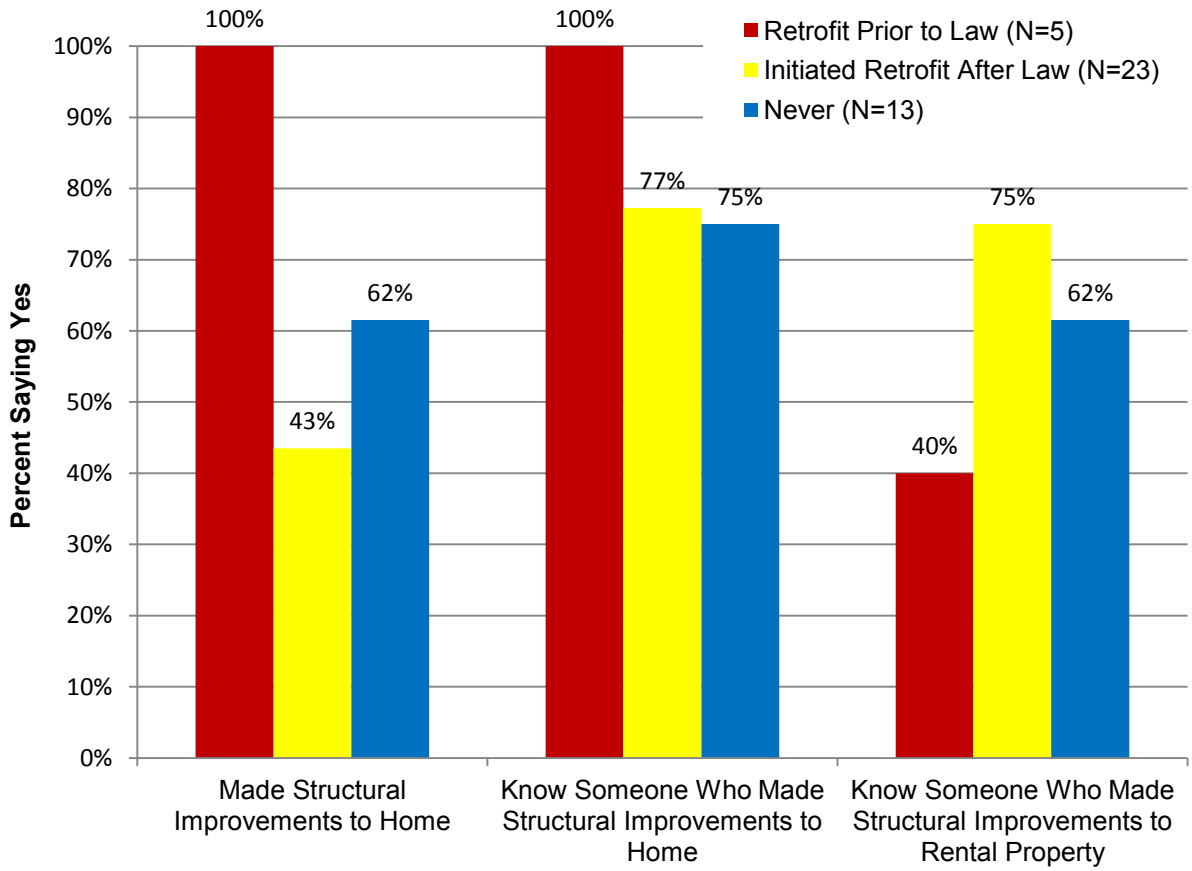

Figure 65. Self-report of past structural improvements to own home, knowing someone who has made structural improvements to a home, and knowing someone who has made structural improvements to a rental property, by retrofit status among study participants.

Earthquake Insurance

Figure 66 shows a breakdown of what study participants reported about their earthquake insurance coverage by retrofit status and ownership type. Only five out of 40 reporting study participants – including two Individuals, two Institutional Representatives, and one Manager – report carrying insurance on all of the properties that they personally own. Another three Individuals report carry earthquake insurance on *some but not all* of the properties that they personally own. Six in total – two non-retrofitters and four retrofitters – report carrying insurance at present on their private residence.

			I do not know the status of my insurance coverage for earthquakes.	*I do not carry any earthquake insurance.*	*I carry earthquake insurance on some but not all of the properties I own.*	*I carry earthquake insurance for all of the properties I own.*	**Total**
No Retrofit	Interviewee Type	Individual	1	8	0	0	9
		Institutional Rep.	0	1	0	2	3
	Totals		**1**	**9**	**0**	**2**	**12**
Retrofit Permit or Complete	Interviewee Type	Individual	0	15	3	2	20
		Institutional Rep.	0	4	0	0	4
		Manager	0	3	0	1	4
	Totals		**0**	**22**	**3**	**3**	**28**

Figure 66. Responses by retrofit status and ownership type to the question, "Do you currently have earthquake insurance for <u>any</u> properties that you own?"

One potential theory is that owners who have insurance coverage for earthquake losses on their rental property would be less interested in doing a retrofit, all else being equal. Just three of 41 respondents to the survey – including two Individuals, one Manager, and no Institutional Representatives – carry earthquake insurance on their soft-story rental property. All of those properties also were, or soon would be, retrofitted. These interviewees seemed to view earthquake insurance and structural repairs as solving different problems. Therefore, *having* earthquake insurance is not necessarily a deterrent to retrofitting and *not having* insurance may not make retrofitting more likely.

When I asked interviewees who carry an earthquake policy why, they talked about protecting a major asset and source of income. One owner explained that he kept earthquake insurance on his rental property, even through periods of extremely high costs, because the property was grandfathered as eligible to be covered by a policy company that no longer underwrites residential earthquake insurance.

> *"Right now the buildings are a major source of income, retirement income, for both my partner and myself. If we didn't have insurance and they were destroyed, that would be a major financial loss." [OB7:37]*

Figure 67 shows the main reasons given by those respondents that do not have insurance on their rental property. The "other" reasons people gave were:

- "I put the premium into improving the seismic performance of the property."
- "I would have it if the Rent Board allowed pass through of premium expense."

- "It is expensive and the Bay Area has gone through major earthquakes since the 1960s and all properties that I lived in had not one bit of damage."
- "There will be too much damage for the insurers to pay out claims if it was a bad earthquake."

One subject reported earthquake insurance mailings or decisions were an instigating factor in their recollection of earthquakes.

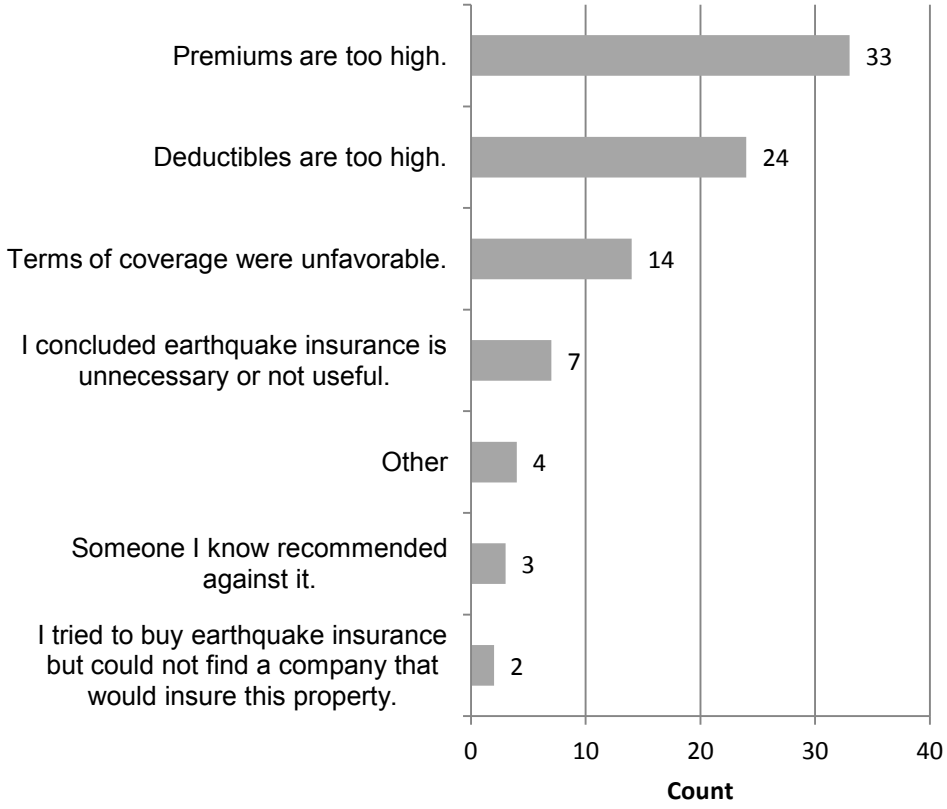

Figure 67. Reported reasons why respondent does not carry earthquake insurance on their rental property (among those reporting having no earthquake insurance on their rental property, N=37). Respondents were asked to choose as many reasons as apply.

In summary to this section, I find that study participants as a whole have neutral to favorable to neutral views about earthquake mitigation and the vast majority have personal experience making seismic improvements to their own homes. The data suggest broad agreement about the downsides of mitigation but slightly greater optimism about its benefits among people who have done it, although there are good reasons why such an effect might be exaggerated by peoples' desires to be consistent.

6.C – Qualitative Discussion of Reported Retrofit Motivations and Barriers

So far, the data suggest that Berkeley soft-story owners and managers have relatively similar experiences and views about earthquakes in general and that those who have retrofitted a rental property in the past have the most favorable views about mitigation. I now move on to explore the qualitative views and spontaneous explanations that interviewed owners and managers offered when asked about retrofitting in general and their own retrofit decisions specifically.

Reported Motivations to Retrofit

When asked open-ended questions about the criteria they used or would use in making decisions about whether to retrofit, study participants offered a range of potential and influences motivations to retrofit. Not one interviewee had a *single* reason. I organized and present here seven broad justifications or reasons to retrofit that owners and managers mentioned.

1. Protect Their Investment

Recall that prior to the BSSO, except for the pre-law retrofitters, nearly all the people I interviewed were ignorant that their building might have a seismic safety deficiency. The law in effect provided them with credible new risk information, and based on that some owners immediately formed an intention to retrofit to – in their words – "protect their investment".

In general, owners view structural mitigation as one potential part of an overall strategy for protecting their financial interests in a property. This is the dominant perspective from which owners view the decision to retrofit. If a building can be made less likely to collapse, that reduces a risk to what is undoubtedly a major asset and/or income source for the owner or institution. Similarly, some of the Managers felt that advising their clients to retrofit was part of their role of keeping the property in sound financial condition on behalf of the owner.

Seismic vulnerability, or even the credible appearance of it, can threaten the market value of an investment and its financial operations in a number of ways – some of which are independent of an actual earthquake event and damage (as will be discussed further in the sections on "Getting off the Inventory" and "Preempt Future Regulations" below). However, a central concern retrofitters was disrupted or lost income generation after a quake. This rationale was particularly strong among the pre-law retrofitters. As one put it:

> *"If you take a big picture look, ten years prior there was a huge earthquake. What's going to happen here? We're putting a lot of money into this property and if it just has any kind of damage at all, then we can't rent it out and what good is that?" [OB17:64]*

Several of the pre-law retrofitters mentioned that the building had long been a concern. The owner had had to wait until they could convince their business partners, for a resistant older parent to pass away, or to save up enough money to do the repair.

"I've been advocating to doing this for a very long time. At that time, that was the building that I felt had the most significant issues in our inventory. Certainly it was the closest to the Hayward Fault and it was the one that I felt had the weakest structure with the most weight over it…Like I said, it was the one that really stuck out to me as needing to be done." [OB19:17]

For the post-law retrofitters, the quotes below reflect a genuine new concern for the performance of the property in an earthquake. These owners seem to have believed and internalized the negative assessments of the city and their own engineers.

"If there's an earthquake, I don't want the city to red-tag the building. It generates…the most income for me, so I want to do the work…Because I know what it would take to just redo the building if there was major damage to it,…I have a self-interest [to] make sure that doesn't happen. [OB36:25-26]

"It's like I'm buying insurance to protect my property." [OB18:23]

"For me personally it was [about] protecting the building. There's a lot of money wrapped up in that building and I didn't want it to roll over and fall down." [OB19:26]

Protecting an investment isn't as much of an issue if the owner needs liquid assets or wants to sell the property sometime soon. For owners who were already or who are now considering selling, potential stigma and issues around ease of selling and sale price mattered. When purchasing their properties, most of the interviewees started out with the plan to own long-term. The data in Figure 68 reveal that most owners I spoke with have no intentions to sell soon even after the law; several expressed a sentiment like the following:

"…it's the type of building that I'd like to give to my children…" [OB9:5]

	What is the current plan or your current thinking about selling your rental property?					
	I will probably sell it within 12 months.	*I will probably sell it 1-5 years from now.*	*I will probably sell it 6-10 years from now.*	*I will probably sell it more than 10 years from now.*	*I have no intentions to sell it.*	Total
No Retrofit (N=12)	2	3	0	0	7	12
Retrofit Permit or Completed (N=26)	1	4	1	3	17	26
Total	3	7	1	3	24	38

Figure 68. Responses to a question about the timing of any intentions to sell the rental property.

Surprisingly few owners spontaneously mentioned other potential business implications of earthquake damage beyond disruption of income, such as potential difficulties in getting financing, regulatory permissions, or materials to rebuild in the wake of a regional catastrophe. One pre-law retrofitter saw the seismic strengthening repair, along with other capital improvements made at the same time, as a crucial aspect of being able to refinance the property's mortgage.

> *"I'd been with a real sleazy [mortgage] company up to then, with an interest rate that was through the roof. So, as a result of doing all that work and then, if you know everything was legal, everything was on the up and up. I was able to get a mortgage which was infinitely lower mortgage rate with [a mainstream reputable bank]." [OB11:39]*

Anecdotally, Individual and Manager decisions to retrofit did not seem to be not built upon concrete or specific expectations about what the consequences to their building would be without and with mitigation. In contrast, several of the Institutions had thought of contingency plans for emergencies and had very concrete ideas about the level of seismic performance they expected to receive from their retrofits.

2. Life Safety: Avoiding Injuries and Associated Liabilities

The owners and managers I spoke with regard tenant safety as both an ethical and a business concern. No one wants to feel responsible (even as a result of ignorance) for a serious injury, but the risk of injury also exposes owners to large potential legal and logistical problems. Thus, the desire to avoid injury to tenants, visitors, guests, and other people on-site at the property – including themselves—was a prominent rationale as owners discussed reasons to retrofit. The ability of a retrofit to protect the safety of people on-site residents (tenants, guests, service providers, etc.) loomed especially large in the thinking of owners who had become convinced that their property was a collapse hazard, because this troubled them on multiple levels. Several expressed gratitude for having the issue pointed out to them.

> *"It was for the people's safety and it protects us from liability and it's the right thing to do…" [OB18:25, first half]*

> *"We see this like [any] aspect of the building that might be not safe. We're worried what's going to happen if there's a big earthquake, is it gonna actually happen? Is it going to be dangerous for the tenants? We're working to get them retro-fitted, yeah. So on that aspect we agree with the city, I guess." [OB29:21]*

For some, tenant safety was even more salient than reduced expected damage levels or preserving the functionality of the property. However, almost no one directly mentioned the desire to avoid liability exposure, though this could be for strategic self-presentation reasons, (i.e., from a desire to appear altruistic rather than self-interested when discussing their motives with the interviewer, who is a stranger).

Even several non-retrofitters who were skeptical about the actual risk posed by their property agreed that life safety would be a key decision variable. In other words, their stance was: "I do not think my property is likely to harm anyone, therefore I do not need to retrofit it."

It is interesting to note that owner concern for tenant safety by and large occurred without any tenant actually vocalizing concerns on their own behalf to the owner. In only one instance did an owner mention to me that tenant inquiries had played a role in convincing him to do the repair [OB27:24].

3. Intangible Psychological Benefits: Peace of Mind and Pride of Ownership

Many interviewees who decided to retrofit their properties expressed a desire to attain or restore peace of mind or to maintain consistency with a particular philosophy of ownership. These factors are naturally interconnected with whatever sense of risk or threat that the owners perceives regarding their financial investment and the life safety of tenants. But, it is noteworthy that several owners connected the behavior of completing a retrofit with fulfilling a moral duty, reducing worry, avoiding potential guilt or regrets in the future, or satisfying the urge to take control of the situation. For example:

> *"I did this project to make me feel better, not because I gained a competitive advantage over any…other buildings around where we are." [OB19:24]*

Note that most of these justifications relate to emotions, both the desire to relieve or avoid negative ones or to restore, maintain, or attain positive ones. Also, these emotional effects can be enjoyed immediately and recalled at will, regardless of whether or when an earthquake happens. As one pre-law retrofitter expressed it:

> *"I was just lucky [to inherit enough money to do it]. Otherwise, I can't imagine why [someone] wouldn't…If you're thinking about it*

long-term, I can't imagine not wanting to. But that's me. I mean, I also still have whopping earthquake insurance on it…And that's just…maybe that's I'm insecure or something. I just don't want to go to bed every night going, "Oh, my God. Oh, my God." So, peace of mind is big with me." [OB11:45-46]

This same owner also related the decision with a sense of tradition and pride of ownership:

"I love buildings a lot. I really do. I'm from a long family history of people fixing up buildings. So knowing that there's something solid under there actually makes me very happy." [OB11:32]

Here are some quotes that exemplify the importance of the *changed* emotional and ethical circumstances *visa vie* retrofitting as perceived among post-law retrofitters in the wake of the law.

"…knowing something about it, I would have felt bad if something happened…" [OB12:27]

"[The cost is] outweighed by…the sort of larger responsibility toward your fellow mankind and, of course, your tenants. So I suppose, even if you're forced by the city, it's sort of the thing you have to do for the community…The only downside is the money, right?" [OB17:29]

"I don't begrudge the city at all…from my point of view, I would feel awful, it would be a terrible thing if we didn't take care of a building well enough and it had damage because we didn't." [OB35:22]

"This way here, if anything happens, I can say, look…this is what was done." [OB22:39]

Ethical motivations were particularly prominent and strong among the Institutional Representatives.

"I think any responsible owner needs to do [a retrofit]. I saw the pictures of the buildings in L.A. that collapsed when they had that earthquake there, gosh, more than ten years ago and they're all the same kind of buildings…we're considering looking at here. [We] tend to have, not exactly a paternalistic attitude towards students but, we do consider it sort of an ethical requirement to do the best we can if we're going to provide them with housing

and other kinds of facilities…We may have a heightened sense of responsibility to the people that live in our buildings." [OB35:29, 35]

"We're part of a religious organization. They're our brothers, they're not just some people paying rents, so even more so than normal, I would be interested in protecting them." [OB13:7]

4. Get Off the Inventory & Preempt Future Retrofit Mandates

Study participants universally felt that having a building listed on the BSSO Inventory was bad news. In discussing it, they perceived, in fact, a long list of negative implications that went well beyond the direct implications of owning a potentially at-risk building. First of all, compliance the law imposed a series of immediate costs and hassles, some of which would linger in perpetuity such as the tenant notification and signage requirements. Second, being listed on the BSSO Inventory is a matter of public record on the property title, so owners must disclose that fact to potential buyers and anyone who inquires with the County about the property will see it. Additionally, some owners found credible the city's threat to adopt a mandatory retrofit ordinance (with potentially even more stringent retrofit requirements) in the future.

The net effect of this was a sense of stigma and devaluation. Owners came to feel that their building was now less valuable, more difficult to sell, and possibly harder to obtain financing for (both as an owner who wanted to refinance and for potential buyers) unless they completed a retrofit. Overall, owners perceived that remaining on the Inventory created a suite of potential problems, set-backs, and impediments to their financial goals for the property. Thus, the idea of "getting off the list" became linked to and reinforced the "asset protection" motivations already discussed above.

Below are a series of quotes that exemplify the sense of stigma and other perceived problems associated with remaining on the Inventory.

"You've [got] the Scarlet Letter "A" on your building." [14:51]

"I call it "The Leper's List" because that's essentially what the city is trying to do…they're trying to get you to do the work because you want to get off of this list." [19:62]

"Anybody who would buy [a listed property] knows they're going to deal with this crazy Berkeley thing. So, it's very hard to sell a building who's now up on that list." [5:59]

"It makes the house not sellable at this point…If you do sell it, you have to sell it for significantly less." [6:76-77]

"Do [owners] want to do some upgrades? Yes, but they only want to spend the money if they can get themselves off the stupid list 'cause it's devaluing their building. [OB23:34, excerpt]

Interestingly, the main source of stigma and devaluation did *not* seem to be because tenants care about and are deterred from renting in an at-risk building[39]. While some owners I spoke with were at first concerned about the signage and notification requirements (and were still annoyed with them), most now agree that those requirements had little if any observable impact on the ease, speed, or price of renting out units. Only one interviewee stated directly that the BSSO was making it harder to rent out units or affecting the unit rental price.

"It's making it harder to rent and it's making it harder to get the rents [owners] need." [OB23:34, second half]

Rather, the stigma seemed to arise mostly because *other owners and potential buyers* now know and care about the regulatory hassle and other costs of owning a property on the Inventory, and see the issue as a potential business liability.

"We did have one building that was bank owned…The bank had to reduce the price of the building tremendously just to cover the Soft-Story Ordinance project. So, most owners aren't going to want to buy the building if they knew that the work and the amount of money it takes to put into it." [OB32:29]

"Yes, [being on the Inventory] will get priced into it to a degree…The thing buyers would be worried about is whether … the city may come back and require that the work gets done…I just don't see how the [city] can do that. But this is the City of Berkeley and they have been known to do all kinds of crazy things." [OB19:68-69]

Managers, real estate brokers, and those Individuals who had done condominium conversions seemed particularly convinced that the prospects for listed buildings have been altered for the worse. These interviewees also mentioned potential difficulties in obtaining financing, though mostly in a hypothetical way.

"I think eventually what's going to happen is you won't be able to get a loan on those properties if you don't do the work."[OB9:46]

[39] The flip side of tenant disinterest in earthquake safety is that units in retrofit buildings cannot be rented at a premium. I will return to that point in a later section (Inability to Recoup Income).

"They put this negative thing into all these properties, so now if you ever try to refinance the property or anything, the lenders now look at it and go 'you can't refi, you can't do anything because your building might collapse tomorrow'…So, if you ever think you want to try to sell it or market it or refinance it, you got to do the work now to get it off that list." [OB33:38-39]

"I'm glad we have done [a retrofit] because…not having a Soft-Story [retrofit] done would prevent people from coming in and, let's say who are cash buyers, everybody's nervous about things that can't be insured and just generally [it causes] problems." [OB37:14 (first half)]

I spoke with two owners whose buildings had been converted to condominiums in the years since the law was passed. Both had done retrofits and expressed that they felt compelled to do so given their desire to convert the building to individually sellable units. Those owners reported a particularly high degree of concern about the implications of the building's listed status for their ability to proceed through the condo conversion process and for the potential salability and sale price of the units. These owners also described being in a Catch-22 with regarding financing for their retrofits.

"It is a real problem because the credit environment has changed so significantly from a few years ago. Probably in 2005 or 2006 you could get a home equity line of credit to do this work on your place but now, you may or may not be able to. And they may say no, we're not giving you…credit 'cause we're not going to lend on the place with the problem, to give you the credit to do the work to fix the problem!" [OB37:9]

"[It's as if] they put lien on each property so as an owner you cannot refinance 'cause the bank didn't know how to deal with this." [10:39]

As testament to the overall power of the idea of getting off the list, below is an example quote from a condo conversion building owner who persisted despite a nearly four-fold cost increase to complete the retrofit project.

"When we were placed on the list, we did the plan and …we thought that it was around a $20,000 retrofit but after we did the report the engineer said, well, in addition, I'm concerned about this shear wall issue on the back wall with the second story, it's not really part of what the ordinance covers but he noted it in his plan. Then, the City of Berkeley, when they reviewed our plan, came back and said [they're] going to require [us] to do that. So

actually, it wound up being a much more expensive retrofit…more like a $90,000 project. We were lucky to get it done for around $70,000." [OB37:7]

5. Process Effects, Momentum, & Bundled Steps

Operating in concert with the above factors was how the very actions involved complying with the BSSO made it easier for owners to conclude that it "made sense" to retrofit. The law forced them to take the first steps towards a retrofit, which include finding and engineer and obtaining a rough idea of what upgrades were recommended and how much it would cost. On a practical level, this raised their knowledge and skill level relative to the recommended action. It also reduced outcome uncertainty and potentially reduced the cost of doing the work. There was also an immediate financial benefit. Several study participants told me that their engineers were quickly to point out the potential cost savings of completing full plans for a retrofit at the same time as the evaluation, rather than waiting until the city imposed a mandate.

A key step in the compliance process was to find a qualified engineering professional to complete the necessary report. Some owners, previously unaware that their building was at risk, seemed to feel a retrofit was warranted the moment an independent engineer confirmed the city's diagnosis. In other words, this group of owners might have done a retrofit *even if they had become informed about their building's condition by some other mechanism.* To them, the report itself became a superfluous chore.

"I never considered…just starting it without finishing it. It didn't make sense to me just [to] do it halfway. [OB27:32-33]

"For safety reasons, [I thought] why don't we just do the job rather than go to all the trouble of getting a report saying that yes we need it, 'cause I can see we do." [OB25:18]

Other owners who were still undecided after receiving the engineer's verdict were persuaded by their engineers was that if you ever think you might do a retrofit, it would cost less overall to bundle the report-writing and permit application preparation processes together now, rather than waiting. As one owner put it:

"I didn't want to go through and spend all the money for the engineering report and then have to redo it when we, you know, do the work. And it wasn't something I could spend and then use as we went into construction drawings….I just thought how to keep my costs down and not duplicate work." [OB14:73-74]

This probably led some owners to get building permits who may not, in fact, act on that permit in the near future. However, as of 2011, all but six of the open soft-story retrofit building permits had been finaled.

Once owners committed to the idea of doing a retrofit, at least two additional forces kicked in to help them follow through on their intentions. First, the engineer now has an active business prospect and he or she has incentive to keep the owner on track and work to eliminate obstacles. Second, most people desire to be consistent with their own publicly-declared commitments, especially when they've already put resources into it. Thus, there was added momentum to follow-through on the decision even as problems and cost increases occurred along the way.

The degree of influence that contact with an engineer had on owner decisions may have depended on a mix of factors such as the owner's prior beliefs about mitigation, how the owner found their engineer, the degree of satisfaction and trust that the person came to have with their engineer, and the engineer's degree of persuasiveness or stake in securing future business with that client.

For owners or managers who started out uncertain about the vulnerability diagnosis and prognosis for their property and who were open to considering a retrofit, the engineer's assessment and recommendation could be quite influential. Some found an engineer through the city-provided list of engineers who had attended the official trainings sessions. Others chose an engineer based on the recommendation of a peer or from their own past experience. One person I spoke with used the yellow pages, resulting in much frustration. A few owners I spoke with deliberately treated the evaluation as perfunctory, choosing an engineer out of necessity but with little to no intention to seek or take any advice from that person.

The evaluating engineers were in a good position to estimate costs for the owner or even customize the scope of the work and its approximate benefits in terms of increased building performance according to the owner's budget and preferences. Owners and managers with less direct construction experience might be especially likely to trust in the expert's opinion. Whether an engineer expressed concern or seemed nonchalant about whatever weaknesses were identified could signal for the owner how he or she *should* feel about those weaknesses.

Ultimately, after going through the compliance process, the hazard information that owners received no longer felt like it came randomly from a stranger. Their building had been evaluated by an engineer they themselves choose and established a relationship with. Only one owner I talked to claimed of "reading" the whole evaluation report. Instead, owners and managers talked about what *their* engineer said.

6. Preempt Future Retrofit Mandates and Stay Ahead of the Curve

Another reported impetus to complete a retrofit was the city's threat to implement a "Phase 2" mandatory retrofit program. Owners who did voluntary retrofits were told they would be exempt for 15 years from future retrofit mandates, and that was important in the minds of some owners regarding whether and when to do a retrofit. For an owner who believes that a mandatory retrofit law is likely to be passed while they still own the building, the

decision becomes, "Do I want to retrofit now or wait for the law to be passed and do it then?" As one post-law retrofitter put it:

> *"Well, they didn't make me…But what are going to do if you know they're gonna get tougher?" [OB22:36-37]*

Again, some post-law retrofitters I talked to rationalized that it would be cheaper to act sooner, and not just because of inflation. Realistically, owners could save money (perhaps on the order of one to three thousand dollars) by doing the evaluation report and full plans for a retrofit at the same time. Others felt that leaving the retrofit to later increases the risk of having to meet to even more stringent (costlier) standards.

At the same time, in the post-BSSO climate, lots of soft-story owners in Berkeley were talking to each about what each other were doing. As noted previously, many are friend or family members and own more than one building. Berkeley property owners in general are fairly well organized (in part through the city's history of rent control), and the owner's association held several public workshops. Eventually, voluntary retrofits apparently reached a tipping point: enough owners upgraded and word got around about it, such that every owner and manager I talked to now views doing a retrofit as inevitable.

Conclusion: Most owners now know a retrofitter & think it's better to be one, *even if they still have doubts about the EQ risk or mitigation effectiveness.*

> *"Eventually everybody is going to have to do it. That's my feeling. There's no doubt about it….And if you have to do it, you might as well do it sooner than later because it's going to be cheaper now than in the future." [OB36:38 & 40]*

> *"It really wasn't a question of whether or not to do the work, just a question of how and when. [OB37:6]*

7. Mistaken Impression that the Law Mandated a Retrofit

I discovered in my interviews that at least three owners and one manager thought they were *required* to retrofit. These owners got this impression both from talking to others, including their property management company, and from mis-reading the city's letters.

In concluding this section, I want to emphasize two things that owners did *not* mention as motivations to retrofit. One was cheaper insurance. As noted above, the three owners I talked to that have earthquake insurance also retrofitted their properties, but none of them perceived that this would reduce their earthquake insurance expenses[40]. The two non-

[40] It is current practice in California not to offer insurance discounts for structural mitigation work accomplished. Insurance rates are primarily determined by zip code.

retrofitters that carry earthquake insurance similarly did not see any potential insurance-related benefits to retrofitting (such as removing the need for carrying an expensive policy).

Another thing owners did not spontaneously mention as a motivation to retrofit was the ability to market to tenants or get higher rents for retrofit units. Retrofitters thus made their decisions *without expecting income increases to offset the cost*. I will discuss this point further in Chapter 7.

> *"The market is the market. I don't think the tenants are looking at the safety issue 'cause I don't think they go and look and see if that building they're going to rent is on a list. I know we're not on the list anymore because we did the work but it's, it's a benefit that is not translatable into an increase in rents." [OB14:40]*

> *"Tenants never ask or very rarely…this is the first year…where I actually said in my posting for rentals that the building had been retrofitted. I don't think that that actually made me rent the units better than I would normally have…it was a nice thing to be able to say, but I really don't feel that it made anyone rent out of our building versus another building. So, as far as a marketing advantage is concerned, I don't see evidence for that yet." [OB19:23]*

Barriers to and Doubts about Mitigation

Only one out of five Berkeley soft-story owners took retrofit action following the law, and even the post-law retrofitters faced numerous difficulties and had doubts regarding their projects. Hence, it is also important to discuss what study participants said qualitatively about the perceived barriers to investing in structural mitigation. In this section, I group their comments together into four main obstacles that range from up-front costs to process uncertainties ironically created in part by the BSSO. Even though the law was intended to motivate voluntary retrofits, it may have made doing a retrofit slightly more difficult and costly.

1. Up-front Costs & Cost Uncertainty

Participants universally recognized that structural mitigation can cost a lot of money. At a minimum, retrofitting a soft-story apartment building of five or more units will cost thousands of dollars, and interviewees reported spending between $60,000 and $130,000 in total, or about $8,000 to $11,000 per unit. Depending on the sizes and rents that the owner is getting from each unit, that might be equivalent to about 75 percent of the total rent gross for a building for one year.[41] To give perspective, for a 12 unit building, a rent increase of about $83 per month per unit for all units for 10 years would cover a $120,000 total project cost.

[41] Assuming that an average rent rate in Berkeley for a one bedroom apartment is $1100.

Several non-retrofitters than I spoke with said the estimated cost of a retrofit would be unsustainable for them financially in relation to the value of the property or the amount of loan already encumbered on it.

> *"[The costs are] of such a large scale that we're considering selling the property. [OB15:48]*

> *"We had a bunch of contractors come by and look at it and…I think what they decided is that this isn't going to happen anytime soon so [they didn't] need to work real hard. [Only one] came back with some numbers and the number he came back with was $470,000. That's a big number. That's more than twenty percent of the value of that building." [19:55-56]*

Project complexity is one factor that can contribute to prohibitive costs. Complexity can arise from multiple angles, including project size, building configuration, use of special technologies or materials (e.g., steel welding that can require special inspections), landmark or heritage status, having commercial units, or other work to be completed simultaneously. As one Manager put it:

> *"I think it was $35,000 to figure…out [how much a retrofit might cost]…We spent a lot of money trying to get the information that we needed, which we may never use." [OB19:127]*

Second, many owners anticipated hassles and inconvenience for themselves and complaints from tenants. Three persons I spoke with [OB19, 34, 36] stated that the degree of tenant disruption that would potentially need to occur was a major factor in their decisions not to do a retrofit at this time. Having three or four units vacant would be a major setback to their income stream, and also it was not clear how or when it would even be possible to create the necessary vacancies given Berkeley's strict rent control laws. Owners must assist tenants with relocation, in some cases with compensation or rent reductions, when major capital work needs to be done. This is a good example of a type of cost that is hard to anticipate and that can rise unexpectedly once a project is underway.

On top of the absolute cost, retrofit costs can be hard to predict at the outset. Doing a retrofit is a multi-step process and expenses accumulate in steps, each of which involves some degree of uncertainty. Costs can escalate unpredictably as an owner moves from getting an estimate, obtaining bids, hiring a contractor, and all through project execution. Fear of escalating costs was exacerbated in this case because of the added uncertainty about precisely what would be necessary to get off the city's Inventory.

Some owners – including some that did retrofits and some that did not — mentioned that City of Berkeley practices and politics create extra cost variability in this case. Part of the added uncertainty comes from confusion about the requirements for a retrofit to get a property off of the Inventory. The issue of confusing or ambiguous requirements for retrofits will be discussed further in the section addressing implementation lessons learned from the

policy case. However, on top of that, owners wondered, 'What if the standards I'll be held to just change again soon?'

> *"It's like one thing is going to lead to another and it's kind of a mystery of what's going to come up for you next, you know? [OB39:41]*

> *"I think [some] owners will drag their heels as long as they can, simply because they don't want to deal with the city if they can get away with it. There's also owners that will say, 'I don't want to do anything except the bare minimum in this city because it's such a hassle' and also because it costs more in this city…I've literally had contractors say that, 'My bids are higher in Berkeley because I have to deal with the city'." [19:86]*

Cost uncertainty may be less of an obstacle (or at least less intimidating) for more experienced, networked managers and owners.

> *"Most [owners] don't have that experience so they can't tell. So they need somebody…to tell them an idea of what it would cost within a certain range so that it reduces the fear factor. You've got the cost fear factor, you got the city fear factor, those conspire to get people to [put it off]…and people are busy. They don't have time to do this stuff. I do this for a living so I make time for it." [OB19:108]*

Up-front costs are especially an issue for owners whose properties are already in financial difficulty or if there are issues that restrict the owner's access to capital. Newer owners, namely those who had purchased the property within the past 10 years, are likely to have less equity. Owners who have a large percent of pre-vacancy decontrol tenants (who pay below market rent) might have less cash flow to cover a new expense. Those who recently inherited the property from an aging relative might have a large backlog of deferred maintenance to handle, or fewer years of contingency savings set aside.

2. Inability to Recoup Costs through Increased Income

Some owners expressed that they considered a retrofit like any other business proposition and it simply fails to pass a basic business case. These interviewees pointed to two distinct obstacles to recouping the costs of a retrofit from the rents taken in on a building: lack of tenant willingness to pay for the attribute of renting in a retrofitted building and rent control. Most interviewees stated that they perceive little to no tenant interest in earthquake safety, much less a willingness to pay for it.

"It's not something I decided not to, it's something that tenants don't want to pay for. That's all. Simple as that…I'll be perfectly happy to do it [if] Berkeley would allow the rent to go up and if the tenants are willing to pay for the…capital improvement." [OB5:47-48]

Even several retrofitters admit that tenants do not seem interested in the upgrades.

"I will say this, not a single tenant cares. At a vacancy, they don't ask. They don't care. Not an issue." [OB2:59]

"[Tenants] never ask." [OB5:17]

"[Interviewer: Do tenants notice or ask?] They don't." [OB3:31]

"[Interviewer: Do tenants ever ask about earthquake safety?] No, not at all. It's not an issue I think with most of the people that live here." [OB6:21, excerpt]

"Most of our tenants are students and I don't know how much they think about it… I'm doubtful that the students would communicate to the[ir] parents, 'I'm looking at a building that's been retrofitted.' I'm not aware that any applicants ever asked that question." [OB7:35]

Others focused on the ways that Berkeley's rent control policies block them from charging more. Current rent control rules permit an owner to make a claim for an individual rate adjustment for seismic upgrade expenses paid[42]. However, this is irrelevant for units that are already at market rate. If rents are below market rate, then there is room to charge more. But, the RSB currently only will allow owners to "pass through" capital expenses if the owner's total income on the building is still under a maximum allowable net operating budget cap. On a practical level, most owners have had substantial tenant turnover since vacancy de-control in 1999, so their net income is high enough now that they would not be eligible for a pass through even though seismic repairs are an allowable expense.

If tenants indeed have positive willingness to pay for a retrofit unit, then rent control is an obstacle to recouping the costs of a retrofit. In the past, rent control in Berkeley has deterred capital investments of all types, and until 1999, prevented owners from testing whether renters in the local market would be willing to pay more for improved earthquake safety. Since the BSSO, owners have had the capacity to see how better informed tenants (both current and prospective) might react. In the interviews, post-law retrofitters did not report feeling that they'd gained any market advantages.

[42] Note that some of the institutions are exempt from rent control laws, as long as the tenants are all students.

> *"Even if Berkeley was to allow the rents to be raised specific amounts…it's not like it would be a selling feature per se to where I could say, 'Oh, and you can move in here and it's gone through an earthquake refit. So, you don't have to worry about getting crushed in the middle of the night.' Most people are going to go, "Huh, I haven't thought about getting crushed in the middle of the night. Maybe I should go look someplace else." So it's kind of like a no-win scenario that I can think of for funding it and then, 'cause obviously it has to get paid for…it's a business, it's got to be paid for somehow." [OB3:30]*

If tenants do not care about earthquake retrofits and won't pay more for them, then rent control is merely creating an illusion that there *would* be an ability to share the cost of a retrofit with tenants where there in actuality is no unmet demand. If tenants truly do not have positive willingness to pay for earthquake safety, rent control in effect tricks owners into feeling like they're at a greater disadvantage than they really are.

Several owners recognized that lack of tenant interest in earthquake safety might be linked to the invisible, hidden, and distant nature of retrofits – and these are also downsides in the minds of owners.

> *"Most of the work done, [tenants] don't really see it." [32:92]*

> *"[A retrofit is] something that doesn't generate any more revenue. Usually, if you want to put money into your property, you'd like to get a return on that and [with a retrofit] it's kind of an undefined return. The return would be that you supposedly have a safer building. But at the end of the day, you don't really know. Engineering is not an exact science. So if there is an earthquake that is bigger than what the city thinks is going to happen, your building may or may not be protected. If it's smaller, then obviously it's going to be protected, but nobody can guarantee it." [OB14:38]*

Although owners didn't mention it directly, it is worth noting that if there is no mechanism to increase income following a retrofit, financial institutions may be less willing to make a loan to do the recommended work.

3. Skepticism about the Need for Mitigation

Several interviewees discussed a sense of fatalism and inevitability about earthquakes and the potential consequences for themselves. Most viewed earthquakes as a fickle and unpredictable threat. Some extended this view even further by viewing the damage that earthquakes inflict as *arbitrary*.

"If there will be a major earthquake, I'll be like the rest of my tenants. I'll be dead. It will be like with everything. This is how you say it's inevitable. No engineer was born up to now [that] knows what's going to happen." [OB15:81]

Some non-retrofitters, while acknowledging that a large earthquake may happen in the Bay Area, felt unconvinced that a large earthquake would be a very serious, or atypical, threat to their particular building.

"I think [my building] will have -- like any other building -- substantial damage…I'm personally not too concerned about it cause even if it would happen there are other two side walls sitting there with an angle but there's some seismic strength in there and it has been built very well so I don't think it's gonna collapse completely. But, you know, even an 8.0 earthquake I don't think anything else will stand around either." [OB6:58]

"I've not [done a retrofit] and I refuse to do it because I think it's an incorrect, I think it's just putting unnecessary fear in people where there is none, nothing." [OB31:47]

Some interviewees had specific reasons why they felt the conditions at their property are not actually that dangerous, arguing for instance about a lack of tenant exposure directly above the open area or that the opening is backed by sidewalls partially buttressed by hillsides.

"I really don't feel that it's a true soft-story building because, the building is like rectangular … [The opening is] on the narrow end and the parking is underneath…how can a building topple over or crumble when only like less than one fourth of it is overhung? Plus on each side there is earth between…in the wall… [so] it's kind of like the parking is underground." [OB39:37-38]

"I understand from a technical perspective what… [the city would like to] be done on a building like that. [But in my opinion] it didn't have that much of a risk. It's only a two-story building even though they call it a three-story 'cause the garage goes into the basement. " [OB6:31-33, excerpt]

Sometimes this attitude seemed to be inseparable from the low level of trust from the owner towards the City of Berkeley or resentments about rent control and other regulatory hassles. As discussed previously, for some owners, they simply felt their building had been wrongfully targeted. One owner, a city planner, admitted that his property falls under the technical soft-story definition but doubts the true level of hazard [EABO 39:25].

Some owners I spoke with were still struggling to reconcile their previous impression of their building as "fine" with the recent messages – sent to them first by the city and now by one or more engineers – that their building is at high and possibly unacceptable risk. In part, the city's decision not to mandate retrofits from the outset sent a confusing "mixed" message about how serious the actual hazard is. Among non-retrofitters, it was common to use the fact that their building survived past events as evidence that the building is likely to perform well in future quakes, or at least would fare no worse than other similar properties.

> *"First out... let's get it real. All buildings, if you really want to get into this, have some seismic exposure. I don't care what you do. And the further back in time you go, the more exposure those buildings have. [My building] is a wood-framed building on a concrete slab. That's not too bad. It's not reinforced…it's got four garages out in the very front so…the front end is…potentially structurally weak in a major earthquake. It survived Loma Prieta without any problems whatsoever. OK?" [OB16:47]*

> *"My building is built in the fifties so it has…gone through probably the two or three earthquakes that I know substantially in the Bay Area including the one in Oakland, the Loma Pieta and all of them without shaking, nothing." [OB31:37]*

4. Benefit Timing and Outcome Uncertainty

Some non-retrofitters in this study were convinced their buildings had a problem, but were not convinced that a retrofit was a useful or viable solution because of the delayed timing and perceived uncertainty associated with its benefits. After an earthquake retrofit, an owner faces an unknown period of delay between when the retrofit is done and when they get to see how well the upgraded building performs in an actual earthquake. The owner will never know, of course, how the building would have performed if left unimproved. The benefits are largely invisible and "unproven" even when the upgrades are "tested" in an event because the counterfactual is invisible, too. Thus, there will always be uncertainty about the effectiveness or incremental benefits achieved through the retrofit investment. This makes them difficult to verify as well as hard to point to or claim credit for in the meantime, for instance when attempting to explain to or sell to potential renters and buyers.

In this study, participants showed acute awareness that the benefits of a retrofit are uncertain and limited. The benefits of a retrofit largely feel conditional on when the next big quake happens and how big it is. Owners wondered: "What if the quake is bigger than expected?" or, "What if there is no quake before I decide to sell?"

Several non-retrofitters also showed skepticism about whether mitigation can do much good at all. Here's what an experienced contractor and owner of multiple Berkeley properties (including two soft-story buildings) said when asked if he ever worries about earthquakes as a property owner:

"Oh yeah. (sarcastic laugh) I mean, do you get worried about being hit by a car? You still cross the street, right? Yeah. Every building is susceptible to some type of damage…[it's] like part of doing business. It's not going to make much of a difference. If the big ones comes, its' gonna come and whatever [an engineer would] do it's not going to do much, it's going to minimize damage but it's not going to stop any damage." [OB24:28-29]

Two or three retrofitters even expressed regret about doing a retrofit. All respondents seemed to perceive inevitable but unknown *limits* to the kind of benefits mitigation can provide.

"…[the engineer] said now all the other buildings in the neighborhood will collapse supposedly except for ours. But…[in a really big] one they're all going down anyway, so I don't see. I'll tell you, it's definitely was not worth [it] to actually do the work". [OB33:32]

"If there's an earthquake tomorrow and the building still collapsed, then I wasted my $150,000." [OB9:25]

Overall, retrofitters seemed to have appropriately modest expectations about what level of performance they should now expect from their retrofit buildings. Most showed that they understood they've only purchased a "life safety" or "damage reducing" level of performance. Some retrofitters expressed lingering doubts about the potential benefits that mitigation can deliver.

"With the soft story seismic job completed I think the tenants could at least have time to escape the building safely in a large earthquake." [OB41:11]

"It still could collapse but I think, you know, I hope we've improved our chances right now." [OB9:15]

"The way it is now -- very strong -- it would probably get twisted but it would be like no would get hurt." [OB40:15]

"I hope it's a lot stronger and can withstand an earthquake and did I over-improve it? Maybe. But, you know, I won't know. The money's invested. [The building has] been…designed to withstand certain forces as I understand it and hopefully it will do what it was designed to do." [OB14:62, first half]

6.D – Findings Regarding Individual Personality Factors

I report here on an exploratory aspect of this research, an investigation of the relationship between owner retrofit status and timing and certain personality traits that could be associated with precautionary behavior including conscientiousness, emotional stability, openness, and regulatory focus. I was motivated to do this first by the small but growing number of studies linking risk perceptions and risk taking proclivities to personality factors and second by the literature linking loss aversion and regulatory focus. Both personality and regulatory focus seemed potentially relevant to how owners and managers responded to the BSSO.

Retrofitting and the Big Five Personality Traits

The Ten-Item Personality Inventory is an extremely brief set of items designed to capture the five major "traits" or dimensions of personality: conscientiousness, emotional stability (often referred to in its negative form as neuroticism), openness, extraversion, and agreeableness (Gosling, Rentfrow et al. 2003). Each trait gets just two question items that the subject rates themselves on using a seven-point Likert-type scale (values range from 1-strongly disagree to 7-strongly agree with 4 as a neutral point). One item is reverse scaled (antonym) and one is a straightforward scaled and the two are averaged. My prior hypotheses were that retrofit behavior would be associated with higher scores on the conscientiousness scale and lower scores on the emotional stability scale, but I incorporated all the items out of curiosity. Not all study participants completed the personality section, so the valid N for the summary statistics is 37.

Figure 69 reports the reliability scores (Cronbach's Alpha[43]) for the items used in the survey. Although Gosling et al. (2003) point out that their inventory was designed to maximize construct validity, not reliability, but the Alpha scores in this study reflect reasonably high reliability, especially for conscientiousness which was one of the two main scales of interest.

	Cronbach's Alpha (actual)	Valid N	# of Items
Conscientiousness	0.84	37	2
Extroversion	0.62	37	2
Emotional Stability	0.57	37	2
Openness	0.51	37	2
Agreeableness	0.40	37	2

Figure 69. Reliability statistics for the Ten-Item Personality Inventory.

I provide as a reference point means scores for each trait in a general US population sample by sex (Figure 70). The number of study participants is not large enough to draw statistical inferences about whether they differ as a group relative to the general U.S.

[43] Cronbach's Alpha is a coefficient (a number between 0 and 1) commonly used to rate the internal consistency (homogeneity) or correlation between all the items intended to measure the same trait on a psychometric test.

population, but the data hint that this population of Berkeley landlords might have higher emotional stability and conscientiousness and lower agreeableness scores than a typical American.

		Emotional Stability	***Conscien-tiousness***	***Openness***	***Agreeable-ness***	***Extroversion***
Whole National Sample	Mean	4.83	5.40	5.38	5.23	4.44
	Std. Deviation	1.42	1.32	1.07	1.11	1.45
Women Only	Mean	4.66	5.51	5.40	5.32	4.54
	Std. Deviation	1.45	1.11	1.06	1.11	1.47
Men Only	Mean	5.13	5.19	5.34	5.06	4.25
	Std. Deviation	1.31	1.15	1.09	1.1	1.41
THIS Study	Mean	5.27	5.86	5.39	4.97	4.39
	Std. Deviation	1.16	1.14	.99	1.00	1.54
Expected Cell Values*	Mean	5.06	5.23	5.35	5.10	4.29

Figure 70. Comparison to study participants of mean TIPI personality trait scores in a reference population of Texan college students (N=1813) by sex.

* *Expected cell values represent a weighted mean of the national sample values based on the proportion of men and women that participated in this study. Source: (Gosling, Rentfrow et al. 2003), Appendix B.*

Figure 71 presents mean scores for each trait by retrofit status and timing. As expected, non-retrofitters as a group had the highest average Emotional Stability score. However, pre-law retrofitters had a higher Emotional Stability score than post-law retrofitters, which was not the ordering I anticipated. This does lend weight, however, to the notion that Berkeley's post-law retrofitters might tend slightly more to anxiety and responsiveness to negative emotional stimuli than their peers.

I expected pre-law retrofitters to have the highest Conscientiousness scores, and they did by nearly a full scale point. Their group average was also a full scale point higher on average than the reference population, suggesting that they might be an extremely conscientious group relative to other Americans, not just relative to their Berkeley landlord peers.

I did not have specific hypotheses regarding the three other traits and there do not appear to be strong differences in those traits by retrofit status timing. Figure 72 shows the same data visually; the error bars reflect one standard deviation above and below the mean. There were no noticeable distinctions to be drawn when I treated Managers and Institutional Representatives separately from Individual owners.

When (If Ever) Was a Building Retrofit		*Emotional Stability*	*Conscientious-ness*	*Openness*	*Agreeable-ness*	*Extroversion*
Never (N=11)	Mean	5.91	5.82	5.64	4.73	4.85
	Std. Deviation	0.89	0.98	1.1	0.68	1.18
Retrofit Prior to Law (N=5)	Mean	5.40	6.40	5.90	5.50	5.10
	Std. Deviation	1.64	0.89	1.08	1.17	2.36
Initiated Retrofit After Law (N=21)	Mean	4.90	5.76	5.14	4.98	4.00
	Std. Deviation	1.07	1.27	0.88	1.09	1.42

Figure 71. Table showing mean and standard deviation of five personality trait scores by retrofit status and timing for a subset of study participants (N=37).

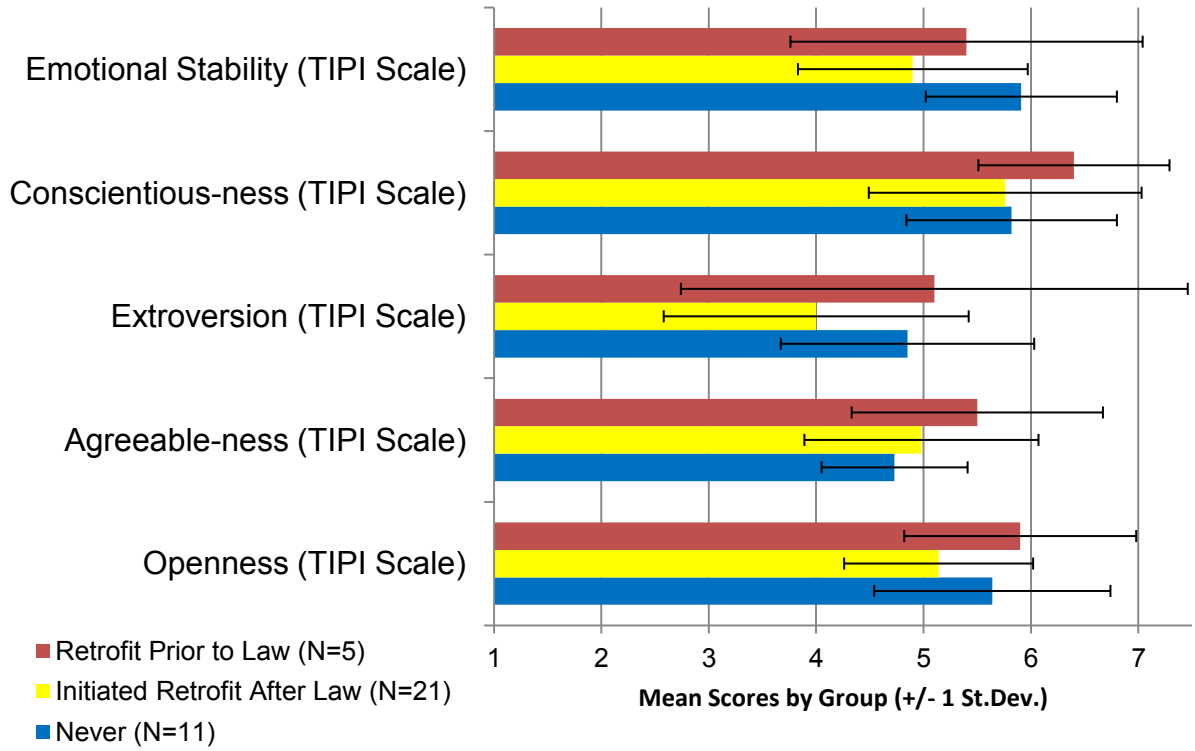

Figure 72. Mean scores on five personality traits by retrofit status and timing.

Retrofitting and Chronic Regulatory Focus

To reiterate, chronic Regulatory Focus is a measure of a person's natural overall goal orientation, which in theory will be dominated by either seeking of positive outcomes or avoidance of negative ones. A person's regulatory focus score (RF) is computed by totaling their

Promotion pride strength and subtracting their Prevention pride strength based on an eleven question set that contains both straightforward and reversed-scaled items (Higgins, Shah et al. 1997; Higgins, Friedman et al. 2001). The Promotion score reflects the extent to which the respondent is prideful about their past ability to actively achieve positive end states, while the Prevention score reflects the extent to which the respondent is prideful about their past ability to avoid negative end states. Most people have slightly stronger Promotion pride strength, so RF values typically range from around zero to one.

Figure 73 reports the reliability scores (Cronbach's Alpha) for the regulatory focus items in this survey.

	Cronbach's Alpha (this study)	Valid N	# of Items
Prevention	0.79	38	5
Promotion	0.60	39	6

Figure 73. Reliability statistics for the Promotion and Prevention sub-scales.

Although the number of pre-law retrofitters in the study is quite small, they appear to have a slightly higher Promotion tendency and slightly lower Prevention tendency on average, leading to the highest overall average RF score. This is consistent with the qualitative information as discussed above that suggested pre-law retrofitters were among the study participants most convinced of and attuned to the *benefits* of mitigation.

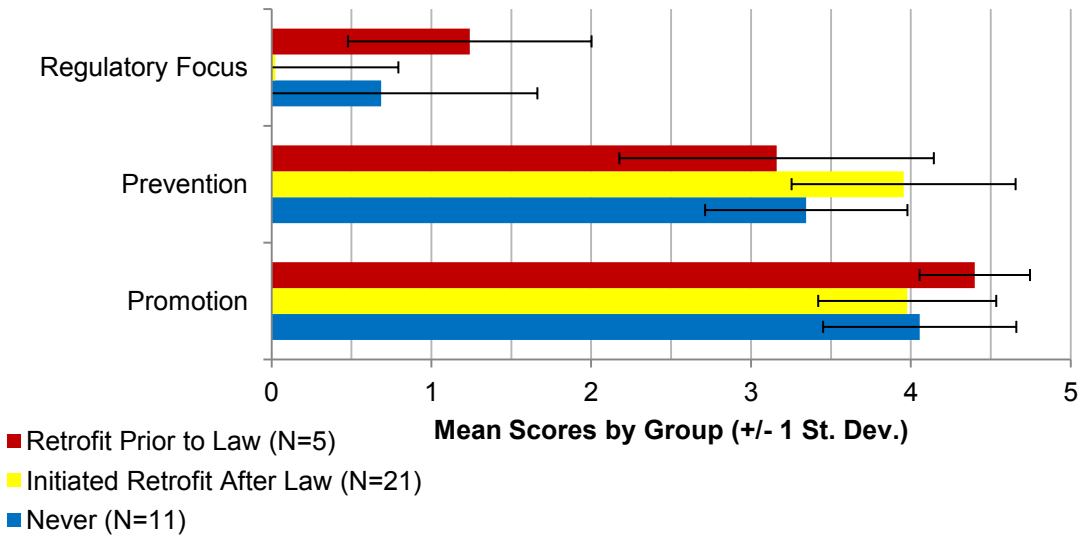

Figure 74. Mean chronic regulatory focus scores by retrofit status and timing for study participants.

Post-law retrofitters and non-retrofitters appear to be indistinguishable on the Promotion scale, but the post-law retrofitters had the highest Prevention score on average, leading to the lowest overall RF score. Overall, post-law retrofitters on average were the closest to having a Prevention-dominated goal-orientation, suggesting the greatest sensitivity to

avoiding negative end states among study participants. This again speaks to the importance of the law's reversal of the social norms regarding retrofitting and the negative consequences that the BSSO added to the status of *not* retrofitting. Interestingly, pre-law retrofitters and non-retrofitters seemed indistinguishable on the *Prevention* sub-scale.

These results, although not statistically testable given the size of this study, warrant further investigation because they suggest that the law managed to motivate retrofits among members of the target population that have a different personality profile than persons who spontaneously retrofit on their own. This lends credence to the idea that pre-law retrofitters took action in part because they are strongly interested in *promoting* positive outcomes for themselves. Post-law retrofitters appear to be more interested in preventing or *eliminating* what they perceive as bad end states or outcomes for themselves. Non-retrofitters were in the middle, on balancing favoring positive goal attainment but not as much as the pre-law retrofitters.

This leads to yet another potential implication: the *interaction* between a person's RF and their strength of belief in the benefits of mitigation may be important to persuasion and behavior change outcomes. Perhaps non-retrofitters are very similar to pre-law retrofitters in terms of personality but are simply less convinced of the benefits of mitigation. Another possibility is that non-retrofitters somehow faced more financial and other obstacles than pre-law retrofitters, and adapted their beliefs about mitigation to be more consistent with what they viewed as their feasible action set. In either case, adding short term downsides to not retrofitting did get some *prevention-oriented people who could afford it* to take action.

6.E – Summary of Factors Involved in Berkeley Soft-Story Owner Retrofit Decisions

The Berkeley soft-story owners who participated in this study are very aware of earthquakes in general. They've lived in the San Francisco Bay Area an average of 20 years. Eighty-three percent report living through the 1989 Loma Prieta event and one out of four *personally* experienced property damage. Furthermore, over half have personal experience with earthquake mitigation to their own home and about two thirds know someone who has done a retrofit.

This high degree of general awareness and even direct mitigation experience, however, did not translate into precaution regarding their rental properties. Prior to the BSSO, nearly all were unaware that their buildings might have a seismic vulnerability.

In just a few years, however, Berkeley's soft-story ordinance reversed the state of local knowledge and custom. The law forced owners to investigate the vulnerabilities of their properties by hiring a professional engineer. About one in five owners responded by initiating a retrofit. Even though the remaining 80 percent did not initiate a retrofit to date, I did find evidence that the beliefs and expectations of non-retrofitter have shifted substantially, too. Everyone that I talked to now believes that they must either do a retrofit or accept that their property is worth less. Owning a soft-story property in Berkeley is now regarded as a business risk, in part because of the earthquake threat but also because it subjects and makes owners vulnerable to future regulatory burdens.

The evidence I collected suggests the involvement of all four influence factors – risk perceptions, perceptions of the recommended actions, social perceptions, and individual

differences – as well as significant interactions between them. No simple story emerged as to why some owners went one way while the others went the other. Furthermore, perceptions arising from the new social context were highly important and in some cases trumped perceptions about the hazard and about retrofitting effectiveness.

Below, I present some additional overall conclusions and summarize key take-way points from this chapter.

1. *Among study participants, retrofitters do not seem to differ very much from non-retrofitters in terms of risk perceptions, hazard experiences, hazard knowledge, or degree of concern.*

In this study, retrofitters and non-retrofitters appear to have similar hazard experiences and risk perceptions. This population is highly aware of the general threat of earthquakes and rate themselves as somewhat knowledgeable about them. The majority have either experienced past earthquake property damage themselves or vicariously through an acquaintance. However, for most, this background did translate into a high level of concern. Qualitatively, the interviewees report following the dominant social custom prior to the BSSO of *not* attending to earthquake risk when making rental property purchase and management decisions.

2. *Non-retrofitters had as much or more experience with past structural retrofit to their own homes as post-law retrofitters, but showed less overall faith in mitigation benefits.*

Over half of study participants had experience retrofitting their own home or residence in the past, including all of the pre-law retrofitters and two thirds of the non-retrofitters. This behavior did not carry over into their rental property ownership decisions. This high rate of personal investment in structural mitigation is undoubtedly associated with the City of Berkeley's transfer tax rebate program, which in part explains why similar investments were not being made in rental properties.

Overall, study participants view mitigation positively but do not rate it as a particularly important or urgent issue. There might be differences in general attitudes about mitigation by retrofit status and timing. Retrofitters seem slightly more optimistic about the value and benefits of earthquake mitigation, but this could be a result, rather than a cause, of having taken that action.

3. *Formation of retrofit intentions is linked to specific events and external cues.*

The retrofit stories collected in this study support the idea that intention to retrofit arises in connection to specific, focusing external events. The instigating events for pre-law retrofitters included: purchasing a property, receiving an inheritance (in one case an elderly co-owner relative had been resistant to making significant repairs), completion of other major upgrades or repairs, and experiencing a recent large local earthquake.

Pre-law retrofitters varied in how long it took from formation of intent to retrofit until actual implementation of a retrofit project. Two pre-law retrofitters I spoke with completed their projects within one to two years after property purchase (a short latency between

intention and action). The other three took in some cases a decade or more (a long latency). In those cases, intention to retrofit was formulated close to the time when the property was purchased and then the actual work was initiated and completed after a major new source of financing became available, such as when an inheritance was received or when financing terms became more favorable because of the economy.

Institutional owners tended to faced large financial difficulties and complexities (e.g., use of bond funding, land lease arrangements with the University of California). One institution that I spoke with that formally initiated a retrofit after the law had been planning and saving for a retrofit for five to ten years previously.

Finally, Loma Prieta was mentioned by several of the pre-law retrofitters as an instigating event. Although the epicenter was more than 75 miles distant, Loma Prieta was a frightening earthquake for the region and widely viewed as a "wake-up call". One pre-law retrofitter felt motivated by the imagery from the Loma Prieta event.

> *"I remember [from] Loma Prieta, with that earthquake there was, in the paper, a building that was very similar to mine that in the earthquake actually leapt off the foundation and landed about ten feet away or something and that was another thing." [OB11:54]*

4. *Berkeley's Soft-Story Ordinance informed owners about the potential weaknesses of their properties and led them several steps down a path towards what they could do about it.*

The BSSO hit most owners as an unpleasant surprise, forcing them to revisit their expectations about their property's physical condition and worth. It forced owners to assess the potential consequences to themselves of owning a building that had been singled out by local authorities as being substandard. They had to contemplate mitigation while working with an engineer of their choosing, and they knew that they were doing this at the same time as many other similarly situated owners which naturally prompted greater level of curiosity about what their peers were up to.

Some owners doubted that their building had any problems when they first received notice from the city, but the law then pushed them to take steps (in a relatively short time span) that would either confirm or refute the city's proposition that their building was hazardous. A small number of the skeptics were proved correct and those owners did not pursue retrofits.[44] But, more than 90 percent of owners received third party confirmation that their building had a soft-story condition. Denial became nearly impossible to sustain. The only narrative that skeptical owners could now cling to was that the program set the threshold degree of hazard inappropriately low, for instance because of excessive zeal on the part of either city staff or engineers. Two or three owners I spoke with held that belief.

It was important that the BSSO forced owners to choose their own engineer. This meant that the assessment was more likely to be trusted or believed and be viewed as a second

[44] With one exception: one institutional representative vowed his organization would be trying to do some earthquake safety upgrades to their property even though the building does not officially meet the criteria for the City's Soft-Story Inventory.

opinion or "confirmation" of the city's assessment. On the downside, it meant that an owner could purposefully seek out an engineer that had less expertise, stake, or interest in the specific arena of earthquake vulnerability assessment. At worst, some owners sought out an engineer who would do everything they could to argue that the building shouldn't be on the list. However, counteracting that were both the engineer's sense of professional ethics and responsibility (backed up by potential liability issues) and the city's review and approval process.

Additionally, any engineer an owner worked with should have a clear incentive to encourage the owner-client to pursue a retrofit. Depending on which engineer an owner chose, the owner might receive a more or less enthusiastic, convincing, or even accurate recommendation about possible courses of action. But many owners chose to use an engineer that had attended the city's trainings. Those engineers were more likely than the typical community engineer to be members of a professional organization that has emphasized soft-story vulnerabilities in their newsletters, conferences, or trainings. Over time, owners gravitated towards a smaller pool of engineers who could claim experience in doing soft-story assessments pursuant to Berkeley's law. Thus, in part because of the Bay Area's engineering talent pool and BID staff connections with regional experts, most owners ended up working with engineers who had above average credentials and interest in soft-story issues.

From this, I conclude that some of the voluntary retrofits done after the law probably came about because owners were now informed and wanted to fix a problem of which they were previously unaware. Also, owners were now more capable of evaluating retrofit options and carrying intentions to do one because they had taken several important steps towards preparing to fix that problem. In particular, they had established a relationship with an engineer who was not only capable but motivated to talk them through the remaining steps.

5. *Berkeley's Soft-Story Ordinance became a powerful new instigating event because it altered the social context surrounding retrofit decisions and gave them several more timely reasons to take action.*

> *"The Soft-Story Ordinance has given people a big push to do something." [OB7:46]*

Even if the new, personalized, and expert-delivered information did not sway their personal views about the risk, the BSSO was a powerful motivator of behavior change because it shifted the social context surrounding owner decisions about retrofitting. The new social context, in turn, added new perceived costs to leaving the building as is, giving owners several new immediate reasons to retrofit. On top of that, the BSSO kept on nudging soft-story owners with multiple reminders and prompts to action, including continued public discussion about a future mandatory retrofit law.

The BSSO was also able to shift the social context because it added several new costs for owners that chose not to remedy the identified vulnerabilities. Before the law, owners felt that the only thing *certain* about a retrofit is that most of the benefits will not come immediately if at all. (A few people valued the "peace of mind" benefit but not everyone felt that was affordable or worth it). The BSSO changed that perception because owners came to see being

"on the list" as negative and a business risk in numerous ways: being listed involves several nuisance obligations that continue in perpetuity, it conveys stigma that might reduce the owner's ability to sell a property or the re-sale price, and it makes the owner vulnerable to future potential regulation.

The law radically downgraded owner and potential buyer expectations about the listed properties. Many of the post-law retrofitters I spoke with were highly motivated by trying to get free of these near-term negative consequences created by the law. Removing the stigma (and its perceived economic implications), gaining freedom from added administrative hassles, and eliminating fear of further regulatory impositions were all powerful motivational factors. After doing a retrofit, regardless of when a future earthquake occurs or how their building performed, these owners could reassure themselves of several external reasons why doing a retrofit was a reasonable idea. Owners who retrofit after the law were also concerned about protecting themselves from liability exposure. Those owners who choose not to take action after being informed are more exposed to lawsuits in the event that anyone is ever injured as a result.

Passage of the BSSO showed owners that City Council Members and staff were serious enough about this issue to expend enough political and resources to pass one law and credibly created uncertainty and fear that the city might soon go further and pass a mandatory retrofit law. Owners took seriously the suggestion by city officials that the BSSO might soon be followed by a mandatory retrofit program. Many owners told me they acted to preempt the city later requiring them to do the recommended repairs, often at the urging of their engineers who argued that future requirements could be more stringent and because it saved money to evaluate and plan for a repair at the same time.

Ultimately, over the five year period after the law was passed, even owners that are not inclined to do a retrofit came to believe that doing retrofit would be advantageous and possibly inevitable. The owners I talked to felt there had been a 180 degree shift from the previous status quo.

> *"[People did] not do something like this retrofit ten years ago. If somebody now is coming to buy a property like this, OK, he knows what he is going to face. But when you bought it, nobody ever talked about it." [OB15:41]*

By very publicly forcing revelation of the seismic weaknesses of a large group of similar properties in one locality and all around the same time, the BSSO effectively established a new reference point for owner retrofit decisionmaking. Owners had no choice but to shift their decision frame from *whether to make an acceptable quality property even better* to whether to *restore* a property to acceptable quality by remedying a known defect. Pre-law retrofitters may have asked themselves, "Do I want to gain the benefits of retrofitting this building?" Owners affected by the BSSO were facing an importantly different decision context: "Do I want to gain the benefits of retrofitting and avoid the numerous negative side effects of being on this Inventory?"

There exist at least three judgmental heuristics that might have made this effect even more powerful. First, if owners still felt "endowed" with the previous value they ascribed to the

property, a reference point shift may have greatly magnified the perceived value of avoiding the negative consequences imposed by the law. Second, the new "avoided costs" associated with retrofitting to get off the list involve removal of possibly emotionally aggravating states. These might feel more immediate and certain than the direct benefits of structural mitigation that are only realized when a future earthquake hits. Therefore, they should be less distorted by present-biased preferences (Loewenstein, O'Donoghue et al. 2003) or myopic discounting (Frederick, Loewenstein et al. 2002).

I did discover that a few owners had the mistaken impression, in some cases through the advice of a property manager, that the law required them to retrofit. This suggests that some of the post-law retrofits should not be counted as "voluntary."

For a variety of reasons, the City of Berkeley provided a ripe setting for rapid change in social perceptions and context. In part because of rent control and being a University town, the local property owner professional association is fairly well-established and many owners are highly networked. The actions and thinking of peers can be seen or found out at low cost. The BSSO simultaneously affected a large group of similarly situated owners in a real estate community with high continuity of ownership and where many owners own multiple rental properties. It spurred owners to talk with their peers about mitigation in a context where everyone is trying to figure out what everyone else is going to do. It prompted them to consider what other people similar to them are doing about the same problem at a time when everyone is also deciding.

This meant that when a small number of "early-adopter" owners decided to retrofit following the BSSO, this fact became quickly known in Berkeley's relatively small multi-family real estate market. When owners called to speak with Dan Lambert, the program manager, they heard the same refrain – some of your peers are doing the recommended repairs. Favorable signals about mitigation were now coming from multiple directions.

6. *Retrofit behavior in this context appears to be motivated by economic or "business" rationale but was influenced and in some cases overridden by social and individual factors.*

Overall, the BSSO appears to have opened up new motivational pathways to becoming a retrofitter. The pre-law retrofitters I spoke with were largely trying to secure the benefits of protecting their real estate investment from the potential consequences of a quake. This is the "traditional" reason to do a retrofit. The post-law retrofitters I spoke were also concerned about avoiding earthquake damage and the possibility of tenants being injured, but they also wanted to be free of the many negative outcomes of remaining on the Inventory. The changes in circumstance created by the BSSO figured so prominently in some owners' thinking that they proceeded to retrofit even though they have lingering doubts that the actual earthquake threat warrants it.

Post-law retrofitters wanted to get off the Inventory to remove stigma, avoid ongoing administrative hassles, and restore their property's value. They also wanted to preempt future mandates, feeling that if taking action was inevitable it would be advisable to do sooner rather than later. Retrofitting also immediately eased concerns about future tenant recruitment, the ease of future sale, and the future expected sale price. Importantly, these secondary benefits

were realizable immediately and could possibly be large enough (regardless of the owner's risk perceptions) to justify the expense.

When non-retrofitters were asked to discuss barriers and reasons why they have not done structural upgrades to their properties, high upfront costs and the inability to recoup costs (owing to rent control and tenant disinterest in earthquake safety) were the predominant factors. However, cost uncertainty and intangible costs were also brought up. Skepticism about how dangerous their properties really are, and about how well structural mitigation would actually work, was also important.

Study participants nearly universally expressed the belief that soft-story properties in Berkeley must someday be retrofit, either because they city will mandate it eventually or because nobody will be willing to buy the property (without sacrificing the approximate cost of repairs in the sale price) unless the repairs are made and the building is off the city's Inventory. This implies that there are really two "types" of non-retrofitters now in Berkeley's soft-story owner population: 1) people who want to retrofit but feel they can't afford it or are otherwise waiting for more favorable timing or more financial circumstances to materialize, and 2) people who are not personally motivated to retrofit but that feel they will someday have to or accept a financial hit on the building if they don't.

CHAPTER 7 – KEY IMPLEMENTATION ACTIVITIES & CHALLENGES

This section expands the discussion initiated in Chapter 4 regarding the key implementation decisions, events, and challenges encountered and how they were addressed. Here, I move beyond simply chronicling events to discuss the implementation experiences of BID staff, engineers, and affected owners, institutions, and managers. I organize the material according to three key processes related to the program: program management and development of administrative procedures, the process of obtaining and getting approval for an engineering report, and the process of completing a concurrent retrofit. Within each process, I show key activities in approximate chronological order.

7.A – Program Management and Administration

> *"the biggest problem with this [law] is…way too much making it up as they went along…" [OB23:19]*

Individuals and organizations forced to comply with a new regulation want to experience streamlined, results-driven processes for handling their case. Any hint of inadequate preparation, indecisiveness, or inconsistency is unwelcome. They have a natural resentment to the "learning by doing" type of program management that often accompanies groundbreaking legislation, especially when those programs are under-funded and under-staffed.

BSSO program staff were aware early on that they did not have enough resources to run the program in an ideal manner. Whether or not proponents failed to anticipate the level of resources needed or simply understated them in order to get support for the program is not clear. That being said, the two key individuals who operated the program were highly committed, and both the City Council and management in the Planning department had committed publicly to the policy, so everyone set about trying to make it work.

Outreach & Messaging

> *"They did do some pre-work by saying there is this ordinance coming down, your property's potentially on the list. They kind of prepared the grounds…I have to say, if you were reading your mail, the city did a good job of telling owners that it was coming, at least in my estimation. [OB19:41]*

> *"I just don't know what transpired before… maybe there was a lot more education work done by the city to help explain this on the front end, which I clearly missed." [OB30:60]*

In total, eight out of 43 participating owners and managers reported hearing about the law prior to being officially notified. Their sources were either word of mouth, a newspaper article, or through membership in a local property owner's association. This is consistent with

my finding from the policy history study that stakeholder outreach for the BSSO largely occurred after the idea for the law was already well-developed and around the time when the law was actually passed and afterwards. No one I spoke with remembered attending the February 2005 Community Forum, which was oriented to presenting the final shape of the law. That being said, good ideas – ideas that were actually used like the concept of an initial appeal period – resulted from the small amount of outreach that did occur.

Program managers did not take advantage of the potential role of property managers, other social network members, in generating a dialog about the law with potentially affected owners. For better or for worse, both before and after the law was passed, staff relied heavily on communicating through the Berkeley Property Owner's Association (BPOA), the largest local established organization representing property owner interests. The past-president of BPOA from 2002 to 2005 claims he barely remembers hearing about the issue until he received a notification letter about one of his buildings in 2006. Most owners I spoke with – with the exception of the institutions – were familiar with BPOA, and many were present or past members. However, many soft-story owners I spoke with reported that they do not belong, read the newsletters from, or otherwise participate in that group. Several reported feeling that BPOA is not a helpful or effective organization in general, or had specific complaints about how it failed owners on this particular matter.

BPOA has a long history of being at odds with the city and in particular the Rent Stabilization Board. The BSSO program manager participated in several educational lectures or workshops for owners that were hosted and organized by BPOA. Some featured engineers who presented summaries of the technical issues, other times the program manager presented information about how to comply.

Notification & Reactions

As noted in Chapter 4, the process of sending out notice and orders to affected owners went fairly quickly and smoothly. However, even though the city tried to make owners aware that notifications would soon be coming, but given the limited amount of outreach (reaching only highly-networked or attentive members of the owner community), the law did "surprise" many owners, especially institutional owners and those with less social capital in the real estate world (i.e., that own only one income property, have a paying job outside of real estate, do not belong to any associations, or report not knowing many other landlords).

> *"No one knew anything about it. It was just an ordinance that came up and now they want to protect the buildings and the tenants and everyone involved in case of a big earthquake. But, I don't think any of the owners knew this was coming." [OB32:38]*

Upon hearing about the law, owners and managers had reactions ranging from fear to annoyance to anger. Clearly the notice was not good news. Dark humor, cynicism, and a sense of victimization were common in the interviews. One owner scoffed that this law was "typical Berkeley" [OB6].

"I sort of at first thought it was a joke. Come on, what are they doing now?" [EABOB5:32]

"Berkeley is always coming up with stuff. It's part of the reason why rental properties is inexpensive in Berkeley (sarcastic laugh)." [OB3:33]

A few owners perceived the packets as wordy and complicated or reported being confused about what they needed to do. Some owners claimed the written communications were excessively officious, bureaucratic, and legalistic. One owner jokingly described each communication packet he received from program staff as a "folder of doom" [OB29:43]. One manager thought that the letters were excessively "threatening" in tone [OB19:119].

A common confusion involved the deadlines and the dates when different elements of the law went into effect. Most owners I spoke with did not understand when affected owners must start to notify tenants and post signs, and did so only after the compliance window elapsed or the building was officially confirmed to be "soft-story" according to the BSSO's definitions. One property manager had the impression that appeals and exemptions would be processed for the full two and half year "compliance window", and only thereafter would all the elements of the law be go into effect. Some owners claimed they did not receive (or did not organizationally recognize the need to comply with) their notice until it was too late to appeal inclusion on the list. [OB39:16].

A few owners and managers mistakenly got the impression that it was mandatory to retrofit. The letters from the city are clear that this is not the case. So we conclude that something like the following occurred: there was a language barrier to understanding the letter, the owner mistakenly or inattentively read the letter, or they trusted or misheard that information in communications received through their property management agent or some other party.

<u>Status Tracking, Delisting, and Enforcement</u>

Program staff had minimal resources and administrative support, so timely status tracking was a challenge. Staff gave priority to tracking reports through the review process, but did so "by hand" in an Excel spreadsheet because the city's planning department database system was considered too inflexible and costly to amend. The current level of report compliance was not reached until the initial compliance window ended and multiple letters and waives of reminders were sent, including at least three waves of warning letters for non-compliers.

Because staff were initially caught off guard by the immediate interest in pursuing concurrent retrofits, early administrative efforts were deflected into developing a process for coordinating building permits with the report review process.

"They weren't prepared. I think they were just surprised. [At] anybody that is willing to do the work, is my impression." [OB33:28]

Some owners I spoke with complained that the city was slow in responding to their submitted reports. From the key informant interviews, I learned that program staff were the bottleneck for responding to owners about report approvals or revisions, not the reviewing contractor. The contractor turned over report reviews in on average less than 10 working days. In some cases, the owner might have thought that the city was delaying when instead their engineer was not actively working on the project.

Staff created a public website where anyone – owners, engineers, and the public could see the status of properties on the list. However, the list was only updated annually. Some owners resented being listed as not being up to date on the website for months. The public website did serve as a place for interested parties to obtain background documents and other forms and templates. However, some owners complained that the website was not updated frequently enough. The compliance status field was only updated annually.

"[The website list] is very inaccurate. It's not kept up very well." [OB6:82]

"I don't think the city is very on top of this. Look at this list right now, we were finaled last year…this list on the city's website is ten months old." [OB37:21]

Some owners I spoke with had no problems and received official confirmation from program staff of their status within one to three months. When delays and inaccuracies in record keeping did occur, they were especially resented by two groups of owners: those that were originally listed in error and those who voluntarily invested in retrofits.

"[Our engineer] determined that the property is not a Soft-Story as defined by the building codes and so we then began a process to have the property removed from the City of Berkeley's list. [The city] eventually agreed to do that. It took a couple of years, but they agreed to do that." [OB35:4]

"Just recently, I got a letter from the [city]…they didn't realize that…I had completed all the work. [city staff] were notified and everything…but they sent me a letter as if I hadn't completed the work telling me that I was required…to put notices up here and there and do tell the tenants everything and stuff like that…so they were completely at sea as to things… I wrote to [the program manager] at that time and presumably he took care of it…there was really no reason or no excuse for them not having their records straight, but they don't." [OB27:58-59]

Staff also had a responsibility to periodically update and maintain open lines of communication with the City Council, various Commissions, and the Rent Board. The time-costs of these activities were significant. Preparing a report to Council about the status of the law's implementation could take up to a month of the program's sole staff member's time.

Tracking of tenant notification and signage compliance did not receive much attention until late in 2010, well after the initial compliance window ended. Beginning in February 2011, the RSB sent a Field Representative to visit buildings still on the Inventory to confirm that the required warning sign had been posted. By April 25, 2011, the Field Representative had visited 160 of the 206 properties subject to the sign requirement and found 70 sites with a sign and 79 with no sign. The RSB Field Representative was unable to access, and therefore unable to confirm, the conditions at 11 of the properties. The remaining 46 sites had not been visited as of January 2012.

Tracking of compliance with the tenant notification aspect of the law was a low priority and remains strictly voluntary. As of April 2010, about 50 percent of the owners had at least once volunteered evidence of tenant notifications and many of these are now surely out of date. Thus, the current tenant notification status is not known or up to date for the many of the properties on the Inventory.

<u>Communications & Customer Service</u>

The complexity and novelty of the program requirements not only confused owners but also burdened BID staff as they tried to help owners and engineers navigate the compliance process. Handholding ended up taking a lot of the program manager's time. For an owner, it meant that non-urgent communications were sometimes not handled promptly. Staff had to field numerous phone calls, emails, and inquiries from engineers and owners, and in a few instances tenants.

The report review process in particular, and especially at the beginning, might involve tens of communiqués and could last one to three years, depending on the complexity of the property case. The duration might be especially long if the owner was trying to simultaneously do a retrofit or request reconsideration of their status, as it did for this owner:

> *"[I spoke with the program manager] dozens of times. I kept most of my contact by letter…I did write a number of letters, and if there was a phone call with him, I would at least write a fax following… acknowledging or outlining or briefly stating the phone call so that there was a record of it in some form and I have a fairly substantial file. I brought one component of that file out in this regard and actually it [took] more than two years…" [OB16:25]*

Delay in responding was a chief complaint.

> *"Nobody likes the city bureaucracy anyway. So, you submit a paper and your engineer tells you 'oh, no you can't do it.' [Then] it takes [the city] three weeks to respond to [the engineer, to] even acknowledge that they got something…maybe they don't even acknowledge. But, you know, that's how cities work." [OB18:68]*

Some owners reported waiting many months to receive an "all-ok" letter after their report was accepted. One owner reported repeatedly receiving communications to the wrong address, despite several phone calls and letters to try to correct the problem [OB39:15]. Communications about "delisting" were particularly slow.

Overall the owners and engineers I spoke with gave the program mixed reviews for customer service. Some reported that working with the city was "no problem" [OB9] or "not terrible" [OB11]. Some said the planning department treated them "nice" [OB2, 16] or "apologetic" [OB2]. Some interviewees volunteered positive anecdotes or thoughts about the program manager, using such words or phrases as: "nice" [OB2, 10, 27], "very helpful" [OB12, 27], or "really good" [OB40].

> *"I had to become acquainted with the ordinance which took a while because it was rather confusing... The fellow who was in charge of earthquake mitigation…was very nice. He was quite helpful and … eventually got me pointed in the right direction on how to do things." [OB27:27]*

> *"I went to the office and told the guy there about what I'm doing. He was a real cool dude, he was just doing his job and going by the guidelines…so, the people in the office were fine." [OB20:38]*

Others, however, reported that the program staff were bureaucratic and inflexible. I heard two specific complaints about lost paperwork that led to major delays [OB15, 31]. A few thought the program manager had the wrong technical skills for the job in that he was not an engineer.

> *"[At] the administrative level, people you deal with [at the city] could be kind of a drag… it shouldn't have taken as long as it did. They should have been smarter. They should have been more responsive. We would send stuff to them and I told you it was six months of silence and then they would say something and then, to their credit, a couple of letters were like apologies for not jumping on this sooner or dealing with this. But there's a lot of robots there who were just doing…what their interpretations of the regulations called for…I'm not a big fan of, and I really hope to minimize any further kind of dealings with, city officials." [OB17:59-61]*

In complying with this law, owners had to work with many different city offices, including the planning department, the outside contractors who reviewed the reports, and the earthquake mitigation staff in the Building Inspection Division. Retrofitters might *additionally* have to deal with building inspectors in the field, the Rent Board, parking and traffic, or the Landmark Commission. Owners agreed that the city did not present a "unified" front in terms of working with them on their retrofit projects.

One owner felt his previous experiences with building inspectors showed them to be two-faced.

> *"They are very nice, you can talk to them and they are very sympathetic, but when you do something…Be careful!" [OB15:96]*

Another reason is the already low level of trust between owners and the city.

> *"How can you work with [the city]? I don't trust these people at all. I don't know whether they will respond to my questions…Who do I have to ask? Do I have to ask the Mayor or somebody? I don't speak to anybody." [OB26:39]*

As a "one man" operation, the most important deficiencies in the program as implemented appear to regulated parties as closely linked to the skills, attitudes, and tenure of the program manager. Owners and engineers alike appreciated how accessible the program manager was when the majority of his time was dedicated to running the program. However, when the city budget shrank in 2009, the Council approved elimination of the earthquake mitigation program manager position, and he was reassigned to another function. Owners noticed and greatly regretted his departure, which also may have caused paperwork delays for several owners I talked to [OB8, 35].

> *"When [Dan Lambert] was there in charge of this project, it was very easy to work with the city…I have another property that's on that list… and since Dan is no longer there, we haven't been able to get a building permit to do the work that would make the building safer…Because there's not anybody really at the city anymore who's shepherding this project. " [OB35:12-14]*

> *"The people they had in the city they kept moving around to different positions, so when you talked to one guy, then the next time now there's nobody taking care of it 'cause they don't have the budget for it, or didn't try to, they didn't really care." [OB33:16]*

> *"Now that Dan Lambert is gone, there's no real contact person." [OB32:80]*

"I think they cheated [us]. You want to have one person that's familiar with all the laws who can and who stays on. I don't know why they don't do that….I know they keep saying budget cuts or whatever, but they just [cut] people and the learning curve is too long…it's [a] frustration for owners who do want to do the work [when the] people that we're dealing with…don't know what the rules are and they don't know what the law is, they don't know what code is, they just make it up as they go. Well, that's the kind of frustrating…I'd say to the city you need to hire somebody who's going to stay on from beginning to end, especially [for] something big like this. Where you're going to [go] against 350 or 400 landlords and tell them that your buildings are unsafe and we got to tell every single tenant in your buildings is unsafe, put a huge sign up saying your building is unsafe, and then have nobody that we could talk to?" [OB33:49-50]

7.B – The Report Production and Review Process

Finding & Working with an Engineer

As discussed in Chapter 4, the city advertised within the local engineering community and hosted two formal trainings. Program staff then prepared a list of the 56 engineers that attended a training event and put that list online as well as sending it to all noticed owners and referring owners to it if they inquired. Program staff made it a point not to endorse or recommend specific engineers, either on or off that list.

Several of those engineers turned the BSSO as a business opportunity and advertised their services directly to affected owners. To do this, those engineers obtained the list of properties, looked up the owner names using county property records, and sent out letters or postcard reminders. In effect, those marketing materials became another reminder mechanism for non-compliant owners. Several owners that I spoke with reported receiving multiple letters from multiple firms [OB10:45, 15:36, 30:33]. At least three different engineers gave presentations about the BSSO at a Berkeley Property Owner's Association meeting as a way to generate business. Several interviewees reported finding their engineer this way.

As of May 2009, 58 different engineers had worked on one or more reports for the BSSO, about one third of whom had attended a training event (36%). The majority of reports either in-review or approved as of that time (97 of 163 or 60%) were worked on by an engineer that had attended a training, because the four out of five of the most prolific engineers were attendees. Even though 58 different engineers had worked on reports, the top five engineers together did over half of all the submitted reports. Forty one engineers submitted only one report. Most of the engineers were local, hailing from Berkeley, Oakland, Emeryville, Alameda, Walnut Creek, and San Francisco.

Most owners who chose to use an engineer not on the city's list either used an engineer with whom they (or their organization) had worked with before or an engineer referred to them by a business partner, family member, or acquaintance. One owner said he called engineers in the phone book and found very few that were even interested in looking at his property [OB25:23].

Some owners reported having difficulties finding and working with a qualified engineer to complete the required report. Two owners said they approached engineers who gave them very high bids ($25,000 per report); those owners speculated that the engineers purposely overbid the work so as to avoid getting the contract. Some owners took the time to get two or three quotes before deciding on someone to hire. Others were disappointed by the services the first engineer they worked with, and they opted to switch to a different one mid-stream. One owner reported to me that the engineer moved away from the area mid-project without informing him.

Some owners reported being confused whether the city's engineer "list" was a requirement, a recommendation, or just a list of attendees. One interviewee reported thinking that owners were *required* to use an engineer from the city's list.

> *"I told them I have an engineer I could use. They said, no, you have to use the one off this list. So then we chose somebody off that list." [OB33:18]*

That same owner was unsatisfied with the first engineer and although he stuck with the engineer to file the report, he switched to a different engineer to prepare plans to for a retrofit. The second engineer hired was not on the city's list of training attendees.

Two owners had difficulties when they tried to hire an engineer who had worked on the Framework as a consultant. It took some time for the city to resolve its concerns about whether there would be a real or perceived conflict of interest. In practice, only three or four engineers were ever worked on reviewing reports, and none of them ever did outside work as evaluators.

A major source of disappointment I heard about from owners was escalating costs as the report process went forward. Both engineers and owners that I spoke with told me that it was at first difficult for engineers to accurately bid evaluation report projects. One reason for this is that many reports, especially early on, required multiple revisions before they were approved. From the owner's perspective, this was a surprising disappointment; they expected their engineer to be an expert who would be able to deliver what program staff wanted on the first attempt. Owners found it confusing why engineers weren't more able to do this. Most articulated that the city was to blame because they had been unclear in what they wanted or were "moving the goal posts". Others attributed it to greed or lack of skill on the part of the engineer they hired at first. I heard several anecdotes about owners changing engineer mid-stream owning to these types of frustrations.

> *"The engineer…gave a low bid. He says, 'Well, I got to go talk to the city again and that'll cost a couple hundred dollars more, $600 more. Well, the city wants me to draw another little plan here and that's another $1,000.' So, he sort of started the nickel and dime*

routine which I didn't appreciate. Once the city said 'OK, we have the plans, that's all we need for now,' I told him to stop." [OB25:27]

As noted above, some engineers may have been genuinely caught off guard by various aspects of the city's Framework. Additionally, engineers may also have been confused regarding the city's expectations for a retrofit that would qualify to get the building off the list (a point to be discussed further in the section "Working with the City").

"[The report cost]…between $3,000 and $4,000 eventually…I was sort of annoyed because of having to go back to [the engineer] to prepare plans. My thinking was he was a Berkeley engineer who was doing this type of work. He should have known what the city required and he should have gotten it right the first time but he charged me for…everything he did and then he also got involved with checking up on the contractors who actually did the work. So I had to pay him for looking in on them, too. I should note one of my neighbors used the same engineer mostly on my recommendation and he did a miserable job for them." [OB27:30-31]

Owners who were disappointed somehow with the services their engineer was providing felt stuck, financially, into sticking with that engineer throughout the entire report process.

"I have some owners that didn't like the engineer but once you start putting money into the plans and the engineer, you don't get that money back because if you chose another engineer, that engineer is going to start from scratch. He's not going to start from where the other engineer left off. So you're basically paying again to, you know start all over…owners don't want to waste money. Cause you're already, the ones that are fighting to get their name off the list, [I] think it was $1,800 or $2,000 or something that [one owner] had to pay [as a] fee to submit [their] request to be off the Soft-Story Ordinance." [OB32:48]

The city did not systematically collect data on what engineers charged owners for their reports. Anecdotally from my interviews, the typical evaluation report cost between $2,000 to $6,000. The variation seemed to be high.

"My partner…got wildly different estimates on what it would cost to do the analysis. How intrusive the inspection would be." [KI23:10]

Owners I spoke with encountered several different types of obstacles that increased their costs to prepare an accepted report. These included:

- Not having access to "as built" building plans, thus someone had to prepare a set (in most cases the engineer performed this step, although three of my interviewees prepared drawings themselves);
- Need for destructive investigations;
- Unusual building configurations or physical conditions requiring more complicated engineering analysis (e.g., an historical property, mixed materials);
- Hiring a less experienced engineer (e.g., non-structural);
- Needing to switch engineers mid-process;
- Having the engineer carry out all communications with the city (In my interviews, paying the engineer to communicate with the city was common for owners who do their own property management but do not have a technical background)[45];
- Any other factors that led to multiple revision requests; or,
- Deciding to prepare plans for a building permit, not just a retrofit schema.

Finally, because the burden of proof was set quite high, reports were not necessarily cheaper for buildings that would eventually be declared officially as "not soft". Anecdotally, escalating report costs led some owners to drag their feet in paying their final bill.

Appeals for Removal or Reconsideration

After passage of the law, program staff had to develop an appeal process for owners wanting to get off the list. At the time, staff had no idea how many appeals they would receive. It took program managers several months to create a form that owners could download from the internet and fill out. However, appeals of different types varied in how difficult they were to verify, document, and decide upon. Ultimately, staff processed over 60 appeals, about half of which were approved.

As of April 2010, owners of seventeen buildings were successful in claiming that the ordinance did not apply to them because the property is not "residential" or has fewer than five units. To make these determinations, staff used a combination of information provided by the owner, city records, and site visits. Occasionally the owner presented a letter from an engineer with some data. It may seem surprising that so much effort on both sides went into dealing with some of these errors, but again program staff wanted to be sure that there was evidence, not just the owner's word, if a building was listed inappropriately. Indeed, some appeals of this type were not very complicated. For instance, the owner of a motel successfully argued that the building is wholly in commercial, not residential, use at present. However, one owner I spoke with spent approximately $2,000 to do formal, permitted modifications to a ground floor space in the building in order to conclusively demonstrate that the property did not and could not have five legal dwelling units.

[45] Depending on the skills of the persons involved, using a property manager as a go-between the engineer and the owner could be either cost-effective or a net drain. It was beneficial to most owners I talked to who tried it, but a problem for a few.

> *"[The program manager] would not accept the Microfiche original documents from the 1970's declaring the place a four unit building. He would not accept the documents from the Rent Control Board showing that it was never more than four units. He would not accept a letter from the Planning Department of the City of Berkeley saying specifically that it's a four unit building. He…insisted on requiring [me to remove all physical possibility of a fifth rentable unit]…and this went on for a long time and lots of exchanges…I had to repeatedly demean myself in front of this man in order to move forward." [OB16:19]*

The BSSO embodied an early decision to squarely place the burden of proof onto owners as to whether their property did not quality as "soft" according the definitions in the law. The law was careful crafted with the language that buildings on the Inventory were only "suspected" of having a hazardous soft-story condition, but in practice the program was structured to assume guilt until proven otherwise. To revise the initial determination, the program required an owner to submit the structural checklist Table A-4A of the 2003 IEBC Chapter A-4 and supporting documentation, prepared by a structural engineer, to demonstrate that all elements are compliant with the standard. As of April 2010, program staff approved the appeals filed by nine owners that their buildings were not "soft".

The owners I spoke with who were in this position resented that nearly as much paperwork had to be filed to get off the list as for a building that was legitimately on it. In other words, the burden of proof was set quite high. This was demonstrated by one case I heard about (through the owner's property manager) where extensive drawings and destructive testing were required to produce the required report showing that the building was not-soft [OB23:49], costing the owner thousands of dollars in repair work on top of the engineering fees. Another owner I spoke with was in his fourth year of trying to demonstrate that his building is not soft-story according the law [OB31].

Some owners seeking to appeal reported that they paid engineering costs and spent many hours writing letters, obtaining documents, and responding to requests for further information as part of a lengthy, frustrating ordeal. Several owners were still had pending cases with lingering issues. One owner that had completed a retrofit on the property about ten years earlier paid about $1,500 to the engineer who worked on the previous project to provide additional calculations that the reviewers asked for [OB17:44].

Other owners who found the process of proving that their building was not soft to be relatively painless and not very time consuming, if lengthy. One interviewee – a managing officer at a scholarly institution – knew that their property's soft openings had been closed off previously to create storage areas, and found it relatively easy to verify with the pervious contractor that the work would qualify, and then to get satisfactory documentation of that to the city.

> *"It was just a question of making a couple of phone calls, getting the information back and forth…[but] it takes months to get an appointment." [OB13:13]*

The different experiences of these two owners might have to do with the fact that one is an institutional client for whom the previous contracting firm was willing to do some additional work for free. The other owner was perhaps just unlucky to have worked with a different engineer who did one round of calculations without charging but then asked for a fee once the city requested additional information.

Several persons I interviewed put forth the suspicions that the city was inconsistent over time in the level of evidence it required of owners in order to get off the list. One property manager who worked with multiple soft-story owner clients felt that earlier on it was easier to appeal being listed, and later the requirements for de-listing were made more strict [OB23:47].

Overall, the owners I spoke with gave the city mixed reviews for how it handled requests for reconsideration or removal. Almost all appeal cases I heard about involved multiple rounds of communication and involvement of third parties. One owner, who was still in the midst of processing his appeal at the time of the interview, noted that various clerical errors had delayed his claim, in addition to being asked to provide more and more drawings and calculations.

> *"They lost stuff, to begin with…I had to hand carry and hand deliver and have them stamp envelopes in front of me in order to make sure that this thing is getting to them because they had lost my original response." [OB31:19, first half]*

Owners expressed both amusement and annoyance about being mis-notified under the ordinance in ways that the city should have been able to detect by checking its own existing records: fewer than 5 units, non-residential use, or a previous retrofit.

> *"[City staff] really aren't very good at this type of thing. They sent me notices for two other of my buildings which clearly didn't fit the ordinance. One was a three-unit building and it doesn't have any soft-story." [OB27:56]*

> *"The building was earthquake retrofit as part of this big overhaul… so when we got the letter from the city…[I thought] why don't the two parts of the city talk to each other, 'cause it's like we've already done this." [OB28:3]*

About eight buildings were put on the list that had less than five units according to administrative data *that should reasonably have been available to the city at the time,* creating suspicion that staff had not checked the work of the street survey personnel against the city's own records. This included five one-story buildings put on the Inventory in error.

> *"[The city] had two guys that drove by and whatever the story, [if the opening] was six or seven feet they figure out it's unsafe. I don't know if somebody checked the plan…pretty much I don't think so." [OB10:36]*

At least three owners expressed a related concern that the city had missed properties while creating the Inventory and had no process for handling "false negatives".

> *"Anecdotally, from realtors, I've heard of three or four buildings where from the street you can't tell it's a soft-story, it's down in back and then you turn the driveway and then in the middle from the rear of the lot is how you access the soft-story. They didn't get written up. They got a pass. And why? Think about this methodology again. No science. No review." [OB2:41]*

Two owners I spoke with admitted that they suspected that some of their other properties were potentially soft-story buildings that were "missed" by the city's street survey. One had all his buildings analyzed by an engineer and did some voluntary seismic upgrades on one of them even though the city never notified him about that property.

> *"[After we got notice about one building] we hired the structural engineer to look not just at that building but we have two other buildings in Berkeley and, in fact, I think we were hidden. We never received official notification that we're on the soft-story list but we were kind of trying to pre-empt it… we had a preliminary indication that we were going to be on the list but we never actually received official notice." [OB7:19-20]*

The second owner in this position said the cost was too much for him to do additional reports so he would not hire an engineer to look at those other properties unless it was required, although he did do a voluntary upgrade on the properties that had been noticed.

> *"I have seven other buildings. I didn't go get [an] engineer's report on [the] other buildings…I was thinking about and I said, 'Why?' I'm sure [the city] went to my other buildings too because they just walked all around the street...[those buildings have a] similar kind of garage and stuff like that, why they're not on the list? Why these two were on the list?…Maybe these were not supported well or something…I don't know." [OB9:53-54]*

Difficulties Using the Framework

Despite the best efforts and preparations of city staff and their consultants, the Framework contained provisions that caused confusion among some owners and even some engineers. The Framework was quickly produced using a reasonable expert-driven process. It was a recipe of exactly what the report should contain, complete with headings. Still, because the law referenced an obscure code, engineers were forced to address some ambiguities and make interpretations. Completing a report was generally not accomplished without further communications among the program staff, owners, hired engineers, and the plan check and report review contractors. The Framework was an unfamiliar, out of the blue, and unproven document in the sense that practicing engineers had ever used it before or seen anything quite like it. There was a steep learning curve, both for the engineers producing the reports and for the reviewing contractors. The city and the reviewing contractors had to discuss, in many cases, what level of detail would be considered acceptable.

It was time consuming and unexpected how much the contractor had to "check back" with the city on a case by case basis – especially towards the beginning – as to what kind of information and analysis was required to be in the report. A special concern was what degree or scope of retrofit would be considered acceptable to get a building de-listed.

The choice of retrofit standards was central to both the perception and realization of fairness and consistency as well as improved seismic performance outcomes. The engineers I spoke with told me that the IEBC, the document that the Framework was based upon, is an imperfect code at best. Experts who advised the city warned that the IEBC Chapter A4 is vague about how much of the structure the engineer is supposed to analyze. It contains some ambiguities with regard to whether the interior walls and upper stories should also be retrofit.

Staff at the time were not ignorant of all this, and had concerns engineers would do far more analysis than was really necessary or appropriate. Thus, in the Framework, they tried to give owners a lot of "outs" so that they didn't have to investigate the upper floors, but not all engineers caught on. Some owners felt that the city may have changed its policy later on and in some cases started to demand that plans for retrofit include upper story work.

> *"It took me a long time to figure out …the kind of multiple paths and how you could get to the end of what was required in the report. I think a lot of engineers had a hard time with that." [OB7:37]*

The Framework required engineers to use destructive testing if original as-built plans were not available.

> *"… most of these buildings are old; they don't have drawings. An engineer, you ask them to do a report. This one specifically says you have to go to destructive testing, which means you go out and you rip open a ceiling, rip open a wall. Owners don't want to typically do that. They've got to get a contractor involved at that point. A lot of [engineers] are trying to circumvent that by coming*

up with some ideas about why they didn't have to do that and some other things." [OB7:36]

Some of these issues arose because of the natural tension between the goals of owners and the goals of the BSSO regarding retrofit plans. On the one hand, city staff were hoping to acquire information about how much retrofits (that performed at a given safety level or referenced a particular standard) might actually cost. This way seen as important to establishing the viability of a mandatory retrofit program as well as to determining whether or how much financial incentives owners might need in order to proceed. On the other hand, owners wanting to do retrofits wanted to do the minimum necessary amount of work. That contrasted with the city's temptation to ask for as much seismic performance improvements to a property as seemed warranted or feasible, which in some cases went well beyond remedying the major first floor soft-story openings. It didn't help that the IEBC standard was unclear on this point.

"[The program manager], at some point, was trying to get a handle on if you had to upgrade the building more than just fixing the hole, but if you had to go through and address some other shear walls and stuff, what the cost was. That was part of the basis or the requirement in the end of this report …that you had to describe a suggested upgrade to the building, and then put down quantity [information] so that they could get an idea about, "Are we looking at $10,000 or $100,000 for the average one?" [OB7: 39]

Another issue was that the Framework only asked for conceptual sketches of a possible repair, which angered owners as "spending money for nothing," because actual retrofits would require real working drawings. Asking for approximate materials used in the retrofit plan was supposed to keep the owner from needing to consult a contractor to get an official estimate, but it ended up being an annoying add-on for owners.

Whatever benefits were gained by the engineers who did attend the city trainings, they were not sufficient to avoid a steep learning curve, though of course omissions and calculation errors were also made by engineers who had not attended city trainings.

One reason that preparing the reports took longer than expected to prepare and get approved was that engineers were at first unfamiliar with the type of report content the city wanted. This made it hard for engineers to bid the projects accurately, leading to frustrating cost overruns that embarrassed engineers and angered owners. There were differences between what the city said it needed and what an engineer would naturally have wanted to recommend.

"[Preparing the report] took awhile…I believe some of the information of how to do it was not very well communicated from the city and all. They had some workshops and things like that…I do believe that the requirement, the base requirement, wasn't

quite clear and even now I'm still not completed and going forth and back still with requirements and questions…" [OB6:41, first half]

The difficulties that many engineers were having at accurately bidding their evaluation contracts and completing reports on the first try fueled owner skepticism about what the city had taught the engineers at the trainings. One owner quipped that engineers were "trained" at these meetings to up-sell to a retrofit and to make the retrofit proposals as grand as possible. [OB33:16]

Several owners and engineers thought that they city was inconsistent about what it was asking for.

"…it wasn't like they knew what they were doing" [OB33:16]

"…it's been a five, six year moving target which keeps changing and changing…the thing that angers people the most, you know, is putting the burden on [us] and then not telling us what the burden is." [OB32:76]

One owner actively trying to do a retrofit at the time of the interview put it this way:

"Ultimately, [we are still] trying to figure out what is actually wanted. And to this date, we still aren't clear as to what they want. We're just processing here, and the engineers are still occasionally having meetings with the city…on what exactly do you want? Still keeps changing…and the conversations I have with them are just confusing. I know a lot about this stuff, and I can get my head around most engineering issues, but I can't get my head around the policy making changes. There's nothing to get my head around." [OB23:21]

Another possible interpretation and contribution to the confusion is that *engineers* used a variety of approaches in their analyses, only some of which were consistent with what the city was asking for or that its plan checkers found acceptable. Any methodology for seismic analysis requires the engineer to make certain measurements or assumptions, such as the building's weight, stiffness and strength. Some of these values are prescribed by the governing building code; others are estimated, often using conventional rules of thumb. Hence, there is almost always room for judgment, often as part of a tradeoff between precision and effort (or fee).

In a companion study funded by the Earthquake Engineering Research Institute (EERI) Special Projects and Initiatives fund, structural engineer David Bonowitz reviewed 52 listed buildings with approved reports filed pursuant to the BSSO (Bonowitz and Rabinovici forthcoming). Those 52 buildings were chosen from among the 90 approved reports publicly available at the time of the study. The remaining 38 buildings had one or more complexities or irregularities that ruled out straightforward evaluation and rendered them less comparable,

such as concrete or concrete masonry unit first story walls, wood frame cripple walls and a crawl space under first floor residential units, split-level diaphragms, or significant hillside or partial basement conditions.

Out of this systematic review, we concluded that some engineers in this subset used varying methodologies, calculations, and other simplifications that led to meaningful variation and inconsistencies in approved BSSO reports. In the expert opinion of the authors, these assumptions were in some cases justifiable, particularly where the code and Framework permit latitude or specify a range. Others could be considered errors. For instance, 12 of the 39 reports analyzed used wood structured paneling values to evaluate structures that had no wood structured paneling, possibly because the engineer mistakenly used the properties of the recommended retrofit system to evaluate existing conditions (Bonowitz and Rabinovici forthcoming). Five reports used a site response parameter only appropriate for buildings located 5 kilometers or more from a major fault, which cannot be true for any building in the City of Berkeley owing to the Hayward Fault.

In one instance, two different engineering firms used different assumptions and arrived at distinct conclusions for a nearly identical pair of buildings (Figure 75). Which interior partitions and walls the each engineer chose to count or ignore was particularly important. The decision to count partitions in one report led to demand-capacity ratios of less than one because the open first story has so many fewer. The other report ignored the second story partitions and found demand-capacity ratios of greater than one, suggesting that even with the large open parking area, the first story was still actually stronger and stiffer than the second story.

Figure 75. Photo of two listed Berkeley soft-story buildings that appear to be mirror image twins.

Finally, the study also found cases in which the building had no calculable deficiency using IEBC A4, but the engineer (perhaps prompted by the city's reviewer) nevertheless recommended retrofit. This systemic conservatism probably had the effect of correcting for

shortcomings in the IEBC A4 methodology. Or, it could represent a different interpretation of the goal of the BSSO. If the purpose of the evaluation reports was to find weak, damage-prone buildings, the engineers certainly found them. But some of the identified weaknesses appear unrelated to a soft-story condition. Furthermore, the problem of *other buildings* without soft-story conditions that have just as much or more damage potential was neglected.

The Review Process, Including Coordination with Outside Contractors

As noted in Chapter 4, program staff decided not to review the report reviews internally. Using outside contractors made the review process less costly since there was price competition to get the contract bid and the City could pay on a per report basis (no matter how many reviews were necessary) rather than paying a salary to keep someone on staff.

The outsourcing process probably affected the speed with which reviews were handled. The reviews themselves happened very quickly, often in under a week. The average time required to review a report was actually very fast, between five to ten days. However, the program often then had a backlog of communications in trying to get that information to the owners. So, from the owner's perspective, the entire report review and approval process might take many months and up to two years. The contracted reviewers felt that the average number of reviews required until approved declined over time. Still, many owners were frustrated by what they perceived as "nit-picking" and constant expansion of demands.

There was also an approximately one year period of interruption in the report review process due to a disruption in the outside contract. Owners suspected that this led to substantial delays and perhaps even inconsistency in how the reviews were handled.

Some owners did not trust the City's motives in outsourcing the report reviews and plan checking. Some felt that the City was being "cheap" or shirking responsibility by doing this, and that it led to worse customer service and ease of getting technical assistance. One owner yearned for "the old days" at the City when there was an engineer on staff that you could sit down and talk to and get approval from in just a few days [OB22:12]. These owners were unconvinced that they benefited much from the City's use of outside engineers to plan check and review the reports. Some owners, who were not aware that contractors received a fixed fee per approved report, speculated that "hourly pay" exacerbated the level of "nit-picking" done by the plan checkers [OB2:29].

> *"The city does not use their own engineers, [they] hire it out, you're in the role that's out there working somewhere and the feeling I have is that it limits the communication significantly." [OB6:41, second half]*

> *"I found out the City cannot handle the job themselves and subcontracted the whole process of inspecting and approving the job to outside engineering firm and in the middle of our process they changed the engineering firm, so it took us about 2 years to get the permit to do the job. In the meantime, I had to travel*

between the city and my engineering office numerous times; to correct, to amend, to redraw the plans. It really took a toll on me personally. I am working full time and manage the apartments full time myself. And most of all, it's not very easy for me to take the day off from my job when I wanted." [OB41:15]

"It's always a different engineer because the initial one, they leave, and then they're trying to read the code and that code wasn't as clear." [OB33:22]

7.C – Designing & Getting Approval for a Retrofit

Working with the City to Get an Approved Report and Permit

This section examines the experiences of owners who decided to voluntarily pursue a retrofit in conjunction with their efforts to comply with the BSSO. Program staff were initially caught off guard by the number of people wanting to pursue a concurrent retrofit. Staff had to make up the procedures as they went along and were burdened by the number of cases needing extra review and processing. Settling on a procedure and clear set of standards was made more difficult because multiple City bureaucracies and outside contractors were involved and the analysis and plans that needed to be produced were highly technical in nature. Additionally, everyone involved was doing something unfamiliar and non-routine, particularly in the beginning. The owners I spoke with felt the Program essentially never fully recovered from the lack of planning about how to coordinate among city functions.

"For me it was fairly painless, other than writing checks. For [the engineer] it was a lot of time. He spent more time dealing with the city than he had intended to, especially since we were doing it before everybody else was doing it, so our conversation was what if everybody's doing it at the same time? There's no way they could process all the applications. And it should have been just a very simple procedure. You're doing this work, we're going to expedite it. And it wasn't that way.

So if I have a complaint that was voiced to me [by] my structural guy [it was] that they just didn't know what they were doing, the city, and it took them a lot longer to process something that [is] their…mandate. They should have already thought this out…what if everybody complies with them, they have a problem, they don't have enough people to go ahead and process it all." [OB14:47]

"The whole process back and forth with the City of Berkeley took six to nine months until we finally got approved and ready for

construction…it's hard getting support from the city…I don't know why, it is just the way it is when you have these big projects…" [OB32:55]

"[It is] hard working with the City…this is all new to everyone. So it's a lot of back and forth, making appointments, going in…submitting plans, then getting corrections and then submitting that and then getting corrections, so it's a lot." [OB32:76]

Doing structural upgrades to a multifamily building can be more challenging than a typical capital improvement project. For starters, an extra professional – an engineer – is involved and level of pre-planning, project complexity, and need for coordination are generally increased. Even more challenging in the case of the BSSO is that owners were motivated not just to do a retrofit but to do one that would *for sure* get their building removed from the Inventory. To do so, the retrofit plan had to be approved in both the typical planning department building permit process and by the BSSO program. In other words, owners who wanted to get a building permit to complete a retrofit to be removed from the City's Inventory were not exempt from filing an engineering report. Instead, that report additionally needed to demonstrate that the retrofit would meet all the City's requirements for removal from the list. In some cases, the Landmark Preservation Commission and Rent Control Board (because of tenant displacement during construction) were also involved.

The scope of the seismic upgrades became a point of negotiation between the engineer, the owner, and the City plan check staff, the report view consultants, the BSSO program staff, and in some instance other committees within the City bureaucracy. And again, no one involved had gone through that process before. The standards to which a retrofit would usually be held for one purpose (to obtain a building permit) were not necessarily the same as what those that program managers were asking for under the ordinance for de-listing.

Several owners I spoke with were frustrated with the City's inability to give clear guidelines and make the process transparent up front. They resented that traditional obstacles to getting a permit, such as the application fee or other triggered work, were not waived[46]. Because of the additional negotiations and corrections required, engineers were consistently underestimating how much the retrofit project would cost, which added to owner frustrations and mistrust with both the City and their own engineers.

In several specific ways, the city was unwilling or unable to ease the path for owners who voluntarily decided to go ahead with the actual retrofit. The city did not offer building permit fee discounts or waivers, or otherwise soften its rules to make these projects proceed more easily. For example, capital improvement triggers for other upgrades such as fire sprinklers or sewer laterals were not waived.

"The city is not very supportive in my mind from that standpoint. They could, because it's a capital investment that I… am willing to

[46] The evaluation report filing fee of $583 was waived for persons who were also applying for retrofit building permit, but they did have to pay the filing fee for the building permit instead.

do if it makes sense,…then they could step forward and say, 'OK, because you make a capital investment, we make a capital investment and we won't charge you for your building permits. We're gonna help you to go through the process to help.' But [they said] absolutely not." [6:43]

Also, other city departments such as the Parking Enforcement would not waive the usual limits to tenants' ability to obtain reserved on-street parking during the construction period.

"The city wouldn't come off of their parking policy, which is you are limited to like six two-week permits a year and twenty one-days or something. Well, I had to provide parking for eight or ten cars….So for the two months that construction went on, I just hung around and moved people's cars for 'em. I'm sick of that. It was very typical of Berkeley, sadly." [OB2:35-6]

Given that life safety was a major justification for the BSSO, some owners also resented the City's inflexibility regarding potential alternative, low-cost solutions to the hazard. For instance, two owners I spoke with reported trying to block off ground floor openings in such a way that would lose parking spaces. The city did not allow retrofits that would substantially reduce the number of on-site parking spaces, even if that was the lowest cost alteration that would address the life safety concern.

"I thought, well you could just build shear walls all across leaving access to the garage as storage and…be really inexpensive. The trade-off is you lose four parking spaces but it's something that I could have got on right away and then it would be done by now…It only cost me…I think $450, $600 of work from the engineer who did all the calculations and everything. I submitted that to the city and they said, 'Oh, no, no, no, we can't allow the loss of the parking.'

Let's say an earthquake would have come, something severe enough to just kill someone. So that public policy of saving parking – what's more valuable: a life or parking?" [OB36:3-5]

The need for city inspections of permitted repair work, while not unique to retrofit projects, was another source of delay and special costs, especially where steel welds were being used (requiring special outside inspectors to be hired to supervise the work).

"I had to put a beam in, thirty people, two feet thick and a foot wide, a steel beam a big post way down…It cost me $5,000 to have an engineer from a welding house stand there and watch

'em weld all day…welds are inspected, that guy is getting paid." [OB22:31]

"I've literally had contractors say that, "My bids are higher in Berkeley because I have to deal with the City of Berkeley…it comes down to simple things like their building inspectors showing up on time. They don't and the contractors have to wait around to get things signed off and their jobs have to stop because…and that just happened to me on the last project we did. That the building inspectors didn't show up when they said they were going to and it's simple things like that." [OB19:86-87]

Owners became suspicious of "scope creep" in the retrofit requirements to get off the list. Also, the scope of the retrofit required was eventually decided to be all weaknesses of the first floor and retrofit plans for many buildings also included work on the second floor. Thus, the scope of the retrofit needed to "get off the list" was much larger for some owners than what an engineer might have normally recommended for life safety purposes. Engineers would start out proposing what they thought was the best retrofit for the property given the circumstances of the owner, but owners wanted to do a retrofit to get off the list, and these were not necessarily the same thing.

"[My engineer] said, you know, it's so minor, let's just do it. Cause it's just a garage issue. I said, OK, that's fine, let's just do it. But then when we went ahead and started getting all the permits, then the city changed their mind and said we want you to do the entire downstairs. So now we have to put a whole new foundation in the back, the sides, ripping out drywall and just creating a big mess." [OB33:20]

"[Our retrofit ended up costing] a lot because we had the secondary shear wall. We thought…[fixing] the front was like twenty, twenty-five [thousand dollars] and then it turned out we had to do this whole moment frame on the back which is a second thing and it lifted the thing over with the crane…so definitely it was more expensive than we had hoped…We were originally told that…they definitely did not require this, cause it didn't fall under the specific wording of the ordinance and that's [what the engineer] recommended in his report. After the report went to the city, they change to saying they did require it and that really bumped up the cost." [OB37:23-4]

"We had [a] problem with the city. They wanted me to redesign the engineering again and here I had it all passed and ready to start. And they beefed about [us needing to add more plywood in

the hallways on the upper floors]. My engineer said you know what that amounts to? One percent. You know what I mean? Just to torment me. Just to get that other engineer for his thousand." [OB22:33]

In one case, a retrofit project was delayed because the evaluation report details were not considered adequate.

"We had a board member who's an engineer and drew up some plans on what needed to be done. We hired a contractor. The first contractor was unable to get anything done with the city, so then we hired a second contractor and they have been going back and forth for about a year with the city on whether we can get a building permit or not. It comes down to providing enough drawings to the city so that they will issue a permit and I gather there are some issues about what kind of calculations need to be done." [OB35:25]

Some owners pointed out that the City's decision to set the bar high, or make the rigor of the retrofit very conservative in terms of the total area of the building that needed to be repairs, probably deterred retrofits that would otherwise have been done [OB38]. The fact that owners were retrofitting not just to get the repair done but also to get off the list led to some delays and extra uncertainty, hassle, and cost to the retrofit projects.

"We actually kind of waited a little while because I wanted to see what was going to be in the ordinance so that we knew what was in it so that when did our design we didn't go ahead and do our work and then find out that we missed the design criteria by some small amount and then we had to go back and do yet more work." [OB19:12]

Ironically, adding the motive of "getting off the list" ended up complicating and making more expensive the final cost of the retrofits. The BSSO dictated a particular level of retrofit and additional steps the owner would have to take in order to achieve both goals simultaneously. This point will be discussed further in Chapter 8.

"Here's the thing about the recommended repair…even that's a moving target in this policy…It's a nightmare. It's like one guy saying, "OK, let's put some shear wall," and another guy saying, "Oh, we need a steel moment frame." Every engineer is going to say something different and then basically you're confined to just do a rehab of the building but that doesn't necessarily mean it's going to feel non-soft-story. One person's opinion is [to] forget it.

There's no clear engineering in it and that's another thing that's really frustrating." [OB23:34 (first half)]

Project Logistics & Challenges Encountered During Construction

The retrofit projects done in pursuit of getting off the Berkeley Soft-story Inventory ranged from plywood and beam reinforcement around two or more first floor garage openings to projects that combined installation of new internal steel supports or moment frames, plywood additions to all the first floor walls, and major foundation repairs.

As a practical matter, owners overwhelmingly agreed that timing a retrofit to coincide with other major capital upgrades was the "natural" or ideal way to do it. Some owners did their retrofit as a stand-alone project. Most chose to combine the work with other improvements such as updating the kitchens or bathrooms in some of the units, upgrading electrical system, window or roof upgrades, painting the outside, or doing foundation or sidewalk drainage projects.

Even though the choice of when to do the upgrade is technically at to the owner's discretion, the owners I spoke with mentioned several types of timing constraints such as permitting delays, tenant relations or unit access issues, or weather considerations. Major structural projects are easier to do in summer to avoid rain and to time the work with the typical annual tenant turnover (among university student renters). Most of the owners I talked to said the actual construction project lasted from a few weeks to a few months, in stark contrast to the planning and permitting phase that many said lasted six to eight months or in one case up to several years.

Owners differed in their level of involvement during the construction process. Some said they were on-site supervising every nail and piece of plywood [8:21]. A few did the hands-on work themselves, or served as their own general manager for the construction work.

"We do a lot of maintenance and construction work ourselves. My father does a lot of construction work on [our] buildings so he was able to…hire an architect to design the retro-fit and then basically do it himself with his workers." [OB29:24]

Others delegated the task of construction management to their property manager or, in most cases, the general contractor that they hired. Some mentioned coming on-site to supervise, troubleshoot, or communicate with tenants as the work progressed or handle complaints. One property manager who assisted tens of owners on their BSSO compliance reports and upgrade projects said:

"[The administrative] part, [I spent] a day or two here and there and depending on how far in the process I am with each of these owners but once construction started that…eighty percent of my day was at the building, going back and forth. Or talking to tenants, or asking questions that the City of Berkeley, or answering questions with the contractor, calling the owner, 'We

stumbled across this, what do you want to do? Do you want to replace the window now? Do you want to keep the window?' It's always something." [32:105]

Most owners relied on word of mouth to find a qualified general contractor. Some people experienced delays while waiting for multiple bids. Once the engineer got started, cost overruns were common. Some resulted from problems with the contractor, but most were related to unexpected things that came up once walls were removed and the project was underway. One owner encountered extensive termite damage once the walls were opened up [OB9:21]. Dry rot was another issue mentioned [OB40:5]. Others, particularly the institutional owners, suspected that their engineers had conservatively estimated the costs in order to motivate the project at first.

"…cost estimates [from the initial seismic evaluations]…were woefully off…" [OB4:7]

Owners discussed experiencing "surprise" expenses and on-site safety troubles with their contractors.

"[The contractor] did a nice looking job but in the middle of their work, they claimed that, 'Oh, we didn't bid that part. We're going to want like fifty percent extra.'…They said, 'We didn't even notice.' Well, they had to tear the walls down, shear wall them, bolt the foundation down, they wanted like another $30,000. But I…finally quit fighting them when it got down to an extra $8,000 and just let them go ahead. I don't recommend [them]." [OB2:32]

"We started with [one particular construction company] and it was a nightmare….the owner hired that company from word of mouth. And half way into it we had to let them go and go with another company which wound up being a lifesaver… They weren't safe. Leaving tools around. Trip hazards. It was a lot of problems. Didn't know how to talk with tenants. I would have to go and [intervene a lot]." [32:100-103]

Fear of difficulties in selling their investment property led to some owners being remarkably persistent in pursuing a retrofit, even once the costs escalated dramatically.

"They just sent a letter in the mail and then to comply I hired an engineer…The guy looked at the building, says it shouldn't be on the list and he'll make sure he gets it off. So I paid him, then he does the report and he says there is a soft-story issue and that he wants to do the work. So once he did that, now it's really like on the list at that point…then I called another engineer and he said it

really shouldn't be on the list again, but he's says since it's on, let's go do the work. It will be very minor, so we just started doing it and then…later the city of Berkeley [says,] 'Actually we want you to do the whole thing on the bottom.' So, instead of paying like, I don't know, $30,000 it ended up being almost $100,000 with the work, for absolutely no reason whatsoever." [OB33:15]

A structural upgrade project can create serious disruptions for tenants. Owners must plan for that, and it can affect project timing, increase the overall project cost, and raise the difficulty of project management. Impacts on tenants can include: temporary or permanent loss of parking (meaning added congestion and the annoyance of finding street parking), construction noise and dust, other on-site inconveniences (e.g., temporary disruption of power or water, trip hazards or obstruction of walk ways, lack of access to trash can sites or mail boxes, having to use alternate entrances, scaffolding that obstructs views, inability to use windows). In some cases, intrusion into a unit is so radical that the tenant must be relocated during the construction period.

Noise can especially be a problem for student tenants who might be at home a lot either studying or sleeping during the day. One owner said he was careful to avoid scheduling the retrofit during end of semester exams [OB35:40]. In Berkeley, tenants have the right – and frequently exercise it – to request a rental rate adjustments or other compensation for these types of diminution of use.

Typically, if a parking space is not usable, the owner loses that revenue for the duration of the construction period.

"[Tenants] had no parking. The walls basically got stripped down to bare to nothing and then reinforced….most of these tenants were students and so every day Monday through Friday from 8:00 to 4:00, 8:00 to 5:00 you have construction and noise going and tenants can't study or they can't sleep in. It changes their lifestyle." [OB32:56]

Owners reported a mix of experiences in working with their tenants to complete retrofits. Most owners I spoke with said they received just a few, if any, tenant complaints. A few tenants also asked for rent reductions or to be "paid off", sometimes escalating their complaints during the course of the project. More serious complaints tended to come from long-term tenants with whom the landlord already had some history with.

Some owners reported that prospective tenants were turned off by the idea of construction happening in the near future. Other owners said their tenants were positive, cooperative [OB9], and did not make a fuss about the minor inconveniences during the project. A few owners reported that tenants were "appreciative" [OB13] or "happy":

"The feedback we got from the tenants was this is a really good thing… They're all pretty happy that we took it on and got it done.

So, you know, they may not have liked the noise but they liked the end result for sure, so that was rewarding." *[OB17:21-22]*

Overall, however, most owners felt their tenants were basically ambivalent and uninterested in the repair work outside of the immediate implications of the construction work. One large property owners I spoke with had a large number of tenant issues during his major project.

"[Some tenants] want some kind of compensation but yet the owners have to pay for this $250,000 project. They can't just give everyone free rent so it's kind of a catch 22. So the tenants, where can they go to complain? They're going to go to…the Rent Board… [Even though] most of [the tenants] were told three or four months in advance before construction even started…it's a total different ballgame once construction starts. The people realized just how much they're affected, just how much things are going to change. And, you know, they'll come to the [manager's] office, there's only so much I can do for them here. So then they go to the Rent Board. Or, then now the aftermath is you have all these hearings at the Rent Board, or mediation." [OB32:58-59]

"We've had to lower the rent. Let's say if a owner is used to, 'cause they get, they get a pretty good rental amount for the properties that are closest to campus. So let's just say if an owner's used to getting $1,600, just for example, $1,600 for a two-bedroom unit, we've had to reduce it to like $1,100 just to get tenants in…I haven't heard any [tenants] say…that they're worried about the earthquake…the tenants that move in, they're not concerned about the earthquake. They're concerned about the construction." [OB32:88-90]

"We had a move-out right before the construction started, and we couldn't rent it before the construction … and we couldn't rent it during… from September to February we couldn't even show the unit." [OB32:94]

A different manager/owner I spoke with explained that his retrofit, too, was made much more complicated by problems dealing with tenants even though the building was only six units in total. The two lower unit tenants had to be "bought out" to get them to move out, and those units were then vacant for three or four months during construction. In that owner's mind, his tenants did not seem to understand or feel concerned about the risk and did not seem to appreciate or accommodate the repairs being done [OB34:14].

Retrofit Costs

I collected information about the costs of soft-story retrofits done in Berkeley, California from a variety of sources, including a key word search of city building permit records, written content in the approved evaluation reports, in the qualitative interviews with owners, and from one engineer who was willing to share detailed cost data about five projects. Each source has its limitations and the errors could go in either direction, as I now briefly discuss.

Reported valuations on building permit applications are not an accurate or consistent measure of retrofit project costs for many reasons. First, reported valuations are estimates given before the fact, so they tend to imprecise and it is common practice to anchor on round numbers. Second, reported valuations are often under-stated because the building permit fee charged is a function of the reported valuation. Thus, applicants have a financial motive to report as low a value as possible and doing so is a tacitly accepted practice. Often contractors manage the building permit process for the owner as a service, so they also have incentive to keep the permit cost as low as possible. Underreporting of valuations might be even more extreme in the BSSO case because city staff may have been willing to "accept" valuations that seem inappropriately low because they knew the work being done was pursuant to other city policy goals.

Working in the opposite direction is the possibility that reported valuations can and often do include other non-seismic work, given that many owners undertake seismic projects in conjunction with other major capital improvements. That was less the case for the voluntary retrofits done pursuant to the BSSO, but it did happen.

In the interviews, participants were asked to estimate from recollections a total project cost (Total Cost). Participants clearly reported ballpark values anchored on large round numbers. They may not have been able to remember or construct this detail accurately, especially because project expenses were incurred incrementally over time and one to ten years earlier. They may also have mis-understood the intent of the question. Furthermore, persons who have anger about the policy might have consciously or unconsciously exaggerated about the total cost. On the other hand, discomfort with reporting personal financial details could have led to under-estimation. All the owners I spoke with had difficulty differentiating construction and engineering costs from total project costs.

For these reasons, without directly asking owners for copies of their financial records (which I did not do in this study), it is impossible to verify actual retrofit project costs for the set of voluntary retrofits associated with the BSSO. That being said, there is value in summarizing the available information.

The database of retrofit projects for which I was able to identify at least one piece of cost data started at 72 properties, including 12 pre-law retrofits and 60 post-law retrofits. I then removed six outlier buildings representing the three lowest total cost estimates (that were absurdly low) and the three highest total cost estimates (that clearly included large non-retrofit related capital improvement costs).

Figure 76 shows summary statistics about these retrofit projects in constant 2008 US dollars. Again, the reported valuation is the actual total value of the project reported on the building permit application. Reported valuations varied from just under $6,000 to $228,000 for retrofit projects done prior to the law (N=10) and from $6,000 to $150,000 for post-law

retrofits (N=56). The average reported valuation across all retrofits was $41,502. The average reported valuation for a pre-law retrofit was $54,402 while the average reported valuation post-law retrofit cost was $39,197.

Even though project valuation may vary non-linearly with building size, it is useful to also present project valuation normalized on a per-unit basis. Unit information was unavailable for some of the properties, so I can only report cost statistics per unit for a subset of the projects. In this limited data set, the average number of units in buildings retrofit prior to the law was 12, while the average was 7 units in buildings retrofit after the law.

Reported valuations per unit varied from $353 to $8,496 for retrofit projects done prior to the law (N=7) and from $469 to $30,000 for post-law retrofits (N=49). The $30,000 per unit project was a non-residential property with five offices and one large open commercial space, and the seismic work also included masonry and foundation issues. The average reported valuation per unit for all retrofit projects was $3,726. The average pre-law reported valuation per unit was $3,160 while the average post-law reported valuation per unit was $3,807.

		Reported Valuation	Reported Valuation Per Unit
Pre-Law Retrofits	Mean	$ 54,409	$ 3,160
	Std. Deviation	$ 71,468	$ 2,773
	Minimum	$ 5,996	$ 353
	Maximum	$ 228,000	$ 8,496
	Valid N	10	7
Post-Law Retrofits	Mean	$ 39,197	$ 3,807
	Std. Deviation	$ 31,507	$ 4,400
	Minimum	$ 6,000	$ 469
	Maximum	$ 150,000	$ 30,000
	Valid N	56	49
All Retrofits	Mean	$ 41,502	$ 3,726
	Std. Deviation	$ 39,717	$ 4,217
	Minimum	$ 5,996	$ 353
	Maximum	$ 228,000	$ 30,000
	Valid N	66	56

Figure 76. Table showing summary statistics regarding retrofits done prior to and after the BSSO (maximum number of feasible observations included).

For comparison purposes and to demonstrate how much reported valuations might typically underestimate actual project costs, I also report the word-of-mouth data I was able to collect about total project costs. There are only eight of these observations, and the data come either from word of mouth in an interview or from an engineer. But, these values clearly are higher and include more project cost types than do the building permit valuation data. For these eight projects, reported valuations were on average 56 percent of total project costs, and the ratio ranged from 1:4 to 3:4. In other words, valuations may represent one quarter to three quarters of the actual project cost.

The detailed project cost data from an engineer relates to completed projects in five different small (five to seven unit) Berkeley soft-story buildings for which clients agreed to have the information made public. Total project costs (in constant 2008 US dollars) ranged from $19,500 to $42,193 per building or $2,786 to $7,915 per unit.

Theoretically, the total project cost can be broken down by areas such as engineering, materials, labor, and administration/project management (which also includes tenant compensation). The average engineering cost in constant (CPI-adjusted) 2008 dollars for the five projects report on by a single engineer was $12,848. On average, engineering costs were about one third of the project total. Other post-law retrofitters reported engineering costs around $10,000, but there was a wide range. One owner paid his engineer about $1,500 to prepare a report and plans for an upgrade that were submitted and accepted without changes within a few weeks. Another owner spent close to $15,000 on engineering services and spent over two years developing a complex retrofit project plan.

There is clearly a wide range of project costs represented in both the pre- and post- law retrofit projects, and this is evident to owners. Cost uncertainties make getting a retrofit an anxious, uncomfortable topic for owners to contemplate[47].

> *"[Regarding the cost to retrofit] I've heard from folks anywhere from five, I mean this is a huge range, $5,000 to $30,000 per unit. And that doesn't give one great confidence." [KI23:7]*

<u>Access to Financing: A Problem for Condo Owners and Institutions But Less so for Individual Owners</u>

For the Individual owners and Managers I spoke with that did retrofits, access to financial resources to do a retrofit was not a major obstacle. Most Berkeley soft-story owners that did post-law retrofits reported to me that they could afford to do so or found access to capital without much difficulty.

> *"I just refinanced again and took out eighty grand to pay for the earthquake work and that was that. Almost painless, because…I had [simultaneously] three vacancies, [where I] had to raise the rents." [OB2:92]*

> *"I had to make my decision of do I want to do something now or wait for it to be mandated. I had the cash in the account so I just thought, you know, I'll go ahead and do it now." [OB14:29]*

[47] Owners might confuse uncertainty about retrofit costs across buildings with uncertainty about probable retrofit costs to upgrade a single building. Yes, any given engineer might come up with retrofit plans for a large group of different buildings that vary widely in costs per unit, but the range for retrofit work to a single building will be much narrower.

Thus, the BSSO program probably captured the "low hanging fruit" among people desiring to retrofit– the most willing and able members among local soft-story owners as a class.

Three or four owners were willing to suggest a rule of thumb for the threshold between a repair that would be "worth it" and one that would be cost-prohibitive. They place it at about four to five percent of the property's valuation, or something similar to the transaction costs associated with sale [OB34: 26]. Note that this kind of threshold is easier to pass for larger buildings, whereas in smaller ones a large retrofit cost may not be supportable given the property's worth or net operating income. One owner expressed that the proper measure of whether or not to do the upgrades should be:

> *"The value of the work in relation to the value of the building." [OB19:66]*

A few owners mentioned that it would matter to their decision whether or not the building has positive cash flow, which is typically a function of primarily the mortgage status but could also be affected by the quality of property management (i.e., vacancy rate) and the state of repair.

> *"I funded it out of the cash flow of the property... So, I just told the owner, [a relative], basically I'm going to start saving up money." [OB19:48]*

> *"We do have some loans on the property itself but we didn't get any loans to actually do the work. It came from our savings pretty much." [OB29:34]*

Without exception interviewed owners stated that they did not anticipate receiving increased rent on their market rate units now that their buildings had been retrofitted. Nor will they apply for an individual rate adjustment to allow them to pass the upgrade costs along to tenants. Therefore, increased rental income was simply not an expected source of capital to support making the improvements. Seismic retrofitting is a qualifying expense for which Berkeley landlords can apply for an individual rate adjustment. However, due to the net operating income cap and the 1999 vacancy-decontrol change in the rent control law, most owners are ineligible for any new individual rate adjustments regardless of the expense. Additionally, rent control creates some ironic and strange price effects for owners and their tenants.

> *"We had the money to do it. I told you that we lost money on these buildings for many years and then we sort of broke even but then [vacancy decontrol] allowed us to start earning money. So we had sufficient savings to do this work but that raises another point. The way the rent laws operate, you can't recoup the*

expenses of these projects very easily or at all if you have long-term tenants like we do in that building." [OB27:40-41]

"…The city wouldn't allow me to raise everybody $150 to pay for the earthquake work...So, now I've got people paying $500 living on top of people paying $1100. How much do they like that? …I don't like doing it… it's nuts. Wait a minute, the whole building benefits. Right? Or, why don't you go the other way and say only those two units that happen to be over air have a price effect?" [OB2:46]

Berkeley's RSB conducted a study in 2011 to assess the likely financial conditions of 198 soft-story properties on the Inventory that have not already initiated a retrofit (Board 2011). They found only five percent of the soft story properties (10 of 198) have a majority of units with rents significantly below market rates (because the tenants have been in residence since before vacancy de-control). These owners would probably qualify for a special rent adjustment under existing laws, with increases sufficient to cover the costs of a retrofit, thus they should be able to borrow the necessary amount. The remainder of owners is probably correct that it would not be possible for them to receive approval for an individual rate adjustment.

The RSB Debt Coverage study was based on broad assumptions and limited property-specific information. It also did not assess the type of situation that I heard about from two owners who were trying to prepare their buildings for condo conversion at the time when the BSSO came out. They were forced to borrow from friends or family because the property could not support a second mortgage given the stigma of being on the Inventory.

"[Financing] is a real problem…the credit environment has changed so significantly from a few years ago. Probably in 2005 or 2006 you could get a home equity line of credit to do this work on your place but now, you may or may not be able to. And they may say no, we're not giving you a home equity line of credit 'cause we're not going to lend on the soft-story place with the problem to give you the credit to do the work to fix the problem. Just generally speaking kind of markets are all crazy now and so, it happened that our retrofit and condo conversion coincided with a lot of other external market factors." [OB37:25]

A Note about the Retrofit Intentions and Experiences of Local Organizations

As the above discussion shows, the retrofit intentions and experiences of institutions deserve to be treated separately, yet there were not enough examples in my interviews to do so fully. In this study, Institutional Representatives seemed to report somewhat different stories from those of Individuals regarding the prior existence of plans to retrofit. Several Institutional Representatives' organizations had long been aware of owning building(s) that

might pose an earthquake hazard. Several had prior plans to retrofit that were in extended delay owing to lack of funds, but five out of six organizations either had completed or had concrete plans for structural mitigation. Overall, these institutions are in a situation where: a) it feels like an ethical obligation to maintain their residential buildings in the safest shape the institution can afford, but, b) they face funding barriers and a "portfolio management" problem regarding prioritizing other building issues or needs versus seismic projects.

Several of the Institutional Representatives also reported having organizational emergency management plans, or being in touch with the city previously about other emergency preparedness programs such as neighborhood response team trainings. This shows that earthquakes can enter into the organization consciousness through multiple avenues.

The representatives I spoke with mentioned several additional challenges, chief among them being the difficulties of arranging financing and of managing a major construction project which is not generally a core organizational activity or familiar task to the leadership of such organizations. Arranging financing was especially difficult for the institutional owners I spoke with, often leading to a decade of delay and expensive additional transaction costs such as legal and accounting fees associated with the issuance of tax-exempt bonds.

Two larger institutions I spoke with had experience done their retrofit work as part of major upgrades. One organizational director said that managing that project was "hell" [OB4:5]. For two out of six organizations I spoke to, managing residential property is not a core activity. Leadership was painfully stretched while managing the renovation project.

Retrofits tend to add time and complexity to construction projects that are already a major disruption or distraction to the organizational mission. It is very difficult for organizations to take a building out of operation for six to twelve months [OB4:30].

Commercial organizations and institutions may need to relocate operations during a retrofit [OB12]. This is a different issue than temporary tenant relocation, which involves a discrete loss of income that might be more or less avoidable or last more or less time but does not disturb the long-term viability of the business enterprise.

7.D – Summary of Implementation Findings

The design and implementation of Berkeley's soft-story program started out with an active period of decisionmaking and learning-by-doing wherein a series of essential administrative procedures and policy stances were worked out. The key aims, activities, and functions early on for the program's administrators included:

- stakeholder involvement and outreach;
- notification of affected owners;
- provision of technical guidance and trainings regarding the evaluation requirements;
- the processing of appeals and other requests for reconsideration or removal from the Inventory;
- establishment of procedures for pursuing a concurrent retrofit;
- customer service and communications in the form of correspondence and provision of basic technical assistance; and

- recording keeping and other procedures related to status tracking, appeals, and de-listing.

By two years in, the program shifted towards more of an operational mode where the scope of activities narrowed to the processing of reports, the handling requests for extensions, and case management. As owners became aware of the law, they responded initially by gathering information and then by taking a series of actions about whether and how to comply. Some key activities and choices of affected owners in the first few years included:

- considering whether to protest inclusion on the Inventory;
- finding and working with an engineer;
- submitting a report (or request for reconsideration);
- navigating the review process through to a conclusion; and
- how to handle compliance with the law's additional requirements, if necessary.

In this chapter, I necessarily focused on the owner perspective and to a lesser extent the experiences of the city staff and engineers who both produced and reviewed reports. Below I summarize the key challenges and frustrations faced by owners, and the adequacy of the city's responses as well as what can be learned from how these issues were handled (or not).

1. *Given limited resources, the City of Berkley was able to perform essential implementation activities with a reasonable degree of success.*

Prior to program launch, proponents had done adequate outreach and stakeholder involvement to avoid significant stakeholder backlash. Owners were surprised and disappointed at first, but most accepted the inevitability of needing to comply.

The City of Berkeley operated their soft-story program with a bare-bones level of resources and staff support. Direct costs included one full time senior program analyst/manager for about five years, the consulting fees to produce the initial inventory and the Framework (on the order of $100,000), and the help of outside contractors paid at a rate of $583 per report (which was a direct pass-through from the fees that owners paid, again totaling on the order of $100,000 as of 2011). Additional "hidden" and in-kind costs of the program are harder to estimate, but included information and paperwork management, time to develop and maintain the website, internal consultations among building inspection and permit center staff, and managerial attention. Overall, the program represented a relatively modest investment for the city.

Despite these lean resources, staff were able to handle major implementation activities such as sending out notifications, managing outside review of the filed reports, and fielding inquiries about the program requirements. However, there was a steep learning curve for all parties. Case management (e.g., status tracking, handling appeals and requests for extensions, and answering owner and engineer questions about how to comply) was time-consuming. Another challenge was the highly desirable "problem" of so many owners voluntarily interested in retrofitting. The program manager was quickly swamped by the volume of back and forth communication with owners and engineers seeking additional guidance. This led to frustration among some owners and engineers as the city struggled to devise and put in place procedures to guide retrofitters.

Tracking the status of properties on the list, and keeping that data up to date and communicating about it with owners and engineers in a timely fashion, was made even more challenging by the lack of integration of the program with the Planning Department's existing property databases and information technology infrastructure. Owners and engineers alike came to depend on the City's public website for key documents and programmatic details. Some owners became frustrated with slow response times and the infrequency of status updates.

This kind of intense "customer service" was made necessary in part by the complexity and novelty of the program requirements, which not only confused some owners and engineers but also burdened city staff as they tried to develop standardized procedures and ways to address special cases. Overall the owners and engineers I spoke with gave the city mixed reviews for implementation and customer service.

Two important misunderstandings arose despite the City's efforts. First, some owners were confused about when affected owners must start to notify tenants and post signs. Combined with minimal staff effort on this aspect of the law in the first three years, these requirements did not receive attention until well after they were intended to go into effect and are still inadequately enforced. Signage compliance is likely under 50 percent and the tenant notification status is not known or up to date for the majority of the properties on the Inventory. Secondly, several owners ended up with the impression that the law required them to retrofit. This undoubtedly contributed to the law's impressive "voluntary" retrofit rate, which must be viewed in light of that finding.

Some of the challenges the city experienced relate directly to the newness, uniqueness, and highly-technical nature of the program; others would clearly occur in any program that facing a tight budget constraints or that is under-staffed.

2. *Berkeley's greatest challenge in implementing the law was the development, communication, and consistent application of technical standards for the evaluating engineers to use and for plan checkers to apply in processing buildings permits for retrofits done to get off the Inventory.*

Despite providing very clear guidelines, there was disappointing inconsistency in the analysis assumptions, methods, and overall quality in the resulting reports. This suggests that many practicing engineers in the community may be ten to twenty years behind the latest thinking among issue elites. Practitioners need to think carefully about ways to bring new engineering knowledge to practice more quickly. This is a somber reminder about how much more work there is to do from the technical perspective to enable earthquake policy to move forward.

The BSSO pushed practicing engineers to go beyond what they were previously accustomed to doing for clients. Despite the recipe-like instructions contained in the Framework, some engineers underbid their projects at first, not realizing fully what an acceptable report would require. Reports filed early on were more likely to need revision, sometimes multiple rounds. Variability in report quality was an issue, especially at first but also ongoing. As one plan check officer put it:

> *[There's] still a lot of variability in what [the engineers produce]… The engineers that really did go out and do a good investigation—that actually go out and tear some things open and look—I'm assuming that they probably charged more for their time…than some of the other guys that…didn't get enough fee and they just said, "I'm just going to try to get the minimum through and do that." [KI7:43]*

The choice to reference IEBC Chapter A4 as the standard for evaluation created some of these problems, in part because it was not designed to be a standard for guiding retrofit projects. The 2003 version of IEBC Chapter A4 contained some well-intentioned but ultimately extraneous requirements, in particular a check-list that was later removed from future editions. Some of the wording in that chapter created ambiguity regarding the precise scope of the analysis that should be done. The city and its plan checkers had to resolve those ambiguities in a consistent manner, but were tempted to ask for the maximum amount of information and analysis that the standards could imply. Both owners and engineers balked at this because of the added expense and because it departed from the original impetus for the law. A related issue was the unconventional prescriptions and in some cases "extra" work that the Framework implied the engineer should be doing in their analysis. The Framework gave engineers a detailed outline of what needed to be included, but for a variety of reasons some struggled to follow it.

Over time, two things occurred to ease the report production and review process. First, the contracted reviewers improved in their ability to articulate and work with engineers to improve what was in the reports. This might have happened faster had there not been a major disruption in the report review contract mid-way through the initial compliance period. Second, the market for soft-story report services eventually consolidated down to a small group of engineers who had already had experience getting reports approved. Through this law, the local engineering community became better educated about soft-story criteria and standards. It is possible that city handling of these reports had a positive influence on local engineering practice, which is not obviously to be expected.

To keep owner costs to a minimum during Phase 1, the city required only evaluation and tried to spare the owners the expense of a design. But in doing so, the city did not adequately anticipate or prepare for the question of how owners should retrofit. Also, even though the evaluation scope was specified and uniform, the BSSO opened up an unregulated market for retrofit design services. Even if engineers were correct in saying that the retrofit design could be done at a discount once they were onboard to do the evaluation, it must have sounded like a scam. Overall, these factors colored the owners' impression of the whole program as sneaky, unfocused and lacking a clear goal.

3. *Complying with the BSSO was not simple or cheap for owners. On average, owners spent about $4,500 to file a report and the process took several months to a year. Some experienced frustration finding and working with an engineer, especially when confusions arose as to the scope of analysis required.*

Compliance costs to the owner depended on a number of factors including the skills, workload, and work style of the engineer they chose, the characteristics of their building (which might necessitate a more or less complex analyses), and for some their personal circumstances *visa vie* the property. Owners often faced escalating costs as the report process went forward. Furthermore, placing the burden on owners to prove that they law did not apply to them resulted in major inconvenience and costs to the handful of owners who were inappropriately noticed.

Owner experiences with the report review process varied from speedy and simple to long, drawn out affairs – especially in the beginning – involving multiple rounds of communication and lasting a few months to as long as three years (especially if a concurrent retrofit was involved).

4. Some owners persisted in their retrofit projects despite encountering numerous obstacles.

Obtaining a structural retrofit can be a confusing, costly, and time-consuming project even when initiated spontaneously by the owner. In the context of Berkeley's soft-story law, it is remarkable that so many owners followed through on their intentions to get a retrofit because they faced added bureaucratic obstacles and tenant disinterest, or in some cases directly increased barriers such as added bureaucracy and extra difficulties scheduling the work (summer months, tenant objections, needing a unit to be vacant). The city was not especially successful in "making things easier" for owners who wanted to retrofit. Because owners were motivated not just to do a retrofit but to also get their building removed from the Inventory, the retrofit plan had to be approved in both the typical planning department building permit process and by the BSSO program. What makes this case remarkable is that so many owners persisted despite these obstacles and tenant disinterest, or even direct objection to, the project. For those owners who did retrofits pursuant to this program, financing did not appear to be a major problem.

That some owners persisted in their retrofit intentions despite all these obstacles adds even greater weight to the finding from Chapter 6 that the law added strong new motivations for owners to pursue a retrofit.

CHAPTER 8 –ASSESSMENT, RECOMMENDATIONS, & BEHAVIOR CHANGE INSIGHTS

In previous chapters, I outlined key events, decisions and challenges of developing and implementing the BSSO and explored the effects it may have contributed to in the minds and behavior of affected owners. This chapter moves on to offer a summary assessment of Berkeley's soft-story law on three dimensions:

1) How much progress the program achieved towards its goals while avoiding undesirable effects;
2) How well it balanced costs against the social benefits achieved relative to other possible strategies that have been or could be tried; and
3) What ideas can be derived out of the case for modification or re-design of this and similar government interventions?

Towards the end, I reflect back on the overall research process and offer some ideas for potential follow-up research.

8.A – Overall Assessment of What the Policy Achieved

I begin my assessment by revisiting the program theory or logic model shown in Chapter 4 (Figure 77). Again, the program logic model is meant to show the more or less explicit theory or set of ideas that proponents had about how the policy would work. The detailed policy history presented in Chapter 4 revealed that by the time the BSSO was passed, a nuanced, carefully reasoned set of hopes for the policy had evolved that included both short term, intermediate objectives as well as longer term, end-state goals.

Progress on Near Term Goal 1: Fostering Market Conditions/Social Environment to Promote Voluntary Retrofits

BSSO proponents explicitly wanted to create an environment where voluntary retrofits are more likely. Their primary tactic was a series of regulatory requirements that would help a large set of market participants to become "better informed" about the risks of soft-story buildings (Goal 1a). The assumption was that once market participants were informed, owners would feel more pressure to act.

Theoretically, those new pressures would come about as follows. Through the notice and order, owners would be informed that a building was suspected of being hazardous. Through the mandatory evaluation, owners would hire an engineer and find out from that person's analysis whether the building truly had a soft-story condition and what the implications were for them. Tenants would be informed in writing before renting a unit in those buildings. Tenants and other on-site visitors would also see and be reminded of this fact by the posted warning signs. Finally, bankers and prospective buyers would be informed that a building was on an official city watch-list through the notice on the title. Together, these

measures would raise awareness, stimulate concern, keep the issue salient over time, and eventually affect lease, purchase, and mortgage decisions.[48]

[48] Note that proponents gained a broader opportunity to use "market forces" to encourage retrofits because of rent control changes that took place in the late 1990s. Prior to that, rent control laws in Berkeley essentially made it impossible for owners to increase rents for improvements such as enhanced seismic safety.

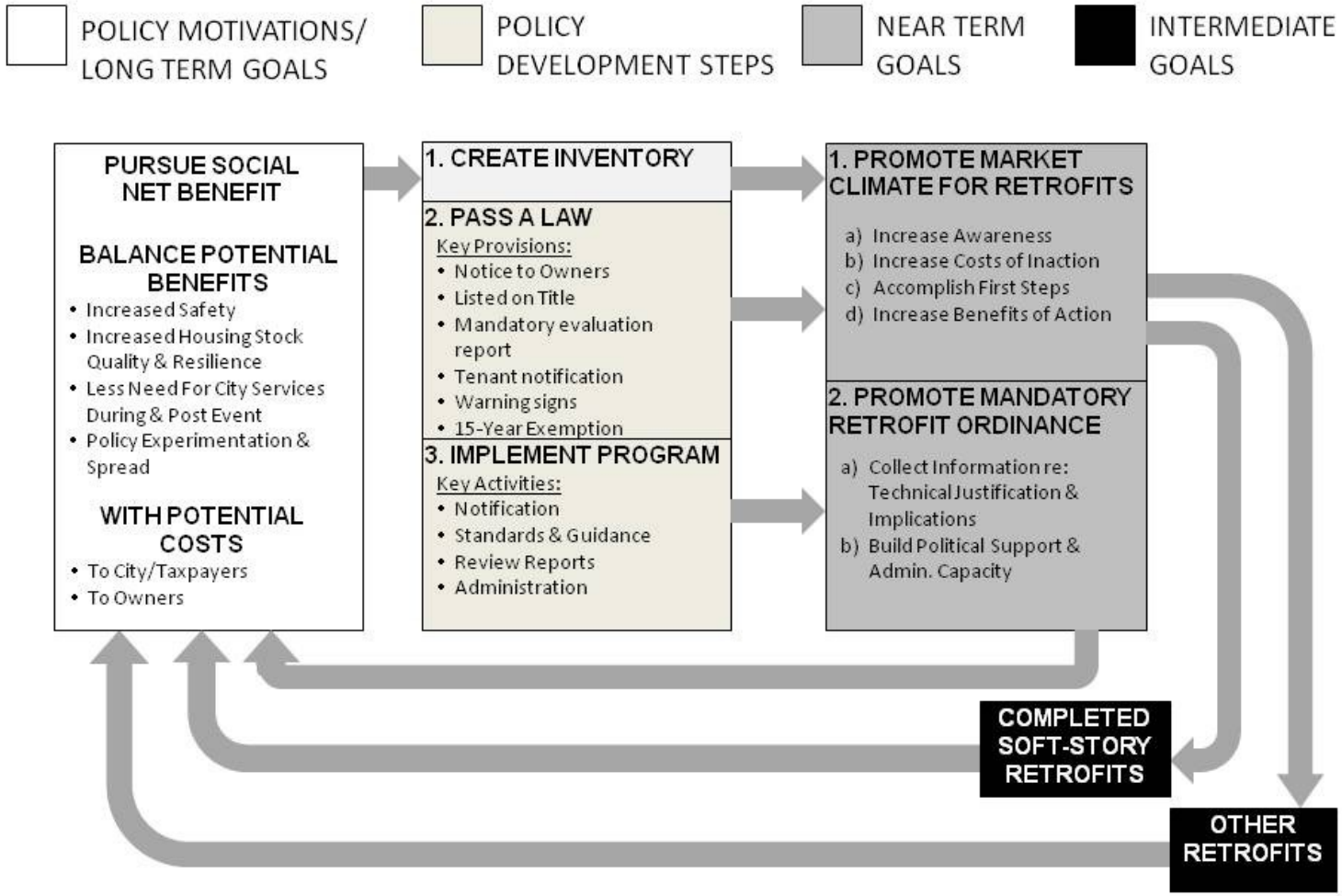

Figure 77. The program logic model for the BSSO, as derived from key informant interviews (also shown in Chapter 4).

Goal 1a: Increased Awareness Among Stakeholders[49]

Community Leaders and City Staff. Recall from Chapter 4 that the BSSO was not produced by citizen or organized interest group advocacy, but by issue insiders and government staff policy entrepreneurs who at times drew upon volunteer experts to persuade other city staff and elected leaders. Overall, the process of developing the policy evidently educated community leaders enough to convince them that government intervention was needed, feasible, and likely to be successful enough to justify the political and direct costs.

Property Owners. The findings of this study suggest that BSSO proponents were likely correct in believing that most owners were ignorant prior to the law about: (1) what a soft-story condition is, (2) that they lived in, owned, or held a mortgage on a property with that condition, and (3) that this could have serious implications for them. As a result of the policy, 317 suspected soft-story owners received notice that their properties were on an official city watch list – a notice associated with some costly and some tedious, repetitious action obligations so it was not easily ignored or forgotten.

The first piece of evidence that the BSSO altered owner beliefs and behavior is that out of 271 about-to-be-listed properties for which I was able to find date-of-last sale information, 28 (10%) and 22 (8%) changed ownership in 2004 and 2005 respectively. That is about four to five times the number that turned over each year on average (6) during the previous decade, a significant change in a pool of properties where at the time about 70 percent had been held at least 10 years by the same owner. Housing prices in those two years were exceptionally high, so not all of the increase can be attributed to the forthcoming law. High prices can motivate a seller to cash in, but also motivate a buyer to sit tight. A second caveat is that the turnover includes not just sales to strangers but also properties passed on to other family members (for instance due to divorce or a death in the family). However, overall, this pre-law surge in sales suggests that at least some owners were aware of the coming law and viewed it as a good time to shed a looming responsibility.

Program managers reported only very rare difficulties or delay in making the notifications. However, despite receiving timely notification, nearly a third of notified owners were out of compliance (officially defined as showing no acceptable progress on filing the required report) as of April 2009, already one year after the official compliance window had ended. Sixty-three (20%) of notified owners were still out of compliance as of May 2010, and about 10 percent were still in that category as of March 2011.

Another source of delay in the "education" process was the time need to processes appeals. At least 62 owners appealed their inclusion on the list or asked for reconsideration or extension of some type. Also, many owners asked for extensions well after the original two year compliance period ended. Some of the reasons given were that the owner was in poor health (e.g., under treatment for cancer), elderly, or was living abroad. Tenants rights advocates might

[49] This study was designed to understand the BSSO primarily from the viewpoint of affected property owners and, to a lesser degree, local engineers and the City of Berkeley. Therefore, I present only indirect observations about the impacts of the law on tenants, contractors and other interested parties as well as society as a whole.

object to allowing extensions for such reasons, but BID essentially had a policy that as long as the owner was communicative and making efforts to cooperate, they should be granted additional time. In general, the annual non-compliance warning letters were effective at getting lagging owners to complete their reports.

Because of what the law asked them to do, notified owners became informed about what a soft-story building is and whether or not they own one. Once a report was produced, owners could no longer claim ignorance of the issue or of their building's status.

> *"We were grateful we found out, that somebody told me. I wasn't qualified to know." [OB18:25, excerpt]*

This new awareness left many owners concerned for the safety of their tenants and the security of their real estate investment. Thus, the law did lead to a fundamental shift in some owners' expectations about their own properties. As discussed in Chapter 6, this shift did not appear to arise primarily from changed risk perceptions. Rather, concern for their properties came from changed economic expectations in the marketplace. The following two quotes exemplify this point:

> *"If I was going to buy another building in Berkeley, knowing what I know about this regulation, I would make sure that … either the [seller] did the work or I was credited with the amount of money that it was going to cost to upgrade the building." [OB14:43]*

> *"If I were to buy…a new building that's on that list, and then [a bank were to] say 'Well, unless you do this work within a year, we're not going to give you a loan' or something. I think that's where it's gonna go eventually and then the [other] owners will be forced to do it." [OB9:49]*

One Institutional Representative stated that the law, and in particular the signage requirement, was putting pressure on the institution's leadership to find resources for needed capital improvements related to earthquake safety, and not only for the building that was put on the city's Inventory. Internally, the BSSO gave ammunition to staff members who were seeking to elevate seismic safety issues on the Board of Director's agenda.

> *"[It's a horrible thing [that people are] still living [in our soft-story building]…it is a matter of grave concern. I know for me and our [institution]…this is an opportunity to be informed by the city that we have a problem in our facilities. Oftentimes our boards, because we operate on very thin margins and most of them, as a matter of fact, are in the red, [we] have deferred a lot of maintenance. When a board hears that a building may be unsafe in an earthquake, they say fix it. So from my point of view, it's actually been a helpful way to go to the board and say, 'We have*

to put a notice on this building that it is potentially unsafe in the event of an earthquake.' And so the board has given me the money to get [my other] building fixed." [OB35:23]

Working with an engineer during the evaluation process appeared to be more influential than the actual written assessment. People focused on the engineer's verbal summary rather than the technical written material. From the interviews, only a few owners claimed they had read the entire report. The engineers I spoke with affirmed this point as well.

"No, I didn't feel like anybody [I produced a report for actually read it]…I haven't got a single phone call with a question about something the report said. The only time the questions and issues came up is when the construction started." [KI4:62]

The owners I spoke with reported mixed experiences with the quality and persuasiveness of the verbal communications that occurred with their engineer. My own reading of a sample of reports confirms that their thoroughness and readability varied as well. The report style and content depended on who the owner decided to hire. Some owners sought out experts in soft-story issues while others sought merely to find the lowest cost qualified engineer that could produce the required calculations. Anecdotally, engineers varied in their approach to helping owners to comply, not just in their fee structure or "building-side manner".

<u>On-Site Visitors and Tenants, both Current and Prospective</u>. Proponents of the BSSO felt it would only be fair and right for the law to require owners to notify current and future tenants. Again, this was not a provision sought by external housing and tenant advocates. Rather, proponents hoped it would add another type of pressure on landlords.

"With the tenants…we felt people are living in these buildings and it was fair for them to have the knowledge. Also, giving the six-month appeal period then gave owners a fair opportunity to get off the list and not have to comply with that." [KI2:103, excerpt]

That being said, program managers had very modest expectations about how influential the signage would be.

"Based on the URM law, we were all a little cynical about how much impact [a sign] was going to have. But certainly [the sign] also is a disincentive for not retrofitting. Because you're supposed to keep the sign up, so you want to get the sign down." [KI2:103, excerpt]

At first, compliance with the warning sign aspect of the law was very low. This was in part because many owners assumed – incorrectly – that the signage and notification

requirements did not kick in until their building was proved to be *on* the Inventory, even if that was well after the compliance window had ended. Therefore, it is unlikely that many on-site visitors saw signs on buildings until 2008 or later. Also, the signage was not truly standardized until April of 2010, when the city sent all owners a model sign and reminded them of the requirement to post it. In summer of 2011, the RSB conducted a street survey to check on sign compliance (RSB 2011). Inspectors from the RSB visited 160 properties and found that 44 percent had the appropriate sign posted while 49 percent did not (at another five percent of the sites, the location where a sign should be was not accessible for making a verification).

Compliance with the tenant notification aspect of the law was also slow and weak at first. According to official data, tenants in only about half of the buildings had been informed as of May 2009. It is still not known how diligently owners are working to notify new tenants. Some owners told me that they revised their lease agreement to accomplish the notification.

Considering the low initial compliance with the signage and tenant notification requirements, it seems unsurprising that owners did not report these having much direct impact on tenant awareness or behavior. Again, this study was not designed to capture opinions of tenants directly. In the interviews, owners reported mixed, and in some cases inconsistent, opinions about the effects of the tenant notification and signage requirements on the market for rental units in soft-story buildings. The legal requirement to post a sign did get some attention, in part because it created a nuisance for them and in part because it was intimidating on its face and created fear that renting units out could become more difficult.

> *"The biggest concern we had when seeing that ordinance was the requirement to post notices so that we started out as basically destroying our market. [OB7:47]*

> *"Nobody wants a warning sign, 'this property is dangerous,' or something like that." [OB13:22]*

One owner who was still in the process of sending out tenants notifications expressed dread of the fallout, saying:

> *"I'm sure we'll be inundated with [inquiries about] what this means, you know, how dangerous is it? Stuff like that." [OB15:62]*

In contrast, other owners I spoke to who were farther along in the process told stories suggesting that their early fears about the signage requirement weren't borne out. Some expressed surprise at how little effect it had had on their renting success.

> *"I just told [my tenants]. I gave them the letters and stuff and [it] didn't seem to bother them." [OB20:37]*

> *"It was interesting…I would even tell prospective tenants… 'Listen, the building is on the Soft-Story list and, I just want to make you aware of the sign in the hallway,' and nobody was fazed. Nobody*

ever called me [to ask] are you doing the work?... That was the biggest shock, I think. I thought people were just going to move out." [OB36:23-24]

"It seems like it should have more of an effect, but there are definitely people that ask about it. So, I know it's having some effect…" [OB23:35]

Even several owners that did retrofits reported that they don't think the signs were, or are, a big factor in tenants' minds or behavior.

"I don't think [the signs are noticed]…I own seven buildings in Berkeley, I have only two buildings on the list and both of them I got the work done,…but I've seen some other buildings with that sign. I have not talked to the owners about it but…it's a small sign. Unless you really pay attention to it you won't even see it. They just typed it on an 8.5 x 11 paper." [OB9:36-37]

"I don't think [the signs affected the tenants]. None of the students [are] stupid, you know." [OB10:48]

"Oh, no, [tenants] don't care about that. Nah, they couldn't care less. Kids…I don't think the kids have any idea... I've never met a tenant who knew anything at all about it. We chatted about it. And if they did they would have noticed that I never put anything up in the hallway. You're supposed to say, "Hey, here's this thing," and if it's three years before we did anything and…I didn't even announce that I was going to do some work…Nobody cared." [OB8:61]

Owners I spoke with who did retrofits also generally believed that tenants were <u>not</u> more eager to rent or willing to pay more for a retrofit unit.

"I don't think [tenants feel any better]. I don't think makes any difference [in renting out the units]." [OB6:93-94]

"No…. the market is the market and I don't think the tenants are looking at the safety issue cause I don't think they go and look and see if that building they're going to rent is on a list. I know we're not on the list anymore because we did the work but it's a benefit that is not translatable into an increase in rents." [OB14:39-40]

"I do not think I can charge [more] for it." [OB26:49]

Owners in general reported little interest on the part of tenants in earthquake safety in general, and about the law in particular. There were, however, a few exceptions.

> *"There are renters that ask about this… I think mostly they see the sign on the building but maybe they've even read about [the ordinance] in the newspaper." [OB23:38, excerpt]*

> *"The actual warning we were told to place on the building itself…was probably the worst part cause it…we had to put it up during rental time. During the summertime a lot of students move out. We have to get people to move back in, so when they see this sign they like, they just walk away kind of." [OB29:17]*

One owner/manager thought his tenants were responsible for repeatedly physically removing the signs he posted, a belief that is inconsistent with the notion that tenants "don't care" about the signs. On the other hand, a tenant might feel they have little power over the situation other than to move (which would result in a rent increase since his or her unit is currently rent controlled). Tenants, may, in fact, be correct that they have little leverage in this situation.

> *"…recently, I even suggested to the city that they ought to write a line at the bottom of it which says, "DO NOT REMOVE THIS SIGN," because my biggest problem is not me. I'm perfectly willing to put the sign up, [but] my tenants remove it. They're the ones who don't want to be reminded." [OB19:73]*

The program did not adopt a formal goal or plan for informing *prospective* tenants. Prospective tenants may have received information about the existence of an Inventory or about particular properties on the Inventory either by stumbling upon or being directed to the website, or through informal publicity about the Inventory that was generated in the media and among RSB newsletter content or counselors, and the UC housing service. The RSB Executive Director said that the issue was highlighted in their annual newsletters to renters and landlords.

> *"[The RSB] would've been happy to continue doing notices in our newsletter, 'Make sure there's the sign; if not, you should ask,' 'It's something to negotiate, it's one of many amenities in a building.' 'It's great that you have high-speed internet, but…' So we thought that [the sign was] an additional form of market pressure. [KI19:34].*

In my key informant interviews, I did not hear of discussions about using recognition or rewards instead, or in addition, to the negative market pressures. For instance, the city could have included in its program a provision allowing owners that retrofit (or even that were in compliance) to put up a *favorable* sign.

Local Real Estate Professionals and Investors (Potential Buyers). This study was not designed to directly assess the effects of the law on attitudes and behaviors among this stakeholder group. However, using ownership and RSB records, I was able to identify at least seventy different property managers who worked with building owners with one or more properties on the BSSO Inventory. Nearly every large property management firm operating in Berkeley had at least one building on the Inventory, and one firm had at least twenty buildings. The local property owner's association held multiple workshops on the BSSO; each was attended by tens to hundreds of people. Most owners of Berkeley soft-story buildings are locals, and most potential buyers are local too, so the ordinance caught the attention of a large number of buyers, sellers, and transaction agents in the local multifamily market. Furthermore, the spread of the policy to Alameda, Oakland, Richmond, and San Francisco meant that the issue had relevance to real estate professionals and investors who own properties outside of Berkeley's immediate borders.

Financial Institutions. Just the idea that a bank or mortgage agent (either their own or a buyer's) might care about their property being on the Inventory was influential to owner thinking and behavior, even though only one or participants in this study actually reported encountering a problem. Most stated that banks have never asked them about earthquake safety regarding their buildings [OB2, 6, 15, 17, 18, 20] – not at the time of purchase or when refinancing, even in the past few years and after the law. Furthermore, most owners I spoke with reported that financial institutions remained disinterested even after they've done a retrofit.

> *"All the banks care about is…the appraisal. They don't even…banks don't ask for termite reports. Buyers do, but banks don't. Banks just order an appraisal and they have their formula, real loan, seventy percent or sixty percent or whatever and that's their only concern…in '76 I paid $127,500 for [my building], I'll sell it for a million and a half. I never had any problem getting a bank loan…Insurance companies couldn't care less. Premium didn't change [when I told them I completed a retrofit]." [OB2:52-54]*

Anecdotal evidence from the interviews suggests that a few owners did encounter issues with a bank when they tried to gain access to mortgage or retrofit financing. Specifically, I heard this from two owners I spoke with who had undergone or were planning to do a condo conversion right around the time when the law came out. These owners reported that they or their fellow-unit owners feared – and in some cases had – problems getting access to capital for the retrofit as a result of the notice on the title. Both of these owners choose to do a retrofit, feeling that it was essential to their ability to successfully complete the conversion process and make money on the sale of the units, in addition to being concerned about the safety of the

unit. They were worried about whether potential *buyers* of the units would have trouble getting financing for a stigmatized property.

> *"The problem is they…put it on the deed…saying it's a Soft-Story, so it really affects marketability." [OB33:29, excerpt]*

> *"The fact that the city puts something on your title is really analogous to requiring you to do the work. I mean they might as well just require people to do the work…[they way they did it] gives you a little more flexibility which is good because the truth of the matter is it's hard to sort of organize it all, but at the end of the day it's basically a mandate to do it." [OB37:14-15]*

Practicing Engineers. The law led to a large increase in the number of engineers doing work on soft-story multifamily buildings in the area, leading those engineers to gain more experience with the topic. Furthermore, it forced those engineers to use new evaluative procedures, thereby advancing their knowledge and skill set. Several developed a new "product" line of performing local soft-story ordinance evaluations.

Goal 1b: Increased Costs of Inaction

The BSSO made the downsides of not doing a retrofit more salient and also directly increased them in several ways. Many of these costs are intangible (not easily monetized) and relatively modest nuisance effects like maintaining the signage on-site and keeping up with tenant notifications. Still, these costs loom large because of their valence and repetition – they must be kept up with until the property is sold or upgraded. Fear of tenant turn-off effects or reduction in the property's marketability or income stream, if realized, could become a more serious financial concern. Relatively few owners reported actually experiencing those problems, but their *fears* about them were very real, especially at the outset.

Additionally, the owners I spoke with felt vulnerable to, even to the degree of actively anticipating, future administrative impositions. They took the program as evidence that the political will did – and could again – exist to impose further on owners of soft-story buildings as a group. Also, the city has now in hand an official engineering report demonstrating their building's weaknesses (thereby establishing their membership in a separable "class"), which made future mandates seem even more likely. The net effect was magnified because these costs are immediate, recurrent, and long-lasting, as well as unpredictable and possibly escalating.

Finally, as described in Chapter 6, the BSSO directly increased the costs of inaction for owners through the changed awareness, beliefs, and behaviors of market participants. Stigma, combined with the direct compliance burden as well as fear of future mandates, led to immediate devaluation of the properties in the minds of most owners. This set them back, changed their reference point, and possibly put owners in a "loss-framed," more risk-seeking

mindset. Two owners I spoke with noted that an informed tenant is also a tenant that is more likely to sue and able to win a lawsuit if something bad should actually occur [OB14, 18].

Goal 1c: Increased Benefits of Action

The law also included one provision that directly "rewarded" owners for retrofitting, although it was "designed" to counteract what was viewed as a retrofit barrier (owner fears of having intermediate-term future retrofit measures imposed on them without being grandfathered). Many owners I spoke with who did retrofits did so in part to avoid the threat of a future retrofit mandate which might be more costly, or come at a worse time for themselves financially, than at present.

Goal 1d: Getting Owners to Accomplish First Steps

As discussed in Chapter 6, the BSSO forced owners to take several non-trivial first steps towards a possible retrofit. After complying with the law, each owner had established a working relationship with at least one engineer and also had a plan in hand of what kind of upgrades might be necessary, thereby substantially clarifying the options and reducing uncertainty about the possible costs, further action steps required, and possible outcomes. In effect, this made proceeding with a retrofit seem less costly.

Completed Voluntary Retrofits

The net effect of all this increased awareness, discussion, and action-taking was a swift and clear increase in voluntary retrofit activity. Figure 78 shows known soft-story related retrofit-related build permit applications by year prior to and after the law.

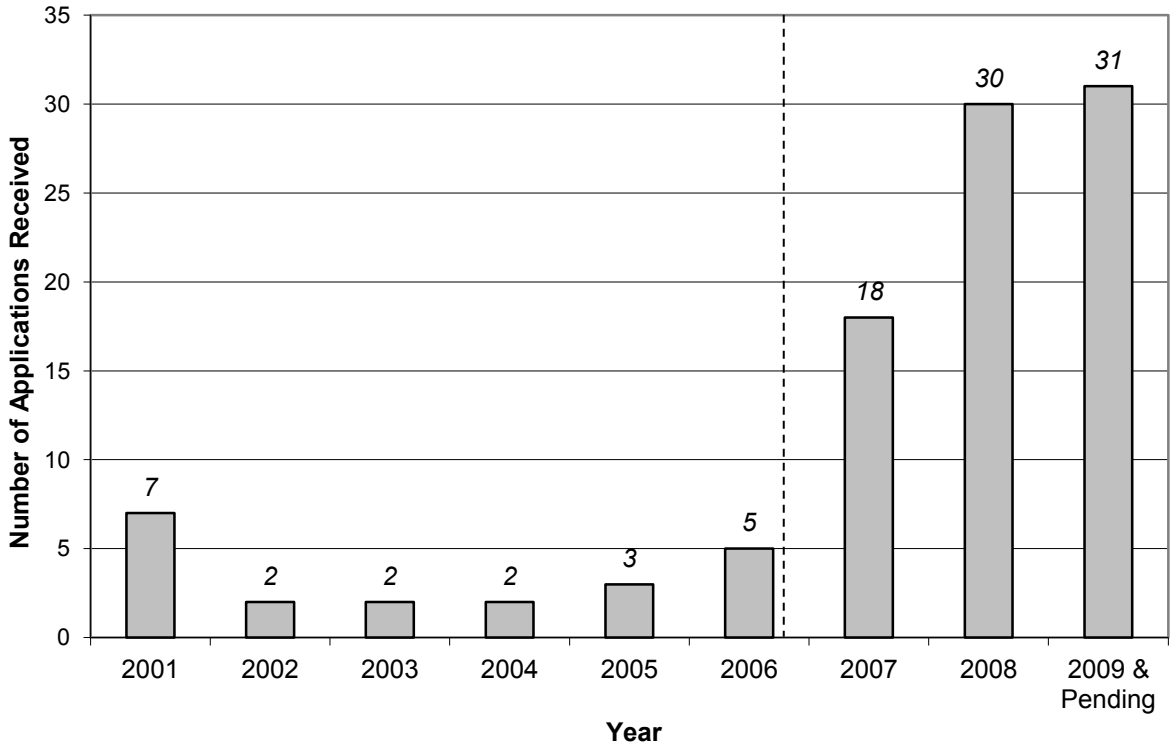

Figure 78. Soft-story retrofit building permit activity in Berkeley by year, showing a marked increase in the years following the Berkeley Soft-story ordinance.
Note: notices to owners were mailed out from February through October of 2006. Data Source: personal communication, Dan Lambert, April 2009.

To put this information in context, about one third of the City of Berkeley population lives in multifamily housing in buildings ranging from duplexes to multi-story apartment houses with 50 or more units[50]. There are about 3,500 housing units in the 321 soft-story buildings that were on the original BSSO Inventory[51], representing about 18 percent of the 18,855 total registered rental housing units in the city as of April 2009.

Five years after the law was passed, retrofits had been initiated in at least 76 buildings involving 976 units. Figure 79 shows the breakdown of the unit totals by retrofit status. Most of the planned retrofits were completed as of March 2011, but about twelve building permits that have yet to be "finaled" three years after the original application was filed. According to official data, eight buildings have had open building permits for at least three years and four have officially amended their status back to "report approved".

[50] According to US Census data, 2000.
[51] A precise total cannot be determined because unit data is missing from some of the properties. The estimate was generated by multiplying the number of buildings for which the unit total is missing by the average number of units for all buildings.

	Mean # of Units	Std. Deviation	# of Buildings	Sum of Units
No Retrofit	10.5	9.4	220	2299
Building Permit	13.1	6.3	12	157
Completed Retrofit	12.8	9.8	64	819
Pre-Law Retrofit	7.0	4.9	7	49
Sub-Total	11.0	9.4	303	3324
Buildings Missing Unit Data			28	
Total			331	

Figure 79. Table showing mean number of units in buildings by retrofit status.
Data source: City of Berkeley soft-story program website, Accessed March 21, 2011.

Some owners are still working with the city to get the report approved in conjunction with acceptable retrofit plans. I heard from owners and managers about instances where approval for a retrofit plan took over 18 months or as long as three years. City officials did not seem overtly anxious about having the earthquake occur while the paperwork for retrofits was in process, perhaps because they view these retrofits as so rare anyhow that any show of progress is acceptable. In other cases, an owner may simply have put their plans on hold indefinitely, even though they have a fully approved report and plans for a project. Money issues (waiting for final financing approval) and the need to schedule the upgrade around tenant and weather constraints were the two most frequently cited reasons for letting a retrofit project sit on hold. In some cases, financing became an issue later on in the project owing to the economic downturn starting in 2008.

Two owners I talked to later became skeptical that a retrofit was really necessary or beneficial to them financially. They have permits for a retrofit but said they've decided to indefinitely postpone doing the work. Some of the planned retrofits may not now occur since the owner became aware (perhaps even through hearing about this study) that retrofits are not actually mandatory.

Even if a few of the intended retrofits did not materialize, I heard anecdotal evidence in my interviews of a handful of retrofits to non-listed properties, either soft-story properties located in Oakland or Berkeley properties of different building types. Owners responsible for other properties in the community started inquiring about the safety of those buildings as well, as demonstrated by the following examples:

- An institutional manager made inquiries to find out about the seismic safety of other buildings his institution owns or are currently considering purchasing.
- A manager took proactive steps to make sure all his other properties that might be on the Inventory were being handled properly. (This includes his Oakland soft-story properties now as well).
- An owner reported beginning to think differently about how he purchases properties and about his other properties that might need seismic-related repairs.

In another case, the BSSO smoothed the way with the Landmark Commission for a retrofit already being planned.

"[The ordinance was] good because it helped us in front of the Landmark Preservation Commission. When…certain neighbors were wanting to get additions to the project that we didn't have the money for,…having the soft-story ordinance helped ….because really it was like, we're meeting the policy objectives of the City of Berkeley and our historic architect has come up with the best recommendation possible…we looked at two different approaches and this is a compromise…without the policy impact of the soft-story ordinance, I don't know that we would have gotten through the Commission." [OB4:23]

Progress on Short Term Goal 2: Facilitate Passage of a Mandatory Retrofit Ordinance

BSSO proponents had two aspirations in mind related to advancing the state of seismic safety policymaking in Berkeley and beyond its borders. The first was to generate useful policy-relevant as well as technical insights out of the mandatory reports filed pursuant to the BSSO. The second was that this information, in addition to the precedent set by the BSSO, would further legitimate and facilitate passage of mandatory retrofit ordinances in Berkeley and elsewhere. Specifically, proponents intended for the activities in "Phase 1" to produce an even more solid justification and specific plan for "Phase 2".

Despite the importance of these objectives, little thought went into how exactly they would be achieved. Most of the *legal* features of the policy were geared toward fostering the market conditions or environment to promote voluntary retrofits. Program staff focused their efforts on acquiring data in the form of the reports (in paper and digitized formats) and managing the review process. They did not create a formal plan or set aside a budget for systematically collecting or analyzing the data contained in the reports, other than logging the soft-story determination and compliance status. Staff were hopeful that resources and a process to organize, integrate, and derive insights from the data could be generated later, but for a variety of reasons this did not occur.

Goal 2a: Collect Information about the Technical Justification, Process, and Implications

As described in Chapter 4, BSSO proponents wanted to collect detailed information about Berkeley's soft-story buildings to assess the degree of hazard as well as to contribute to ideas for how the risk could be reduced. This objective was central to their rationale for the program in its final form, and especially for the two-phased approach.

However, staff made almost no progress towards turning the raw data being collected into either technical or policy insights. This was not an oversight but rather a result of time, financial, and human resource constraints. Program managers simply prioritized immediate implementation efforts and postponed planning and execution of any but the most basic analytical activities. Unfortunately, less, not more, resources became available for the program

as time went on, so these secondary goals were not revisited. This was clearly disappointing to the program staff as well as to outside experts who had supported the policy's development.

> *"My understanding now is that all the information is there, but nobody knows what to do with it. So what? You've got all this data that says these buildings don't work and whatever, but you've still got the holes in them and you still just have reports in a file cabinet somewhere." [KI7:80]*

Through owner compliance with the BSSO, the city did actually acquire a large volume of information of unprecedented scope, comparability, and detail. Proponents thought carefully about what would be asked of owners and what to tell the engineers to include in the reports. These efforts manifested in the Framework, the engineer trainings, and in countless conference calls, meetings, and informal discussions among the many persons responsible for preparing and reviewing the submitted reports.

As of April 2010, the city had approved 83 reports, processed reports and plans from 79 retrofit projects either completed or in process, and had another 45 reports in active review. Never before has a collection of such detailed soft-story evaluations been produced. The contents are potentially valuable to understanding the true degree of hazard from soft-story conditions in Berkeley's multifamily housing stock and can form the basis for tracking progress towards its improvement.

Additionally, the reports collectively reflect how practicing engineers understood and approached soft-story conditions as a concept and how they interpreted the IEBC A4 code standard and Framework guidance. The true import of the BSSO as a policy experiment cannot be achieved or understood without analyzing these points, which is the goal of a companion study currently in progress (Bonowitz and Rabinovici forthcoming). By going deeper into the makeup of Berkeley's building stock (e.g., the construction styles and materials used in various eras), other jurisdictions will be better able to interpret the relevance of Berkeley's policy experiences and soft-story findings to their own circumstances. Also, the report identifies shortcomings in conventional engineering practice and current codes that contribute to inconsistent and sometimes misleading analyses of soft-story conditions. These insights can promote more accurate loss estimates and improve mitigation planning.

Through the mere process of collecting the reports, some technical insights were gained, especially ones that came overtly, quickly, or easily. Proponents felt that the report outcomes validated both the premise of the law and the quality of the original Inventory. Only twelve of 331 properties as of April 2010 had demonstrated that their initial inclusion on the Inventory was in error because the building does not have a soft-story condition. Thus, the false positive rate for soft-story condition among noticed properties was 4.5 percent (excluding those for which no report has been filed yet), which the program managers felt was very good. When administrative errors are included, such as noticing a building that did not have five dwelling units, the false positive rate was near 16 percent. The number of four-or-fewer unit buildings in the city that have soft-story condition is not known.

One of the immediate "surprises" for program managers was the number of owners that wanted to do a retrofit to get off the Inventory. Through this, program managers were also

quickly able to tell that the law was motivating some voluntary retrofits, even if they didn't know exactly how or why. This also implied that resistance among owners to a mandatory retrofit program might be less than previously thought. Program staff also got a general feel for who owned Berkeley soft-story buildings, both the "typical" owner and the range of ownership types. This also eased fears of political backlash to a mandatory ordinance, because owners did not appear motivated or organized enough to effectively fight against the BSSO.

As noted previously, tracking the status of properties on the Inventory, and especially the retrofit projects in progress, proved a difficult challenge for program staff. Staff were hampered in their information management efforts by the aging informational technology infrastructure of the Planning Department and the decision to work outside their usual database program. Program personnel struggled to glean data about the planned retrofit projects using the existing permit database that did not have an easy way to "flag" seismic-related construction projects. Transfer of information among administrative purposes remained *ad hoc* and was never systematized or automated. This meant that any information about the retrofits that resulted from the program were tracked, at best, in an Excel file that at any given time might contain large gaps or errors or be very out of date. Just determining when each permit closed or lapsed took a new internal investigation each time.

In the program implementation stage, staff came to see that the original timeline for the law was too ambitious. Program managers for the BSSO initially hoped to have all evaluation reports filed and available for analysis within the two year period. Instead, it took close to five years to obtain 70-80 percent compliance. The feeling emerged that a mandatory retrofit program would realistically operate on a ten to fifteen year time scale, even if the rhetoric used to communicate about it involved a much shorter timeline.

The BSSO constituted a major administrative experiment in that it asked engineers to use a standardized evaluation approach (especially the use of the IEBC A4 table). Hopes regarding the quality and content of the reports were partially realized. Deriving engineering insights from the reports is hampered by the fact that some reports are of much high quality than others, and that review for approval is not entirely consistent in demanding the same information or style/process of analysis for all properties.

> *"The other thing we wanted to accomplish was to get the reports in such a way that we could get the data out of it easily without having to spend a lot of time trying to interpret these reports to get some sort of data. So there were a lot of things in the Framework about specific data points that we needed. Unfortunately, to my knowledge, that hasn't been done yet." [KI20:14]*

The law was only partially successful at its goals of legitimizing and advancing the framework for evaluating soft-story hazard. There is no procedure to analyze the hazard on a property by property basis through information systematically collected in the reports. By extension, there is no ability to assess the hazard community-wide, nor the incremental improvement to community well-being that was achieved through the voluntary retrofits. Thus, the program was unsuccessful, at least so far, in clarifying desirable technical specifications for

retrofits. There has been no progress in clarifying appropriate engineering analysis procedures, nor appropriate soft-story retrofit options. That being said, some information related to these goals was collected, and is now public, and can be used by third parties to conduct those types of analysis.[52]

Through informal conversations with owners and engineers, program staff also got a feel for what the evaluation reports were costing owners, even though this information was not tracked systematically. Anecdotally, the reports ended up costing more on average than proponents had originally expected. From my interviews, a typical report cost between $2,000 and $6,000. Some reports, especially those that were associated with actual retrofits, reached as high as $10,000 or $15,000. Owners, of course, tend to speak in terms of "total fees to the engineer" which is not exactly equivalent to what the report only would have cost. However, that is the realized amount an owner who was doing a retrofit had to spend, which is an important metric. Proponents were also excited to learn that engineers were successfully convincing owners that it was less expensive to prepare full plans for a retrofit at the same time with the report, rather than waiting to prepare plans separately later.

Retrofit cost data was seen as particularly important for the development of a second phase mandatory program, because staff knew that discussions would be re-opened about financing options and incentives for owners. In practice, however, program staff did not request in the Framework that engineers estimate the cost of the recommended repair work. Instead, the guidelines merely asked for estimates of some of the raw materials that would be needed, on the assumption that dollar values could be estimated from that information:

> *"Additionally, report the approximate quantity of new or re-nailed plywood (to the nearest 50 square foot increment), the amount of new hold-downs and miscellaneous hardware, the size and length of members of new steel frames, or other similar information for other repairs that are to be added based upon the strengthening program." [KI15:11]*

Staff did not produce any formulas for how to make cost estimates from the material estimates that were requested. Overall, there was no plan to address the difficulties of trying to generalize about a group of buildings that might well have many more distinctions than features in common. Figure 80 shows a summary of the information collection goals, rating them as either achieved, partially achieved, and not achieved.

[52] This is the aim of a companion study currently being conducted by the author in collaboration with a structural engineer, David Bonowitz.

Example Data/Information Collection Goals	***Status***	***Comments***
Compliance status for each property regarding the evaluation report.	*Achieved*	Not easily accessible from the city's permit or property information databases.
Whether a building permit for a retrofit has been obtained.	*Achieved*	Not linked to and or easily updatable relative to the BSSO status tracking spreadsheet.
Voluntary retrofits completed to date.	*Achieved*	Requires manual checking of permit status information.
Confirmation of soft-story designation according to legal definition.	*Partially Achieved*	Status unknown for approximately 60 owners in non-compliance as of 2011.
Who the affected building owners are and the barriers to retrofitting they face.	*Partially Achieved*	This report and the 2011 Rent Board financial study.
IEBC A4 Table data for all properties found to be soft-story.	*Partially Achieved*	Data collected but not aggregated or analyzed; missing reports of non-compliers.
What types of retrofit strategies were proposed and used.	*Partially Achieved*	Data collected but not analyzed; missing reports of non-compliers.
Reported valuations for proposed retrofit projects.	*Partially Achieved*	Building permit application data is available but not systematically collected.
Compliance with signage requirement.	*Partially Achieved*	Rent Board conducted a 2011 on-site inspection survey for a sample.
Probable costs for proposed retrofit schemas.	*Partially Achieved*	Some data collected but not analyzed; missing reports of non-compliers.
Financial costs to owners to comply (evaluation report costs).	*Partially Achieved*	Some anecdotal evidence collected. Also, see this report.
The degree of hazard present for each property/designation of risk categories.	*Partially Achieved*	Data collected but not analyzed; missing reports of non-compliers.
Compliance with tenant notification requirement.	*Partially Achieved*	Voluntary reports of compliance only.
Assess appropriate timelines for a mandatory retrofit program.	*Not Achieved*	
Adequacy of retrofit strategies proposed and implemented.	*Not Achieved*	
Actual costs for completed retrofit projects.	*Not Achieved*	
"Identify fully the risks to the city and its inhabitants."	*Not Achieved*	
"Determine the feasibility of programs to address the vulnerabilities."	*Not Achieved*	
Degree of hazard reduction achieved through the voluntary retrofits done to date.	*Not Achieved*	

Figure 80. Table showing a list of Berkeley Soft-Story program information goals by level of progress achieved.

Key to Evaluation Classifications:

Achieved	Information collected and readily usable.
Partially Achieved	Some information but incomplete or no clear process for use, analysis, or updating.
Not Achieved	No information systematically collected or analyzable.

Goal 2b: Develop Staff Capacity and Political Support

Proponents were confident that the BSSO would lay the foundation for a future *risk reduction* program. As articulated in Berkeley Municipal Code 19.39.010 section A.8 of the legislation:

> *"The establishment of an Inventory and notification of owners and residents is a necessary first step in developing a mitigation program and will provide the basis for obtaining input from affected parties for such a program". [KI16:4]*

Formally, it was hoped that one outcome of "Phase 1" would be a specific recommended plan of action for a mandatory retrofit program. Some of the mandatory program elements that proponents expected to be clarified during Phase 1 included: 1) establishment of risk category designations, 2) appropriate timelines and deadlines for retrofit, 3) other triggers for retrofit such as change of ownership or large renovation, and 4) incentives and sanctions.

For a number of reasons, this hope did not materialize. Resources for managing the program dwindled along with the economy (fewer construction projects means less permit fee revenue for the department as less overall tax receipts to sustain the city budget. (Note that permit fees are generally well correlated with regulatory service demand, but not for this kind of service.) In 2009, the City Council decided to cut back on the staff devoted to the program. The City Council eliminated the position of the sole staff person devoted entirely to the City's two earthquake mitigation programs (URM and soft-story), and that person moved to a different functionality (energy efficiency programs) 4 out of 5 days of the week. Further, in summer of 2011, both the lead initiator of the program and the former program manager retired from civil service to the city.

Even without a formal plan or process to compel owners to remedy their soft-story properties, the BSSO did put the city several steps closer. First, it established a clear legal precedent. By executing a successful "proof of concept", the BSSO demonstrated the feasibility of a local government program that tackled soft-story buildings. The BSSO increased visibility and political interest in the topic as well as issue expert buy-in. Second, it put owners on notice, thereby reducing resistance to further actions on the issue. Third, on a practical level, it also established a set of local engineers experienced in producing reports and designing retrofit schemes. Local contractors, too, gained experience doing soft-story retrofit projects. Figure 81 summarizes some of the main policy development goals as achieved, partially, or not achieved.

City staff involved with the BSSO program gained knowledge and experience that would have made running a mandatory retrofit program much easier. However, as noted above, that human capital was largely lost owning to budget cuts and then the subsequent retirement of the two key civil service personnel involved. Because administrative procedures were not embedded in other departmental functions, there is no obvious way to continue the development of a mandatory program. The Rent Stabilization Board initiated several actions in 2011 related to assessing the feasibility of Phase 2, but no City Council action has been taken yet.

Ultimately, the policy may have been so "successful" at motivating voluntary retrofits that it reduced the sense of need and urgency for passing a mandatory retrofit law. Whether or not this was pivotal to the current stalled state of policy development cannot be known, but it probably contributed to it.

Example Policy Spread and Promotion Goals	***Status***	***Comments***
Establish a legal precedent and set of administrative procedures that leads to replication or adaptation elsewhere.	Achieved	
Foster experience among local engineers in producing soft-story evaluation reports and designing retrofit schemes.	Achieved	
Legitimize, advance, or refine the process for establishing soft-story inventories.	Partially Achieved	
Legitimize, advance, or refine the process for evaluating soft-story hazard.	Partially Achieved	Data collected but not analyzed.
Increase technical expert buy-in.	Partially Achieved	With retirement of key personnel, the involvement of outside experts has essentially ceased; program data are yet to be systematically analyzed.
Clarify desirable technical specifications for retrofits.	Partially Achieved	Data collected but not analyzed.
Development of staff knowledge and institutional capacity to assess and address seismic risk.	Partially Achieved	With retirement of key personnel, much of the experience gained was lost.
Clarify the justification and develop specific policy recommendations for a mandatory ordinance.	Partially Achieved	Data collected but not analyzed.
Embed and improve administrative procedures for facilitating retrofit projects.	Not Achieved	

Figure 81. Table summarizing policy spread and promotion goals by level of progress achieved.

Summary of Short Term Goal Progress

The BSSO's primary aim was to induce belief and behavior change, and it appears to have achieved large shifts in both. Approximately 75 voluntary retrofit projects were initiated in Berkeley the first five years of the program, or about 20 percent of the 317 initially listed properties. As of 2011, all but six of those projects had been completed. Furthermore, the social regarding seismic retrofitting has been reversed such that most soft-story owners in Berkeley now regard completing a retrofit as the ideal.

For a variety of reasons, the program was not very successful at facilitating eventual passage of a mandatory retrofit requirement. Since 2010, the program has officially been operating at a bare-bones maintenance level. The Rent Stabilization Board continues to discuss and keep alive the idea of a mandatory retrofit phase, but action by the City Council remains distant and unlikely. In brief, it became evident that a rigorous soft-story program was not easy

to operate nor likely to come to quick closure. The program was novel, highly technical in nature, and customer service-intensive. Its initial success diffused the sense of urgency, and the natural time to expand the program coincided with a severe economic downturn and associated budget shortfalls as well as the retirement of key personnel.

8.B – Net Social Effects & Regulatory "Reasonableness"

In this section, I present a framework for discussing how well the BSSO balanced progress towards its objectives against the burden placed on owners and other program costs. Proponents were operating on what they regarded as a well-justified premise: soft-story buildings in general represent such a safety risk to tenants and threat to overall community well being that it would be unconscionable to leave the problem unaddressed. They saw creation of *some kind* of program as an ethical or moral imperative that did not need to maximize efficiency or pass a literal cost-benefit test. The aim was to design and develop support for the strongest *affordable* and *politically viable* program possible that would advance the policy goals. In this sense, it is most appropriate to perform something like a cost-effectiveness analysis comparing the BSSO against other possible approaches given the constraints.

The city's primary constraints were limited resources and the internal and external politics of the situation. As policy entrepreneurs operating from within the city bureaucracy, BSSO proponents knew they had to craft a legislative proposal that was palatable to key stakeholder groups: their management and peers within the affected city departments, and elected officials as well as the building owners. The opinions of these groups, in turn, hinge on keeping the costs of the policy – to both the city and owners – roughly in proportion with available resources and the program's potential to advance important societal aims. Nearly everyone involved could see that the benefits would be long-term, uncertain, intangible, and difficult to measure or value, even after a major earthquake occurs.

It was in this vein that proponents developed the idea of a mandatory evaluation program supplemented by a number of "market transformation" features. In essence, they staked out a compromise position between a purely voluntary program, which would be cheapest but probably ineffectual, and a mandatory retrofit program, which was perceived as politically unsupportable without some source of financial help for owners.

After developing the overall assessment framework and defining the evaluative criteria, I will discuss how the BSSO performed on each. Then, at the end of this section, I will compare the BSSO to three other policy alternatives: a purely voluntary program (currently in place in Richmond and San Leandro, California), a mandatory screening program (currently in place in Oakland, California), and a hypothetical mandatory evaluation program (currently being contemplated by the cities of San Francisco and Berkeley, California).

<u>What is Regulatory Reasonableness?</u>

In <u>Going By the Book</u>, Bardach and Kagan (2002) define "regulatory unreasonableness" as imposition of requirements where compliance would clearly not yield the intended benefits

or entail costs that clearly exceed the resulting social benefits. In other words, an *unreasonable* regulation is one that is not cost-effective *in practice*[53].

The downsides of pursuing economically inefficient public policies are easy to list. Resources are scarce, so the money, time, and effort put into programs which fail to produce at least that same amount of benefit is essentially wasted and unavailable for other worthwhile purposes. Another more insidious cumulative effect, also pointed out by Bardach and Kagan, is that inefficiencies owing to excessively rigid adherence to rules tend over time to discredit government institutions as agents worthy of public trust.

To state the obvious, operating only demonstrably cost-effective programs is an unattainable ideal. Many programs will fall into a "reasonableness grey area" – they are not obviously inefficient, nor are they clearly efficient. The Berkeley case points to at least three reasons why this occurs, and why it might not be such a bad thing. First, in some policy arenas, assessing program cost-effectiveness or efficiency is exceptionally costly or complicated by uncertainty, ambiguity, information gaps, data quality problems, and assumption-making. Despite the best efforts of technical experts, both costs and benefits remain poorly understood. We might refer to this generally as *issue complexity*. A second factor is program scale. Some programs are just too small to warrant a formal cost-benefit assessment (i.e., the act of analysis itself would fail a cost-benefit test). These cases may be particularly common at the local level, where federal and state procedural requirements to evaluate costs and benefits may not apply and programs tend to be smaller. Finally, people are not sometimes uncomfortable judging programs solely (or perhaps even at all) using typical cost-effectiveness standards, for instance if they involve fundamental rights, goals, or ethical concepts like human safety, equity, access to opportunity, or stewardship. In other words, because of the importance of the issues at stake, society is willing to proceed despite doubts or greater uncertainty regarding the level of benefits relative to cost.

That being said, we still need to apply clear criteria to circumstances where we lack the capability (or desire) to evaluate program efficiency or cost-effectiveness with precision. I propose the following three interrelated measures to assess the *reasonableness* of a regulation as implemented.

1. **Legitimacy:** The authorities and assumptions underlying the strategy of government involvement are transparent and valid. The policy approach should be viable in that the public resources devoted to it exceed any minimum thresholds necessary for success, and sustainable (or adaptable) in that undertaking this particular program does not unnecessarily preclude future actions.
2. **Procedural Fairness:** The procedures employed are open and equitable. Adequate opportunities or processes exist for public participation, scrutiny, and accountability.
3. **Commensurability:** Expected societal benefits are of a type and scale such that the costs seem justifiable. Distributional outcomes are roughly in keeping with the relative stakes and responsibilities of affected parties.

[53] As a reminder, cost-effectiveness analysis is the process of assessing the costs required to achieve a certain fixed level of benefits, while efficiency analyses (typically, benefit-cost analysis) assess the net benefits achieved per unit of cost.

I will now discuss the BSSO with regard to each criterion using my own thinking as well as the content of the narratives of the owners and managers I interviewed as they subjectively discussed how the law affected them. In doing so, I further clarify some of the key aspects of each criteria.

Legitimacy of Government Intervention

In Chapter 1, I outlined the key elements of the case for government involvement on the issue of soft-story buildings. To summarize, soft-story wood frame buildings pose a demonstrated collapse and life safety hazard. The probability of a major earthquake in the San Francisco Bay Area is 63 percent, and in such an event approximately 20 percent soft-story buildings may collapse or be damaged beyond repair. Also, because of various inherent problems of hidden and asymmetric information, the problem is unlikely to ever be resolved without some type of public involvement or intervention. For these reasons, it is reasonable to consider motivating upgrades of soft-story apartment buildings a significant and appropriate public aim.

This view was echoed among study participants. Their attitudes about the city taking *some* action on the soft-story issue were generally supportive and in a few cases grateful. Most accepted that soft-story apartments *in general* are a hazard and a legitimate public concern. The following quotes illustrate acceptance of the law's rational basis and acknowledgement that soft-story buildings can affect community and tenant wellbeing, not just owners:

> *"I guess from a public policy point of view, I don't have a basic problem with what the city is trying to do. The city has a vested interest in making sure that its buildings don't fall down in an earthquake….That's for sure. That hits on so many levels. I mean public safety to begin with. Costs, recovering from an earthquake, all of these things are going to be a big hassle for the city. The city could barely handle the fire that happened. What will happen when they try to recover from an earthquake and they have a number of buildings that need to be put back together again?" [OB19:83-84]*

> *"I don't begrudge the city at all… I welcome the city's interest in helping us make our building safer." [OB35:22 (first part), 25]*

If there is a weakness in the case for the legitimacy of Berkeley's Soft-Story Ordinance, it arises in the movement from the general to the particular. Variation among members that seem to be "of a type" is a fundamental policy design challenge well-exemplified by this case. The act of selecting a specific subset of buildings to put on an Inventory inherently involves a *risk threshold* determination. Whatever the process used, it manifests a trade-off between errors of omission (individual members that should have been included but weren't) and mis-identification (individual members that were included but shouldn't have been) according to their status relative to the stated public aims (see Figure 82, leftmost-column). I shall refer to

this as the *targeting process*. The legitimacy criterion – everyone (who owns or lives in an apartment building) should be treated similarly (the buildings they own or live in should meet a minimum earthquake performance level) conflicts with efficiency criterion – every apartment building whose retrofit is worth it should be strengthened.

When a law is passed, official inclusion and exclusion criteria must be established against which targets will be evaluated. I call this the *diagnosis process*, and it can result in other types of mismatches between the aims of a policy and the group members actually affected. In total, then, Figure 82 shows six different types of "errors" that are possible in this policy design.

Some errors may undermine the legitimacy of a law more than others. For instance, errors of omission in the targeting process (over-conservative targeting) may not be noticeable in the short run, and therefore may weigh less heavily in the minds of legislators. However, this can ultimately be costly to society and the making of major political scandal (e.g., Hurricane Katrina), especially if reasonably accurate screening procedures and remedies were available but not used. Over-inclusive targeting, on the other hand, can be costly from an administrative sense and politically embarrassing in the short run.

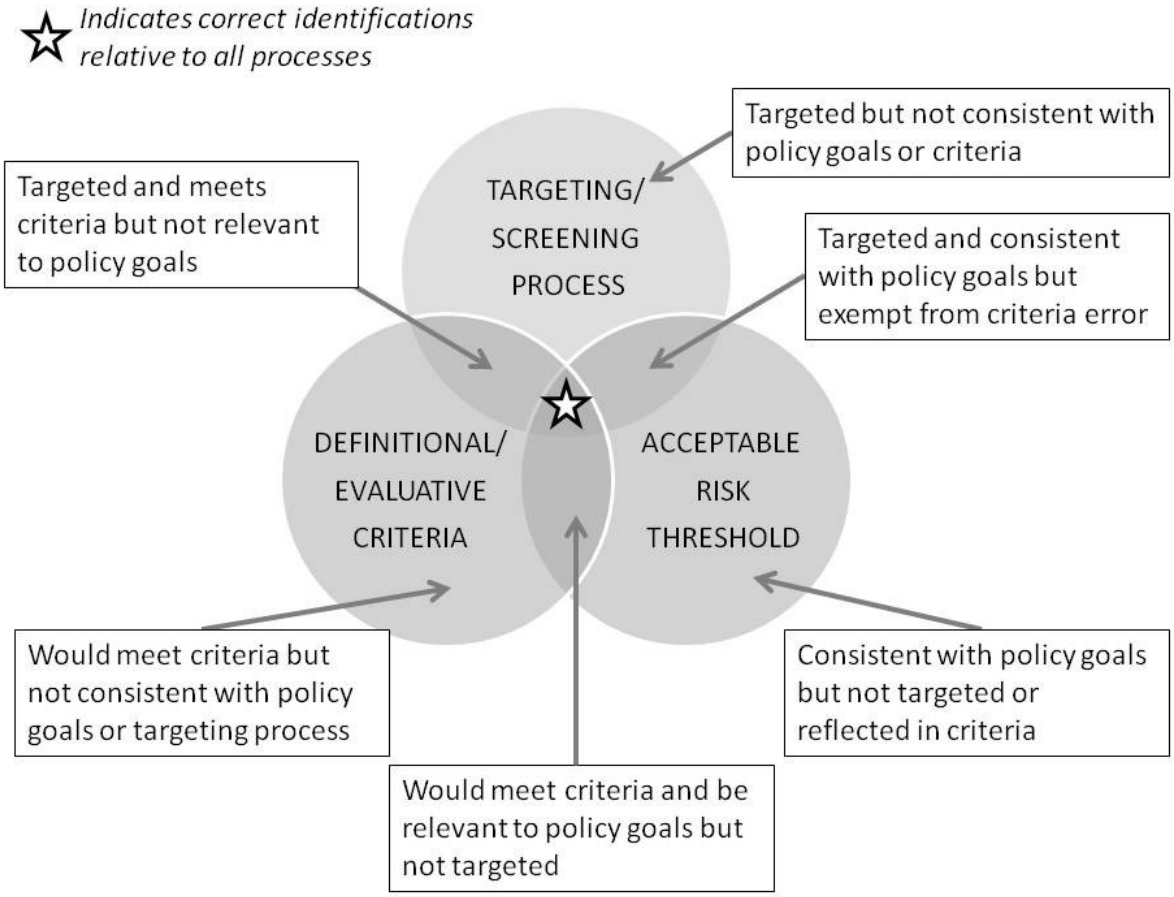

Figure 82. Diagram depicting the universe of policy implementation and risk identification outcome, including six error types.

The policy's implicit aim of identifying buildings that exceed a certain risk threshold depends on engineering definitional criteria that for any given building may correlate more or less well with the actual level of hazard. Given that targeting and diagnosis procedures will inevitably be imperfect, the legitimacy of this type of *policy* is closely linked to the real (and perceived) error rates that result. In the Berkeley case, the targeting process consisted of a handful of experts employed to look for high-probability targets. Later on, a group of local experts paired with university students collected additional information about a purposive sample of the properties. The diagnosis process depended on IEBC A4 and the BSSO Framework as well as how those technical guidance documents were interpreted and acted upon by the practicing engineers, program staff, and during the report review process.

Several study participants were either misinformed or highly skeptical about the origins and quality of the city's Inventory. Some felt that *their property* should not have been singled out for one reason or another, and a few thought the procedures to create the Inventory were inappropriate. Here are several quotes that exemplify these attitudes and beliefs:

> *"…[the list was made by] civilians with no requirements and no training…it's ridiculous." [OB2:71]*
>
> *"[The city] just hired – I don't know if it was students or whoever – and they went around… and made note of potential soft-story buildings…" [OB14:20]*
>
> *"…they took some UC Berkeley students going around the properties to see if they had something called soft-story issues. And then these kids went and looked around and they thought certain buildings, in the case of an earthquake, it might collapse…" [OB9:4]*
>
> *"I think…the classification was done by an incompetent and the rest of the [problem] is bureaucrat[ic]." [OB31:34]*
>
> *"[It's really frustrating that we had to go through all this and do this, especially when I feel that…this is not a Soft-Story building. It was just Berkeley engineering students that went around, just drive-bys, and said, oh, yeah, this is a Soft-Story building. They didn't really do any analysis of it. They just kind of drove by and said, 'oh, you have underground… parking that's unsupported by the structure.' But [in my building] there are also sidewalls to the underground parking and it doesn't extend a full length of the building…it only extends like one-fourth of it." [OB39:25]*

Only in rare cases did a study participant bring up the underlying question the City's basic right to tackle the issue or suggest that the city set the hazard threshold too low. One owner/manager did question the rationale for only tackling soft-story properties, arguing that

the city should have used a risk-based approach or applied the policy to a wider class of buildings [OB34]. However, most owners and managers are not in a position where it is easy to judge the technical merits of the policy.

The analysis of approved engineering reports (Bonowitz and Rabinovici forthcoming) suggests that criticisms about the targeting process and diagnosis criteria have some merit and thus deserve further comment.

The premise behind the initial Inventory was to use a combination of *visual cues* and administrative data (e.g., occupancy, use) to create a list of potentially hazardous or suspected hazardous multi-unit residential structures. In a re-analysis of 39 case study buildings with a consistent methodology, Bonowitz found that an open front and low wall strength ratio can be misleading and that the absolute strength may a better performance indicator than irregularity in wall configuration (Bonowitz and Rabinovici forthcoming).

Even more troubling, this means that the visible indicator of open fronts for tuck-under parking can be misleading. Returning to the "twin buildings" discussed in Chapter 7, both reports found higher (worse) demand capacity ratios[54] in the short direction, despite the soft-story visual indicator of an open *long* side. This is a result of the nearly solid long-direction first story wall at the back of the parking area, and it suggests a shortcoming in our presumptions about soft-story buildings and possibly in the IEBC A4 definitions of weak story, soft story, and open front deficiencies (Bonowitz and Rabinovici forthcoming).

The BSSO exempted several buildings that appear to have concrete block first story walls due to partially below-grade parking, and this might have been the basis for the exemption. However, among the 90 reviewed by Bonowitz and Rabinovici, several of the reports approved by the city also had this condition. Four of the buildings exempted from the program as "not soft story" appear to be very similar to others that completed evaluations and were found to be "soft-story".

Thus, the targeting step, while making it easier to pass a law, may have ultimately obfuscated the law's purpose, focusing the program's attention on finding of soft-story conditions when the intent of the law is tied to *collapse-vulnerable* buildings. Buildings with soft-story conditions should not bear the burden of extra regulation unless we can demonstrate that they pose a higher collapse risk than buildings without those conditions. How much higher is the next important question. In my opinion, the relative risk difference should exceed our best guess as to measurement error.

These insights point to a need for more thorough, nuanced code definitions and step-by-step formulas. Particularly needed is guidance for evaluations that are intended not just to analyze one building's likely seismic performance but to inform more broadly about a building's likely seismic performance *in relation to similar other buildings*. Bonowitz and Rabinovici (forthcoming) give a specific list of issues along these lines needing further attention from the engineering community.

---

[54] Demand capacity ratio (DCR) is a common measure of structural acceptability. The numerator is "seismic demand" – an approximation of the earthquake-generated forces that a building might be subjected to as estimated by a code formula, while the denominator is the estimated strength of the first story (capacity) to withstand that force. A DCR greater than 1.0 indicates an unacceptable condition.

Procedural Fairness

Beginning in the 1980s, procedural fairness in criminal justice has received considerable attention based on the notion that both defendants and victims of crime often care deeply not just about trial outcomes but also about the trial process (Thibaut and Walker 1975; Lind and Tyler 1988). The same preferences are undoubtedly held by the people and organizations affected by regulatory mandates. Even if the basic legitimacy of a regulation's purpose has been established, the handling of specific cases can still make a regulation seem dysfunctional and unfair. Bardach and Kagan (2002) define "site-level" unreasonableness as inappropriate uniformity or excessive stringency in application of regulatory requirements that simply does not make sense *for the case in question*. The more procedural case-by-case fairness (and proper discrimination) the more cost-justifiable the program itself is.

Below I discuss some of the key procedures involved in implementing the BSSO, the types of procedural fairness issue encountered, and how well they were addressed.

Appeals & De-Listing. From a procedural fairness point of view, owners who were affected by the BSSO had the opportunity to appeal inclusion on the list on administrative grounds. However, the timeline in which they had to complete the appeal was very short. Also, some owners were forced to provide expensive evidence and go through lengthy administrative processes in order to be removed from the list for lack of soft-story condition. Extreme cases of hardship from appeal, from my limited sample of owners, were relatively rare but not absent. There may also have been some excessive time delays between when certain administrative decisions were made and when the owner received confirmation or when that information was made available to the public.

Accessible Customer Service. Owners affected by the BSSO had access, at least for the first five years of the program, to a devoted program manager who had sufficient knowledge and authority to discuss the law's requirements and aid owners in compliance. Program staff had trouble responding in a timely manner, however, owing to the high volume of inquiries, iterative nature of the communications, and overall program complexity. Ultimately the program manager was reassigned for budgetary reasons, and owners reacted with frustration and disappointment. As one put it:

> *"You want to have one person that's familiar with all the laws… You need to hire somebody who's going to stay on from beginning to end, especially [for] something big like this. Where you're going to go against 350 or 400 landlords and tell them that your buildings are unsafe and we got to tell every single tenant in your buildings it's unsafe, put a huge sign up saying your building is unsafe and then have nobody that we could talk to?" [OB33:50]*

Enforcement. To date, the city has chosen not to levy fines for non-compliance or tardiness. One owner appreciated that enforcement was lenient given that most owners had been caught off-guard:

> *"I think it's like putting us responsible for something that happened before. We never built the buildings here so how do we [know]?…That is why I think the City of Berkeley is a little lenient on…sanctions, just demands in a manila envelope that comes like once and awhile." [OB29:55]*

However, granting of lenient extensions without penalty could be viewed as unfair to those who complied on time. So might the lack of attention to non-compliance since the program budget shrank to maintenance level. Finally, no efforts or processes are in place to identify soft-story buildings that might have been missed.

Degree of Coercion. A major thing some owners took issue with was the law's overall approach of putting a notice on the title, making the list public, and requiring signage and notification of tenants. There was some resentment about the law's use of stigmatization, humiliation, and coercion as tools of so-called "market-based" persuasion.

> *"[The law] was extremely sneaky because we were forced to do [a retrofit]. It wasn't like you have an option to do it…They may have made it sound like it's an option to people who don't know anything about property, but it was really. You have to do it or you're stuck with this negative rating on your building and you [also have] to tell every single tenant, so now if something does happen, they're going to say 'Oh, it's because you neglected to do this work' or whatever. You're pretty much holding your soapbox of big lawsuits and [a] whole slew of stuff." [OB33:40]*

> *"The [notification and sign] provisions were really bothersome and there was just too much of it, I thought…It wasn't confusing, but the fact that you had to post signs at every entrance and exit, that's really ridiculous. It's a scare tactic and it's not productive of anything." [OB27:65-66]*

> *"What I find is that city government is putting their nose into business that they should not. For one, [they] should not use techniques like [the sign and tenant notification requirements]. I think that was very negative." [OB6:39]*

Voice and Trust. The above perspectives should be viewed in light of decades of overall strained and adversarial relations between multifamily housing owners and the city. The principal tensions are about rent control, as operationalized by the RSB. However, repeated waves of progressive legislation about other topics such as energy efficiency, recycling, and parking have caused local property owner to conclude that city authorities like to pursue their policy goals without regard for landlords. Against this backdrop, the BSSO was seen as a continuation at best, or an escalation at worse, of an already negative pattern.

Many owners and managers I talked to were surprised that they owned an at-risk building, but not that the city would force them to pay for an expensive evaluation and try to publicly shame them into upgrading it.

> *"[People at the city] just hand out demands, basically. So either you follow the demands or you risk the punishments, the sanctions, and that's pretty much how they've been for all time." [OB29:41]*

> *"Dealing in this town, which is just one of the most difficult places in the world to do business for any number of reasons, both for legal and otherwise… we're just numb in some way, …at least I am, I just always expect the worst. I always expect some new bunch of crap to come along." [OB23:10]*

One owner felt that this law in particular typified the attitude or stance that the city takes toward owners on a large range of issues.

> *"The city of Berkeley treats you like a criminal. You are guilty first and then you have to prove yourself innocent." [OB19:70]*

Because there already exists such a poor rapport between owners and various city departments, when things went awry during implementation, there was little cushion of trust to fall back upon. While it is tempting to categorize such comments as mere grumbling, one owner/manager suggested several direct ways that the City's attitude toward owners and reputation of having many administrative barriers might have actually deterred owners in advancing to do a retrofit.

> *"I think there are a lot of owners that…will drag their heels [about retrofitting] as long as they can, simply because they don't want to deal with the city if they can get away with it. And, there's also owners that will say, 'I don't want to do anything except the bare minimum in this city because it's such a hassle,' and also because it costs more in this city because the contractors will say…I've literally had contractors say that, 'My bids are higher in Berkeley because I have to deal with the City of Berkeley'." [OB19:86]*

> *"[Some owners think] now that you've set it up this way, screw you guys. I'm only going to do what I have to do. I think Berkeley…[is] going to have a hard time because nobody wants to deal with the city. [Owners are] scared of the city, they're scared of the process, they've gotten all of these threatening letters. I mean you read these letters from the City of Berkeley…they're threats. Thousand dollar per day fine or whatever, some totally*

unreasonable, even their fine structure is so unreasonable."
[OB19:119]

Management by Improvisation. In Chapters 4 and 7, I discussed a variety of complaints that owners and engineer expressed about the city's customer service, its lack of preparation for handling concurrent retrofit proposals, and the troublesome ambiguities contained in the referenced code and the technical evaluation requirements and guidance. Unfortunately, this type of administrative "winging it" is probably inevitable in this type of small, novel, highly complex program. The idea that it was procedurally unfair to manage in this manner is unrealistic.

Benefits Commensurate with Costs

Three key ideas are important in determining whether the (re-)distributional outcomes created by a regulation are reasonably fair and just. First, the *scale* of the benefits should be roughly in line with the *type* of benefits. For example, we might judge a cost-ineffective regulation as reasonable if it protects what is viewed as a fundamental right, while the same degree of cost-ineffectiveness may seem unreasonable in a program that only addresses an information asymmetry with monetary implications. Next, the expected benefits should be spread widely enough that the program does not appear to privilege a small group of people over others. Third, the cost burden should be distributed among those who benefit roughly in proportion to their level of responsibility for the problem and/or their capacity to act or ability to pay.

Let us first examine the type and scale of the benefits, both realized and potential, created by the BSSO. As discussed earlier in this chapter, the BSSO was moderately effective in achieving its short term goal of facilitating a climate to promote voluntary retrofits and weakly effective at collecting and analyzing information about the community's soft-story problem to facilitate further action on the issue. The BSSO's longer term goals were to: 1) reduce the potential for injury and loss of life, 2) to increase the quality and resilience of Berkeley's multifamily housing stock, 3) to reduce the need for public services during and after a major earthquake event, and 4) to promote sustainability and resilience at the community scale and beyond.

Both the immediate and overarching objectives speak to fundamental community values and the rights of citizens to safety information about the places where they live and ultimately to safer housing itself. Again, that is important because the degree to which we expect the relative magnitudes of benefits and costs to match up may be diminished the more core issues of rights, morality, or ethical principles are in question. As a society, as long as appropriate democratic processes are used to make our decision, we can decide that some acts whose costs are greater than their benefits may be morally right. On the other hand, it is also impossible – both technically and financially—to seek absolute earthquake safety in housing. We ought to seek out policies that sit in a middle zone of the marginal benefit curve.

Longer-Term Potential Benefits. As a result of the law, about 76 retrofits were completed in four years – six times as many as occurred in the previous decade. Nearly all of these projects would not have occurred but for the law. Assuming 20 percent of the retrofit

buildings would have been unusable and demolished in an event with 0.63 chance of occurring in the next 30 years – but now won't be, with avoided losses of $1,500,000 per retrofit building – the total expected losses avoided would be $14.36 million dollars. This is a purely private benefit, so I represent it separately in the overall assessment.

Through these voluntary retrofits, the BSSO *may have* directly reduced existing life-safety hazards by reducing damage likelihood and severity – and especially collapse potential – on a building-by-building basis. The 76 retrofit properties represent just under 1000 units or around five percent of the total number of units in Berkeley multifamily buildings. If we assume 2000 tenants live in those retrofit buildings and 20 percent of those tenants would not have been able to return to their units post-event, about 400 people have been saved from post-event displacement. There is no guarantee that the tenants who were inconvenienced during the retrofit project will be the same people living there when the incremental safety benefit is eventually tested, but this certainly is an incremental improvement in safety for several hundred people.

How many of the buildings actually had residential uses or occupancy on the first floor is one factor to consider in assessing the potential of these retrofits to avoid injuries and lives. The only data available about that comes from the limited set studied by Bonowitz and Rabinovici (forthcoming), where nearly 90 percent (46/52) of the analyzed buildings had some occupied space on the ground floor. Figure 82 shows an example floor plan. Using the value of a statistical life currently recommended by the US Environmental Protection Agency (USEPA 2000), if these retrofits prevent just one statistical death[55], it would be a benefit of about $7.7 million (in 2008 US dollars).

[55] The term Value of a Statistical Life (VSL) reflects the aggregate dollar amount that a large group of people would be willing to pay for a reduction in their individual risks of dying in a year, such that we would expect one fewer death among the group during that year on average. VSL is calculated from survey or revealed preference evidence about individual willingness to pay for small changes in mortality risk.

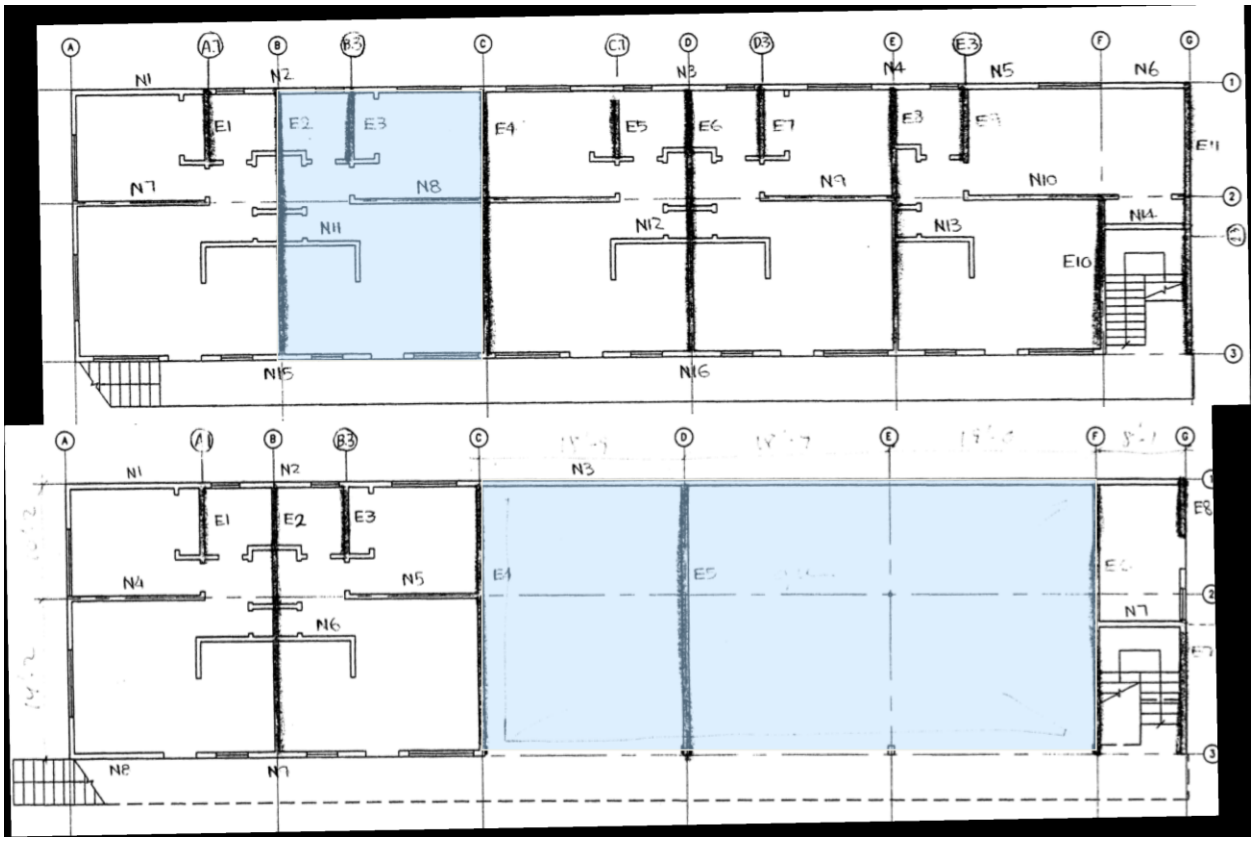

Figure 83. Floor plan of an example Berkeley building found to have a soft-story condition.
Note: The plan demonstrates the presence of ground-floor occupancy and the relationship of the large parking opening on long side of a rectangular footprint. The top frame shows the second story floor plan and the shading shows a typical unit space, while the bottom frame shows the ground floor of this two-story building and the shading shows the open parking area.

These retrofits may also lead to a modest reduction in the need for emergency response services such as fire suppression, police, and hospital services. After a major event, this would translate into decreased neighborhood blight and community uncertainty as owners struggle to repair and replace damages structures. Recovery from the event may also be eased, as there would be less need for recovery services such as building inspection or disaster relief (e.g., shelter & care for any tenants rendered temporarily homeless). With reduced damage comes the benefit of reduced building debris volume and associated clean-up costs. Thus, the BSSO produced a noticeable if modest direct increase in the overall resiliency of Berkeley's housing stock and community character.

Admittedly, the actual private and societal benefits from these upgrades hinge on the true degree of hazard previously present in those buildings as well as the design and quality of the retrofit work done. In order to make a complete estimate, I would need to collaborate with a structural engineer and do further research to determine the scope of the retrofits attempted, the new level of performance or improved safety achieved, and whether the retrofit work was appropriate and executed with high enough quality workmanship to actually improve building performance as intended. Even that analysis would still have a very wide error

band, if only because of the uncertainty about the earthquake. However, I set up the benefit summary here to err on the conservative side of all fronts.

Other Intangible Benefits. Another set of benefits created by the BSSO that are equally difficult to measure include the changes in beliefs and social norms. This program helps address a fundamental problem which is that the costs of not retrofitting are generally not recognized as such. The BSSO successfully educated local owners to the point that it may affect their long term buying habits and cause them to look more favorably on the idea of retrofitting other buildings and building types that they own. This could benefit the city of Berkeley beyond the soft-story issue and other localities. Another societal benefit is the individual and social utility of the information collected in the reports.

Also, BSSO proponents were conscious and deliberate in their efforts to establish a precedent – internally and for other cities – for local governments to take responsibility on this issue. Their aim was to develop a feasible policy mechanism to deal with the problem of seismic risk in existing buildings. Even if the BSSO did not have the power to improve the long-term resilience of Berkeley very much given that the number of affected buildings was so small, spread of the policy concept to other jurisdictions quickly occurred and is continuing. The City of Alameda passed a similar ordinance in 2009, Oakland passed a soft-story screening policy in summer of 2010, and San Francisco is making plans for a program as well. Other cities face fewer obstacles now that a precedent has been established.

The table in Figure 84 summarizes this benefits discussion and gives an overall total benefit estimate.

BENEFIT TYPES	BENEFIT QUANTIFICATION			ESTIMATE NOTES
Completed voluntary retrofits				
Reduced chances of injury or death (number of statistical deaths avoided)	0.63	$ 7,684,094	$4,840,979	Assuming one statistical life saved if a major Bay Area earthquake occurs with 0.63 chance in next 30 years.
Increased the quality and resilience of Berkeley's multifamily housing stock (expected number of buildings with collapse avoided)	9.6			Assuming 20% of the 76 retrofit buildings would have been demolished in a major Bay Area earthquake with a 0.63 chance of occurring in 30 years.
Decreased post-event tenant displacement (expected number of post-event permanent tenant displacements avoided)	252			Assuming 2000 tenants live in the retrofit buildings and 20% of those tenants would not have been able to return to their units post-event.
Reduced need for post-event emergency response services				No benefit estimate available.
Reduced potential for post-event neighborhood blight and community turnover				No benefit estimate available.
Reduced post-event building debris volume and other associated clean-up costs				No benefit estimate available.
Total Social Benefit Estimate (in year 2008 US dollars without discounting)			**$4,840,979**	
Private Losses Avoided (expected number of buildings multiplied by a damage factor reduced from 1 to 0.5)	4.8	$ 3,000,000	$14,364,000	Assuming 20% of the retrofit buildings would have suffered total loss but now will experience a 50% loss, with a replacement value on average of $3,000,000 per building.

Figure 84. Table summarizing types and estimates of potential benefits created by the Berkeley Soft-Story Ordinance.

Costs to Owners. The majority of the direct costs associated with the BSSO were imposed on the 317 affected owners, including the direct expense of preparing and filing the mandatory report as well as the time and hassle of going through the report review process or of proving they should not be on the Inventory if wrongly listed in the first place. Assuming an average cost of $4,000, the 203 submittals associated with approved reports and retrofits

would amount to $812,000 paid to local engineers. Non-retrofitting owners also paid a $585 filing fee per report to the city which was directly passed through to pay the contractor who did report reviews and associated plan checking, for a total of $74,041. (This fee was waived if the owner concurrently pursued a voluntary retrofit.)

Owners who decided to retrofit obviously expended even greater amounts, as summarized in Chapter 7, but they did so voluntarily so I will not count it directly in the social cost estimate. Additionally, some owners may have experienced welfare changes through the devaluation of either the unit rental price or the property in the local housing market. Even the perception or fear of these effects could translate into real monetary consequences; for instance, it could increase their costs or reduce their access to borrowing.

> *"This law did one thing. It took good profitable property and turned it into being a bad losing money property. That's all." [OB15:87]*

Although this effect may be quite real to the owner, it is not appropriate to include it in the net social benefit calculation. The BSSO (in general) identified dangerous buildings that shouldn't be occupied but looked like "good property" and revealed them to be what they were. The previous profitability of these properties misrepresented their true net value owing to an information asymmetry market failure.

Other Undesirable Side-Effects. The BSSO's potential contribution to community seismic preparedness was reduced in two ways. The retrofit "bar" was set so high – and in ways that confused many engineers –that some retrofit projects ended up taking far longer (i.e., two to three years as opposed to less than a year) than might have been possible. Also, some owners who might have retrofit to a lower standard did not initiate at all such a retrofit because it would not have taken them off the list. Tenants may have experienced some temporary inconveniences during retrofit projects, and they may or may not have asked for compensation for that.

Costs to the City. The financial burden to the city for the BSSO included the staff time associated with developing and implementing the proposal, the cost of managing two consultant contracts, managerial oversight, internal coordination, and the opportunity costs of other projects and work not pursued in order to make room on the agenda for a soft-story program. Program staff did not track or make any official estimates of these costs, but I estimate them as on the order of $700,000 dollars.[56]

Costs to the city eventually became a barrier to program success and continuation. Ultimately the City of Berkeley was either unable or unwilling to fully staff the program beyond an initial five year period. There were also some burnout and frustration costs to staff they struggled to implement the program on a shoestring budget with minimal support. Trying to fit in this kind of program on top of other duties proved stressful for the staff. The table in Figure 85 summarizes this cost discussion and gives an overall total cost estimate. I also give some

[56] Assuming a full time employee for five years earns about $500,000 and that the two contractors were paid about $200,000 in total.

hypothetical calculations of the potential lost property value to owners if indeed these properties are not "worth" less the amount it would take to retrofit them.

COST TYPES	COST QUANTIFICATION			ESTIMATE NOTES
Costs to Owners				
Report filing fee (paid directly to review contractor)	127	$583	$74,041	Assuming 127 approved reports submitted at $583 per report.
Report fee paid to engineer (includes non-retrofit properties)	203	$4,000	$812,000	Assuming 127 approved reports and 76 retrofit project plans submitted at $4000 per report.
Time and effort to comply or get de-listed for technical reasons				No cost estimate available.
Costs to City Institutions				
Program management	5	$100,000	$500,000	Assuming 1 FTE (full time equivalent) employee salary of $100000 per year for five years.
Service contracts for production of Inventory and Framework	2	$100,000	$200,000	Assuming $100,000 per contract.
Field inspection of signage, research, & analysis	0.25	$100,000	$25,000	Assuming 0.25 FTE (full time equivalent) employee salary of $100,000 per year for one year.
Total Estimated Public Costs			**$1,611,041**	
Private cost of completed retrofit work, low-end retrofit cost estimate	76	$44,712	$3,398,112	Assuming $3,726 per unit retrofit cost, 12 units on average.
Private cost of completed retrofit work, high-end retrofit cost estimate	76	$120,000	$9,120,000	Assuming $10,000 per unit retrofit cost, 12 units on average.
Other value and cost estimates				
Total value of 271 listed properties	271	$ 3,000,000	$813,000,000	Assuming a property value of $3 million.
Hypothetical cost to retrofit all 271 properties, low-end retrofit cost	271	$44,712	$12,116,952	Assuming $3,726 per unit retrofit cost, 12 units on average.
Hypothetical cost to retrofit all 271 properties, high-end retrofit cost	271	$120,000	$32,520,000	Assuming $10,000 per unit retrofit cost, 12 units on average.

Figure 85. Table summarizing cost types and estimates for the Berkeley Soft-Story Ordinance.

Distributional Outcomes vs. Stake/Responsibility. As seen above, two groups of beneficiaries – owners and the city – roughly split the costs while the other main beneficiaries -- tenants and other Berkeley residents and taxpayers – contributed only to a very small degree, if at all, and tenants only in the properties that were retrofit. For this and other reasons, study participants were disappointed that the city did not address the issue of helping owners find ways to pay for or recover the costs of a retrofit. The city did not use its available sticks, but it

did not offer carrots either. The lack of financial assistance exacerbated already tense relations between owners and may have further degraded trust.

> *"The city ordinance was very tough and I don't have a problem with it and I think it probably has motivated a lot of owners, but as I said before, on the other side of the coin, if you're going to have a tough ordinance, you should have a mechanism for recovery of the money." [OB7:48]*

Another thing some owners found perplexing and vexing was: if you accept that the hazard from soft-story apartments is real (as did most owners I spoke with), why didn't the city *require* retrofits of soft-story properties? As several pointed out, no one is made any safer by having an evaluation done. So, some owners ended up confused at the signal being sent – is the risk significant or not?

> *"What really annoyed me is, in the first stage, they said you had to warn all the tenants that this is a hazardous place but you don't have do anything. This is only devious…If this is hazardous, do the work immediately, if not be quiet." [OB15:26]*

The city, in effect, had chosen a policy path that put a burden on landlords but that offered no overtly *assured* consequences related to its stated public aims. Some even questioned the information collection goal, stating that the reports cost a lot relative to their usefulness and societal benefit. As one owner put it:

> *"I didn't get the feeling they really wanted to do anything [with the information being collected], it's just like a ploy to bother the landlords. I wasn't very happy with that." [OB33:16]*

This leads to a subtle point about the "reasonableness" of the BSSO. If the purposes of the law were to discover and verify a hazard and communicate it to persons who have a "right to know" or are in a position to take remedial action, then the degree to which the collected information is actually disseminated and used is important. In my view, making the results of the evaluations public in a variety of ways (i.e., the signage, tenant notifications, website list, and notice on the title) made the program theory logically consistent.

Summary Assessment of Regulatory Reasonableness

My overall conclusion is that the BSSO achieved a reasonable degree of balance between the burden that the program placed on property owners and the City's use of resources on the one hand against the societal benefits achieved on the other relative to other potential policies that could have been tried. In an important sense, however, the "success" of the law was borne out of a large risk. The quantifiable public benefits hinge entirely on the life

safety benefits of the voluntary retrofits. My conclusions would be different if very few voluntary retrofits had been initiated.

The nature of the benefits being pursued is also important to this conclusion. I believe fundamental issues including the right to reasonably safe rental housing as well as deeply entrenched market failures of hidden and asymmetric information are at stake. The city had legitimate authority and sufficient justification to tackle the issue and initiated action through a political process in which all parties could voice concerns. The approach was proactive but moderate and phased, seeking outside council from experts in the field and using well-qualified contractors who could be replaced if their performance was found lacking.

The idea of "phasing" worked in Berkeley's favor in two important ways. First, the credible threat of a second phase made the first phase more effective than it might have been as a standalone policy. Second, by bringing to light some potential weaknesses in the underlying assumptions used to justify the regulation, it created an opportunity for evidence-based improvements in engineering practice and improved public intervention experiments in the future. Advancing societal understanding of the issue is a major contribution.

On a practical level, the manner in which city staff went about constructing a list of targeted buildings was reasonable, if not very transparent or well-documented, and that was borne out by the relatively low level of false positives. Some affected parties were misinformed about how the list was created, which bred some resentment and distrust. The city could have been more open and proactive in communicating about the steps taken to create the list. Competitively bidding the opportunity to construct a target list or using more general criteria coupled with a simplified appeal process are two potential alternatives. However, given the existing state of relations between the city and rental property owners in general, even that may not have lessened the resentment effect. Some owners mis-interpreted the regulation as requiring them to do a retrofit, which proved a costly error on their part and ended up making the policy appear more successful than it might have otherwise been.

Policies that target specific building types will inevitably involve definitional compromises, ambiguities, and a compromise between the rates of false positives and false negatives. So what matters then is having straightforward, equitable procedures in place for owners that feel they have been wrongly treated to get their cases heard, dealt with, and corrected as appropriate in a timely manner. In that regard, the program was underfunded to deliver adequate services. The City of Berkeley did not anticipate the amount of time and difficulty associated with these tasks.

> *"I think that Berkeley's notoriously bad in terms of dealing as a city anyway. What they do is they create problems they're not capable of handling..." [OB31:43]*

The program measures in place – the Framework – did not deliver the hoped-for degree of consistency, either in the collected data or in the resulting analyses. Soft-story determinations could have been more consistent, and the city could have handled false positive cases more consistently. The absence of a process for handling false negatives is a fairness issue, but it is not an easy problem to solve. Lenient extensions granted later on disadvantages those who comply on time, and lack of enforcement can be seen as unfair.

Figure 87 compares four potential policy models that represent a spectrum from less to most coercive regulatory approaches to this problem: voluntary programs, mandatory screening, and mandatory evaluation. I assigned a subjective “favorability” score of low, medium, or high to each policy on each of the nine Reasonableness criteria. In the diagram, the favorability ratings are depicted with increasingly dark shades of gray to facilitate rapid visual assessment.

The advantages of a voluntary program appear to be the political feasibility, low administrative costs and relative ease of treating cases equitably. However, these factors are traded off against very low chances of resulting in on the ground change. Mandatory screening programs place less burden on owners than would a mandatory evaluation program and can collect some useful data, but have much more administrative burden than a voluntary program and still has very low chances of creating on the ground change.

As the Berkeley case demonstrated, mandatory evaluation can result in real on the ground change, build capacity, and collect important useful data. The main downsides are the administrative costs and difficulty, the burden on owners, the unpredictability of outcomes, and the lack of assurance of tangible benefits. Program management is resource-intensive and requires long term commitment and follow-through. Also, results may be sensitive to economic conditions and social perceptions, and thus could vary with timing and local housing market conditions.

A mandatory retrofit program would impose the highest burden on owners, so it requires the highest level of scrutiny in terms of the justification for public involvement and the fairness of procedures used. Technical findings from Berkeley's mandatory evaluation program may end up undermining the argument that local governments have sufficient technical knowledge to justify and execute a mandatory retrofit program.

	Notification Only	*Mandatory Screening*	*Mandatory Evaluation*	*Mandatory Retrofit*	*Insights by Criteria*
LEGITIMACY					
Authority	Government has sufficient authority to act.	Government has sufficient authority to act.	Government has sufficient authority to act.	Government has sufficient authority to act.	Local governments have sufficient authority to act on soft-story issues whether the program design is totally voluntary or fully mandatory.
Validity of Justifications/ Assumptions	Assumptions are well-supported by evidence.	Assumptions are moderately well-supported by evidence.	Some assumptions lack sufficient evidence.	Some assumptions lack sufficient evidence.	Some assumptions about soft-story conditions may be misleading and need to be re-evaluated or refined.
Viability/ Sustainability/ Adaptability	Easily affordable, operated, & changeable.	Challenging to afford & operate & requires moderate commitment.	Challenging to afford & operate & requires moderate commitment.	Highly challenging to afford & operate, & requires high commitment.	Programs that go beyond mere notification are relatively technical, lengthy, and "high-touch." Without adequate resources, they are potentially not worth doing at all.
PROCEDURAL FAIRNESS					
Transparency (of Processes and in How Decisions are Made)	Processes are somewhat easy to see & understand.	Processes are difficult to see & understand.	Processes are difficult to see & understand.	Processes are difficult to see & understand.	The diagnosis and targeting processes must be transparent and open. Owners and engineers need clear, vetted guidance in order to comply.
Equity in Treatment	Relatively easy to treat cases equitably.	Moderately difficult to treat cases equitably.	Moderately difficult to treat cases equitably.	Very difficult to treat cases equitably.	Consistent procedures are needed for handling false positives, false negatives, appeals, requests for extensions, enforcement, etc.
Accountability/ Learning	Low prospects for learning.	Moderate prospects for learning.	High prospects for learning.	High prospects for learning.	Sustained resources and follow-through are necessary to achieving long term objectives.

Figure 86. Table comparing four possible policy approaches to targeting high hazard building types at the local level on criteria of legitimacy and procedural fairness.

	Notification Only	*Mandatory Screening*	*Mandatory Evaluation*	*Mandatory Retrofit*	*Insights by Criteria*
COMMENSURABILITY					
Benefit Scale-Type Match	Low expected benefits relative to importance of benefit type.	Low expected benefits relative to importance of benefit type.	Moderate expected benefits relative to importance of benefit type.	High expected benefits relative to importance of benefit type.	Less intrusive, cheaper programs -- including mandatory evaluation -- offer little assurance of on-the-ground safety impacts. However, all program types can contribute to policy learning.
Distributional Outcomes vs. Stakes/ Responsibilities	Costs are appropriately concentrated relative to benefits.	Costs are appropriately concentrated relative to benefits.	Somewhat concentrated costs relative to benefits.	Costs are highly concentrated relative to benefits.*	The more a program requires an owner to invest, the more important it becomes to develop ways to share costs among all the stakeholders that benefit.

Ratings Color Key:

Most Favorable
Moderately Favorable
Least Favorable

** Assuming no increase in rent owing to rent control or market failure.*

Figure 87. Table comparing four possible policy approaches to targeting high hazard building types at the local level on criteria of benefit commensurability.

8.C – Program-Level Recommendations

This section highlights specific ways that Berkeley's soft-story program could be improved, as well as lessons from Berkeley's experiences for other communities that have a similar soft-story program or are still considering whether and how they might tackle the problem of soft-story apartment buildings.

Recommendations for Improving Soft-Story Programs in the City of Berkeley and Elsewhere

1. *Continued program success depends on institutional commitment, integration with other departmental functions, and maintaining a stable, technically-informed staff.*

In this type of program, staffing levels and the required skill sets will naturally fluctuate and evolve over time. Maintaining appropriate staffing thus requires special creativity and attention, particularly in light of civil service regulations or conventions (e.g., seniority rules) or public employee unions. One person may need to perform many functions, and it can be hard to recruit and retain precisely the right Jack (or Jill) with knowledge and skill in all the relevant trades. Berkeley's program manager had solid program management experience and knowledge of the housing sector. The owners and engineers I spoke with for the most part found him accessible and helpful. However, there were no engineers on city staff during most of the program's development and implementation, and this was at times a liability.

As a practical matter, public policy efforts on seismic safety in the existing or new housing stock are likely to outlast career episodes of key staff. That means *institutionalization* of the program is vital to delivering good customer service, sustaining focus, and retaining knowledge over time. This is something Berkeley was not able to do fully, but the opportunity is still there for the city to appoint a new earthquake mitigation program manager to oversee the program through to its final years.

Making this kind of commitment can be a challenge at the local government level, where earthquakes tend to be everybody's problem and nobody's job. Also, this type of program cannot realistically be structured to "pay for itself," as there is no dedicated funding stream like permit fees for these kinds of services. Especially in smaller cities, earthquake safety efforts are treated as a low tier priority or luxury item, scattered among departments such as police, fire, public works, public health, housing and social services that are traditionally oriented more towards preparing for disaster *response*. It is thus no surprise that prevention or mitigation efforts are usually unfocused and under-resourced. Berkeley's staffing struggles with the BSSO underscore the challenges of operating small, issue-specific program at the local level. But without such programs, the opportunity goes missed to deliver an important public service. In theory, mitigation done well could lower the overall amount of disaster recovery community development assistance eventually required, but because that dollar figure does not appear on annual budget there is no "fund" against which to borrow.

One alternative is to leverage the planning and policy development capabilities of regional government institutions, such as the Association of Bay Area Governments. Some program costs can be reduced for all jurisdictions if basic policy concepts are worked out first in "pilot cities" as part of a regional program.

2. *Increase the diversity of enforcement tools available and use them to penalize non-compliance, increasing the penalties over time.*

Some Berkeley soft-story owners were intimidated by the large dollar amounts listed as potential penalties on the notice and order letters they received. However, owners eventually became cynical about those threats because no fines have been levied yet. More credible than the threat of using large penalties would be a fine schedule with small penalties for foot-dragging on intermediate milestones and larger, but still credible, penalties available for serious cases of shirking. This is called the "atom-bomb" problem: only having a weapon too fearsome to actually use. Fees or penalties can also be structured to increase over time as key deadlines are missed. Also, by offering a limited window of opportunity for any special waivers of fees, the program can create a sense of urgency and give owners a specific "event" that keeps the topic salient and reminds them of their intentions to take action. Using enforcement tools against shirkers also results in some revenue and rewards owners who comply within the official timeline. The city could consider using larger fines for buildings with vulnerable populations or larger occupancies, such as over 20 units.

Another idea is to amend the regulation to include a small penalty for removal or improper upkeep of the signage and for each tenant notification not completed in a timely manner (e.g., a $50 fine per incident). By advertising the city's willingness to issue specific small, repeatable penalties, it emphasizes the importance of this aspect of the law to both tenants and owners. Small, cheap, certain, and quick punishments could prove more effective (Kleinman 2009).

The city should clarify when the signage and tenant notification requirements begin relative to the report appeal and compliance period, and how those provisions of the law will be enforced. Also, it remains unclear how the signage and tenant notification requirements are supposed to work for atypical properties, such as mixed-use/commercial buildings and for multiple entrances.

3. *Improve communication with and among engineers and owners regarding the technical standards, evaluation requirements, and how to get the most out of working with an engineer.*

To begin with, fundamental improvements and updates can and should be made the guidance documents. First, the Framework should be amended to address the list of issues not adequately addressed by IEBC A4 and by giving specific guidance on the list of building code parameters subject to wide ranging engineering judgment as discussed in Bonowitz and Rabinovici (forthcoming). Again, varying assumptions and methods that might be reasonable on a project-by-project basis where each owner's priorities set the scope (and where *caveat emptor* applies) *do not* promote the city's goal of creating consistent, comparable data for technical learning and policymaking purposes.

Another way to improve the average report quality and reduce quality variance would be to provide both owners and engineers with one or more example complete reports to demonstrate what a high quality submission looks like. Taking this idea even further, the city

could even provide several template reports for various "prototype" soft-story buildings to help both owners and engineers anticipate the procedures, calculations, assumptions, information presentation, and outcomes expected or involved.

The city could also consider offering technical advice sessions for owners and their engineers by request, particularly to resolve cases which have been problematic. This would be a chance for a sit-down meeting to negotiate and answer questions related to the needed analysis and possible retrofit strategies. For owners seeking removal or reconsideration, this could function like a "hearing".

Finally, owners have trouble knowing whether their engineer is doing an adequate job. While a city may wish to remain neutral and not recommend specific engineers to owners, it should make it clear to owners that choosing a less experienced or non-structural specialist to complete a report might make it more likely that the report will need multiple rounds of review, possibly resulting in a higher overall cost.

In some cases, owners might not understand why their report is taking so long to be approved. To remove doubt about the source of delay, owners should receive copies of any and all critiques of filed reports and have access to information about all back and forth correspondence. Along these same lines, owners could use additional signaling information about which engineers have specific, recent, and/or extensive expertise in seismic or soft-story evaluation and upgrading. One option would be additional "specialty" lists or certifications from local professional associations, as long as the organization shows adequate commitment to ongoing evaluation and improvement of both the recommended analytical procedures and training those engineers to use the most up to date approaches.

Another option would be to facilitate an online information marketplace (perhaps through an existing platform such as Yelp.com, Angie's List, or ServiceMagic.com) for owners to rate how satisfied they were with the engineering and contracting services they received. However, it is worth noting that "customer satisfaction" might be a misleading: an engineer or contractor with excellent customer service that does a project inexpensively and on time might still do (invisibly) improper workmanship.

4. Promote even greater transparency by facilitating information collection, flow, and analysis.

While it may already be true, some owners may not be aware that the reports, once approved, are public information, meaning that they are or should be accessible to potential buyers, current or prospective tenants, mortgage brokers, or any other member of the public who asks for them [OB23:38]. The city could do more to facilitate access to the report information. Currently the law specifies that the reports must be filed in duplicate in paper and as a .pdf files on a CD. However, the information is not at all available for easy searching and retrieval. The city should consider creating an online form for owners and engineers to submit their reports, with basic information already populated from the City's database (and available for easy correction).

Similarly, information being collected regarding proposed retrofit projects should ideally be in a searchable database linked to the active building permit database so that status can be tracked. Cities should establish a database process for tracking seismic retrofit work at the building permit stage.

One way to improve the tenant notification process and reduce service redundancy would be to empower the Rent Stabilization Board to annually announce to tenants on their allowed rent adjustment notice whether they live in a listed building and the BSSO compliance status of the building they live in.

5. Find more intangible, indirect, and "in-kind" ways to ease the path to retrofitting.

First and foremost, owners urged city staff to be compassionate and remember that owners are human beings. In nearly all cases, the current owner did not know about any earthquake hazards with their property. In that sense, they too are "victims" of the situation and should not be treated as "criminals".

The owners I spoke with also note that city policies ironically seem to make doing a retrofit even harder than doing an average building project, even though a retrofit is what the city really wants them to do. In response, they urge the city to "make it as easy as possible". Above all, one owner stated:

> *"Make it easy for us to get to the people who can help us resolve issues, whatever that might be. [OB35:38]*

One small thing the city could do is collect and disseminate data that helps owners get a rough sense of what a retrofit might cost for their property. Providing a voluntary form on which owners can submit this data when they submit their reports would be the easiest way to acquire approximate cost information. Whatever cost data the city is able to acquire could then be presented by building prototypes or profiles that owners can quickly match to their own circumstances. Outside regional governing agencies (e.g., ABAG) or professional organizations (e.g. , EERI or SEAONC) might be able to help assemble and interpret this type of information.

The city also has the power to lower retrofit costs without compromising the level of safety achieved by providing more flexibility in its approval process for retrofit building permits. For instance, the city could rewrite the law to allow freedom from the traditional parking requirements or to allow larger latitude in terms of the configuration of the building (i.e., removal of units) to allow the most inexpensive retrofit possible. In more rapidly growing cities, development bonuses could be given, such as allowing additional units to be constructed (e.g., by waiving zoning or use codes without going through or via a streamlined variance process).

Along these same lines, the city could also streamline and expedite the process of getting approval for a retrofit that will get the owner removed from the Inventory. With improved information management support, the city could create a process for concurrent tracking of evaluation reports and permit applications. It could also lower the bar regarding the evaluation analysis required for those properties. By imposing a penalty or requiring completion of a full report if the retrofit project is not completed within two or three years this could even help encourage more people to retrofit and to follow through on their intentions to do so.

The city should support the efforts of FEMA and engineering professional organizations to develop a program to label seismically-upgraded properties and help educate tenants about

the value of renting in retrofit buildings. The city can also lobby the state and federal government to make money spent on seismic evaluations eligible for special tax deductions[57].

6. *Find small (and large) ways to incentivize and help owners finance retrofits. Ideally, all owners should be eligible for some help, while some properties (who can demonstrate an exceptional level of need and/or public benefit) may be eligible for deeper subsidies.*

In my interviews, owners did not seem to be looking to escape all financial responsibility for doing a retrofit. They just want some assistance from other stakeholders that benefit – from tenants, the city, or preferably both. They had two basic arguments as to why that would be fair. First, tenants benefit from a retrofit but may not have to pay more given current rent control laws. Second, because the city is essentially forcing them to do a retrofit, owners are not entirely free to do it on their own timeline or to the degree that makes sense to them individually. Owners were especially concerned about having access to some financial help if doing a retrofit is legally mandated, although opinions about this varied depending on the chosen timeline for the mandated repairs. If the timeline is long, for instance ten to twenty years, many owners I talked to thought it would be reasonable to ask owners to take a loan or come up with their own savings plan in order to fund the work. (Some owners might simply make a business decision to sell the property, but that time window at least provides them a reasonable period to pay off their current mortgage).

The non-institutional owners I spoke with largely focused on amending Berkeley's rent control policies. That would necessitate either raising the legal net operating income allowance or letting owners do a special pass through to pre-decontrol tenancies. A common suggestion I heard was to allow owners to pass the costs through to tenants at a modest rate (e.g., not more than a 5 percent rent increase) for a ten year period. As one owner/manager stated, it would be up to the owner whether to raise "market" tenant rents and risk a vacancy, but probably most would only raise rents on the de-control tenants in their buildings and only in an amount that would be their per unit "share" of the building's total repair cost. The repairs, this person argued, mostly benefit longer term tenants anyhow, who have "made these units their homes" [OB34].

While large scale policy changes to rent control might be politically difficult to achieve, there may be other smaller changes that could help. While it may seem trivial, the $150 per unit per year registration fee for Berkeley rental units affected by rent control is a major annoyance and symbolic source of grievance. The city could consider approaching the Rent Stabilization Board about offering an indefinite or temporary discount or waiver of the RSB annual registration fees to owners who make eligible seismic safety improvements exceeding a certain cost. This could be a great way to focus the attention of ***all*** landlords on seismic safety and to publicly reward those who take action. The financial amount might not be large, but the gesture would be very appreciated and noticed.

Another idea is to shield owners from rent reduction appeals from tenants for inconveniences experienced during retrofit projects or needed temporary relocations. Or, if a

[57] It may be already as a "business expense".

special fund could be created to pay for or help offset those types of project costs, it would reduce overall costs to owners, and reduce cost uncertainty at the outset.

Through the interviews, owners provided other creative financial incentive suggestions. Some landlords were aware of the city's loan fund for solar panels, and suggested that a similar model made sense to them for earthquake retrofits.

> *"If the city were to offer low interest loans, [like] they have a program for putting solar panels on your house or other green stuff where if you take out the loan and the loan is paid back as taxes so it can be deducted from your income tax. That type of program would probably be good for this type of situation". [OB25:54]*

Another owner suggested expanding the existing transfer tax rebate program to make it more useful for multifamily owners by increasing the percent rebate for properties with 5 or more units and lengthening the period of time after a sale in which expenditures can be made. Another owner suggested that the city offer a schedule of incentives that rewards owners for going beyond the minimum level of repair. Namely, the types or amount of subsidy an owner received could be tied to the amount spent or the final expected performance level of the building.

In designing an incentive program, providing a package of incentive options will help the maximum number of owners and owners of different types. Ideally, every owner would be eligible for some type of help to do a retrofit, but with more aid set aside for owners who can demonstrate a higher level of need, public benefit, or both. Overall, the owners I talked to showed a willingness to accept financing help to which access was limited.

> *"For those owners who couldn't afford it, who couldn't borrow money, the city could lend them money and help with the costs on a lending basis." [OB27:62]*

> *"This would be like any, any public assistance program…people have to be screened….If the building you're looking at doesn't have a mortgage, for example, you give them less money. You could let the owner make the case, for example, make the assistance contingent on looking at their tax returns… I'd be willing to open up my books if I'm gonna get money for the building. Now, let's face it, once these buildings are retrofitted they're worth more. These should be loans, they should not be grants, or the [owner] should repay the money. The idea [behind providing government financial help] would be to get the work done as soon as possible." [OB37:56-58]*

An incentive program with restricted eligibility, however, must include a fair and practical operational definition of an "owner that cannot afford to retrofit." Owners have an

incentive to exaggerate their level of hardship if asked that question directly, and we don't want to create public programs so generous that we crowd out individual initiative or frugality, or even worse, reward bad business practices. According to a recent RSB analysis (Board 2011), about one fourth of Berkeley soft-story owners may be in a position that they cannot independently access enough capital for a retrofit. That problem is most likely among the twenty seven percent of buildings (54 of the 198 who have not already initiated a retrofit or otherwise been removed from the Inventory) that were purchased or refinanced during 2003 to 2008, the peak period of the recent housing bubble. One strategy might be to establish and recruit owners to an incentive advisory council so that decisions about how to allocate limited public assistance can be guided by property owners themselves.

Owners also expressed concern about fairness over time. One owner/manager suggested that whatever financing incentives were made available, the resources should be made open to as many different building types and sizes as possible (e.g., buildings with demonstrated seismic safety concerns beyond just soft-story and with less than five units should also be eligible). Also, interviewees insisted that any financing or incentive programs that are established should be made retroactive for some reasonable period of time. Otherwise, early retrofitters would be in effect excluded from public assistance and penalized for acting sooner.

The Institutional Representatives I spoke with said that public funding programs could be important to their ability to complete retrofits in a timely manner. Deeper subsidies may be necessary to address properties that serve poorer tenants. The city should look beyond its own resources, partnering with state and federal programs to assure that affordable housing is also safe housing. One interviewee (from a non-profit institution) suggested establishing a retrofit finance "vision" committee that had representatives from real estate, banking, and the various interested city departments. The committee would be tasked with coming up with feasible options for how to address the needs of owners who need help arranging financing or otherwise cannot afford a retrofit on their own [OB12].

Advice for Other Jurisdictions

Other jurisdictions are likely to find Berkeley's experience inspiring but cautionary. On the positive side, Berkeley proved that a strong local soft-story program can be established at reasonable cost and that such a program can motivate a significant number of voluntary retrofits. The BSSO program model is now out there and ready to be applied or adapted. Legally, the BSSO set a precedent and developed technical procedures that ease the path for other cities.

On the other hand, the BSSO exposed several weaknesses in the chain of assumptions and justifications that underlay this type of law. Furthermore, Berkeley's experiences show that a program that goes beyond simple inventory and notification can be challenging to implement. Soft-story programs that go beyond inventory and notification are relatively technical, customer service-intensive, and likely to last a long time. To maintain regulatory reasonableness, program activities should be performed in a thorough and timely manner. The program budget must include external assistance with report and permit reviews, field checks,

processing of appeal and removal requests, as well as time to counsel owners, manage contracts, and provide technical assistance. Thus, this is not the type of program that can be easily run well by distributing smaller duties among persons with other competing job responsibilities.

Berkeley also had several advantages in passing and operating a program that might relate to the outcomes it achieved. The local government culture is supportive of innovation, and Berkeley voters are often willing to experiment with progressive legislative ideas. Berkeley is also a rent control city with a constant flux of student renters and a relatively active and close-knit rental housing community. Cities without a big university nearby *might* experience larger decreases in property value than Berkeley owners experienced. As one owner speculated:

> *"I haven't seen as much of a devaluation as I was expecting. But again, that's because they're isolating this specific thing. You take this ordinance to El Cerrito, you take this ordinance to Alameda to Walnut Creek, you're gonna see buildings that are wiped out, you know, unless you spend and invest tons and tons of money." [OB23:37]*

Cities with larger overall inventories of soft-story apartments (such as Oakland and San Francisco) may face larger program costs and better organized political opposition. The fraction of soft-story buildings that are condominium properties (be they owner-occupied or rented out) could also affect how a mandatory law plays out. Additional policy and communication measures might be needed to effective reach and help that particular owner audience deal with this issue. Perhaps a system could be set up to help counsel and mediate disputes that arise among condo owners.

For those cities not yet ready to officially target suspected high hazard earthquake housing, there are low-cost ways to encourage voluntary retrofits without mandating anything. Basic data collection is a good place to start. By collecting consistent data about the seismic-related upgrades being done, that information can then be used to understand the state of the city's building stock. Such data also enables a city to publicly encourage, applaud, and build relationships among citizens and businesses that are willingly stepping up to address the problem. For instance, a city could laud all retrofitters on an "Earthquake Safety Heroes" list on a public website, or honor them at an annual community event. Such activities would help make retrofit behavior more public, recognized, and positive.

Another goal is to get small business people that have retrofit talking to those who haven't. Along these lines, a city could team up with local property owner associations, engineers, and contractors to plan retrofitting "workshops" or neighborhood "success tours". Local owners who have done retrofits could sit on a panel or in small groups with other owners who would then hear and ask questions of their peers about specific retrofit experiences. Local engineers and contractors could set up tables and do marketing after the general meeting.

Berkeley's experience points out the importance of implementing fair and transparent procedures, starting with a properly documented targeting process and application of well-tested diagnosis criteria through to the administrative processing of appeals and correcting the

list over time as more information comes to light. The appeal process should be clearly spelled out up front, with information on the removal criteria, acceptable forms of evidence, and approximate time frames within which responses can be expected. Special care should be taken to communicate that buildings retrofit in the past might still need to comply, and to make sure that the diagnosis process utilizes that information. Owners and engineers also need clear upfront information about the scope of retrofit that can get the building off the list.

Adequate customer service and case management are contingent on having sufficient staff resources to process inquiries, submissions, and appeals efficiently and fairly within a reasonable time frame. One owner recommended that cities appoint an Ombudsperson who can mediate minor disputes. Another aspect of procedural fairness is to give owners a generous amount of time to incorporate the new regulatory realities into their plans; ten years is probably a minimum. However, it is important to warn owners that their liability exposure may still be increased, even if the compliance window is not yet over[58].

Because action cues are important, cities should budget for sending owners regular reminders and communications. I recommend using both positive ("Be among the first to get your building off the list") and negative ("Fees for filing your report will increase to $1000 unless you submit your report before January 1, 2015") messages.

Regarding the technical aspects of the law, cities are not limited to taking the approach that Berkeley took in asking owners to find their own engineers. A jurisdiction could either certify a special group of practicing engineers to do inspections, screenings, or reports, or hire engineers on contract to perform the evaluations and then bill the owner. These solutions could improve report and analytical consistency, but have downsides in terms of the perceived fairness and relationship-building and trust benefits of having owners select their own professional. Preparing an evaluation template or a set of example completed evaluations for a few prototype structures and pilot-testing the evaluation guidance documents could reduce the cost of the engineering evaluations, improve consistency, and increase the information collection benefits of the policy.

<u>Broader Lessons for Motivating Precautionary Behaviors</u>

Below I briefly discuss five potential universalities pointed out by this case regarding how to effectively motivate private precautionary behaviors. Each of these points is relevant to the problem of seismic risk in existing buildings, but also transcends this topic and could apply to risk communication and risk reduction programs more generally.

1. *The most basic step in motivating private precaution is to compel engagement with the issue, which is something quite different and deeper than "providing information" or "creating awareness."*

[58] In an important legal precedent in 2010, a California court awarded damages for negligence against a property owner regarding the deaths of two persons owing to falling rubble in an earthquake even though the period for taking action to remedy known seismic vulnerabilities had not yet elapsed according to the local ordinance. See: *Myrick v. Mastagni* (2nd Dist. 2010) 185 Cal App. 4th 1082; 11 Cal. Rptr. 3d 165.

Action cues seem especially important in getting people to deal with threats like earthquakes that are infrequent, cumulative but threshold-driven, or otherwise hidden and latent. Without spontaneous stimuli from their internal psyche or the physical world to engage an individual's attention, people have naturally come to depend on culturally- and socially-constructed signals from their social networks and environments. It's important to discover and link risk communications and intervention programs with decision "moments" that have a natural nexus with the recommended action. In the case of building safety, such moments could include property searches, property purchases, major renovations, financing or re-financing inquiries, and property sale — or, for example regarding vaccinations when someone signs up a new pediatrician, when a child enters school, or when an individual gets new health insurance through an employer.

2. *Individual reliance on social signals adds special challenges, and creates special opportunities, for risk communicators.*

Ignorance of both the threat and the recommended action is undoubtedly a factor in the low uptake of precautionary behaviors for many risk problems. Not believing that the action will help is also a problem, as fatalism often leads to denial. To address these issues, interventionists generally have turned to communication because it is often the cheapest and least coercive form of intervention (O'Hare 1982). However, the BSSO case shows that lack of prior information about the hazard and what to do about it may be closely linked to a lack of social signals to attend to a risk and lack of perceived social consequences for not doing so. Also, when people see others shunning an available remedy, it offers a kind of "social proof" for the belief that the remedy is ineffective.

In this way, low-probability high consequence risks may represent a decision context where factual hazard and action-specific information in isolation are relatively less effective in instigating beliefs and behavior change. Social factors may be reinforcing patterns of ignorance among network actors and keeping general risk communications and marketing efforts from penetrating. New information may be dismissed as individuals encounter contradictory evidence. The importance of the social setting in individual decision heuristics might also help explain the why risk personalization is so challenging. If public information campaigns present a risk too broadly, it is easier for individuals to persuade themselves that the threat doesn't apply to them.

The power of social perceptions to affect information search, receipt, processing, and persuasion represents an opportunity to re-think how risk communication campaigns are designed. Thinking back to the four influence factor diagram, we see that many types of information are involved in belief formation and change. All of them are potentially important to establishing personal relevance and intention to take action about a hazard. But, social perceptions may play a double role as both a *source* of motivations and as a *suppressor* of motivations arising from the other information types.

Risk communicators would be wise to focus more effort on understanding the temporal and contextual dynamics of belief and behavior change, with a special emphasis on the roles played by social perceptions. This might expand the risk communication tool kit and make some

of the existing tools work better. In general, we should try to come up with communication campaigns and public interventions that:

- Collect, distribute, and improve the flow of *all* information types among key stakeholders;
- Find ways to make the recommended behavior more public, recognizable, and positive;
- Find ways to use existing social pathways to deliver hazard- and action- focused information;
- Identify and deconstruct common myths about the social context (not just myths about the hazard);
- Create new organizations or events to give opportunities for people and organizations that haven't undertaken the behavior to interact with those that already have;
- Get third parties involved, perhaps even training them to market their services more skillfully;
- Link risk information to existing social groups with which target individuals already self-identify (e.g., a professional organization) or feel a sense of duty (e.g., being a parent).

At some point, informational interventions bump up against reality. It does no good, for instance, to assert to an owner that retrofitting their building will make it more valuable if the experiences of owners are to the contrary. Regulations – even those that impose relatively modest burdens — can be powerful because they can literally *re-configure* the social setting. As in the BSSO case, regulations can raise the social benefits of taking action, remove obstacles to taking action, and add additional social costs to inaction.

The social "messages" sent by the Berkeley were quite successful. The credible threat of a second mandatory phase had a big influence on getting some owners to take action immediately, and once some did that others started to feel like they too would have to take action eventually because the market norm was shifting. People may feel more able to predict the behavior of politicians than natural forces. Therefore, discussion of the threats of future consequences caused by *human factors* related to a hazard may be more influential than discussion of the threats of future consequences caused by the hazard itself. Beliefs about the social setting can also override remaining doubts about the threat and action. On a cautionary note, however, this means that risk communicators must be extra careful not abuse the power of social marketing.

Overall, there was no single reason or pivotal factor behind their decisions other than loose notions of "self-interest" and "doing the right thing". The economic advantages and disadvantages that owners perceived and/or emphasized in their choices were also heavily informed by the social context. But when I say that "social setting matters," I do not mean that people will do whatever their peers are doing or what an authority tells them to do. Nor am I saying that we can neglect to discuss the threat and the recommended action. In the BSSO case, even though social perceptions were important, people appeared to use a rough "cost-benefit" logic when making decisions about whether and how to improve the earthquake performance of their properties.

3. *Risk communicators need to "know their audience," and that includes understanding its diversity and dimensionality.*

Research has established that risk communication works best when experts understand and speak to the *missing* or *mistaken* aspects of the views held by their audiences (Morgan, Fischoff et al. 2002). In that sense, it is important to create a conceptual model of how the target audience thinks about the problem before embarking on any intervention program. This should be done, if possible, by collecting belief information directly from a sample of individuals in the target group and double-checking the model with stakeholders before using it. The BSSO case emphasizes the need to include *social* perceptions in this type of conceptual model.

It is also important to consider the variation inherent in any audience. The diversity among the 317 owners affected by the BSSO is an excellent reminder that private actors carry with them a wide variety of motivations, aspirations, tastes, values, skills and resources. The potential of individuals to attend to, incorporate, and apply new information in their decisionmaking may even be influenced by things like personality, not just past experiences and prior beliefs. As a result, there is will always be natural variability in receptiveness to new information and the capacity and will to act on it.

4. *Risk communication effectiveness might be increased by using a mix of both positive- and negative-framed messages.*

There is long-standing debate about whether precautionary actions are better motivated by negative or positive messages. The Berkeley case adds evidence to the notion that different messages might be more effective with individuals in one stage of behavior change or another (Weinstein, Lyon et al. 1998). Also, I found some support for the idea that message valence might interact with social setting or personality factors. Ultimately, this means there might be value in using messages of *both valences,* either simultaneously or in sequence.

Negative messages might be more powerful, for instance, at getting people to pay attention and regard a risk as relevant and serious. However, once people become convinced that a hazard exists, additional negative messages may just breed avoidance and denial unless a person is also convinced that feasible remedial actions are available. Positive messages seem more appropriate when discussing action-taking. But referring to benefits of an action that are uncertain and distant in time may not be as helpful. Talking about near term downsides of failing to act, although a "negative" message, might be more persuasive.

This discussion touches on the importance of being careful and deliberate with terminology. My conversations about earthquake mitigation with owners involved a certain level of verbal awkwardness because the terms "structural mitigation" or "retrofit" are not words naturally used often by this group. It wasn't that they didn't know or understand what those terms mean, rather that study participants didn't spontaneously use them themselves. Instead, when discussing their experiences doing or thinking about whether to do a retrofit, managers and owners were more likely to use terms such as "job", "project", "improvements", or "upgrade." Over time, I shifted my language when asking questions about retrofits to refer to it as "the recommended work."

5. *Ambiguous rights and responsibilities among stakeholders may contribute to the persistent status quo lack of precautionary action.*

Clarifying the rights and responsibilities among stakeholders could further motivate individual property owners and tenants to factor the reality of earthquake vulnerabilities in existing buildings into their decisions. Because mitigation choices can, in aggregate, have large societal implications, it is useful to consider alternative ways of clarifying expectations among the parties involved. The issue of who's responsible for earthquake hazards in existing buildings —and who should pay to remedy them— is an obstacle to individual action and to policy formulation. An overt conversation at the state or federal level about creative and explicit ways to allocate the burden among stakeholders might help. For example:

Most of the soft-story buildings in California were not originally "engineered" – they were constructed under the building codes in use at the time of construction. When an engineer analyzes a building and prepares potential plans for an upgrade, she may take on liability by "touching" the building, no matter how narrowly the service contract is written. The scope of that liability could be prescribed by legislation in such a way as to make engineers more willing to do seismic evaluation and retrofit projects.

- The state legislature could adopt legislation to make it explicit how the law regards seismic safety in regard to the "habitability" of a rental unit.
- The state legislature could pass new rent control legislation to allow pass through (over a set period of time, and perhaps with protections for special classes of tenants such as seniors or low income) of retrofit costs regardless of the net operating income caps that local governments may have in place.
- A new state law could make explicit that which is probably already true: a property owner can be held liable for injuries and damages to personal or business property that result from structural damage at that property in an earthquake, regardless of whether the owner is aware of prior structural vulnerabilities or deficiencies in their property or not. If the mortgage holder is also liable, that will motivate serious attention to this issue. However, it is important that liability laws not deter building owners from becoming informed about issues their property might have. Ignorance of seismic safety deficiencies should not be a protection against liability. It might be useful to give owners some legal protection during a reasonable delay period between when they first learn that their property might have an issue and when they are able to complete an upgrade.

Finally, another clear way to get the attention of rental property owners is to amend the federal tax code to require proof of some level of seismic safety code compliance in order to maintain eligibility for a 1031 exchange[59].

[59] Under Section 1031 of the United States Internal Revenue Code (26 U.S.C. § 1031), the exchange of certain types of property may defer the recognition of capital gains or losses due upon sale, and hence defer any capital gains taxes otherwise due. The properties exchanged must be held for productive use in a trade or business or for investment and be of "like-kind."

8.D – Conclusions and Final Thoughts

The BSSO constitutes the most comprehensive intervention experiment to date aimed at pressuring property owners to take action about seismic vulnerabilities in existing buildings. Two additional things made it a worthy topic for an in-depth case study. First, the BSSO was passed 16 years after Loma Prieta, which contradicts the common assumption that major shifts in earthquake policy only happen immediately following a major seismic event. Second, even though the law did not require owners to complete a seismic upgrade, over twenty percent voluntarily took that costly extra step.

I had two specific aims for this study. The first was to document the history and implementation of the BSSO, focusing on key policy actors, decisions, and events. To that end, I interviewed 22 key stakeholders involved in developing and carrying out the policy. Regarding the unusual timing of this policy in the disaster cycle, I found that this exceptional instance of policy entrepreneurship was made possible by the proactive culture of the Berkeley city government, as well as the many connections its staff had with local experts who offered countless hours of volunteer assistance. A trio of internal policy advocates patiently kept the issue alive until the political and economic conditions were favorable. Along the way, the policy concept evolved into a mandatory evaluation law.

The second aim was to explore the economic, risk perception, social influences, and individual personality factors contributing to owner beliefs and behavior regarding earthquake mitigation in this context. Using qualitative and quantitative information collected through 43 semi-structured in-depth interviews, I explored how the law influenced structural mitigation behavior. The key overall finding is that the law transformed both individual beliefs and the social context surrounding owning a soft-story property in Berkeley in ways that effectively promoted voluntary retrofits. In total, 76 retrofits were initiated from 2006 to 2009, which is six times the number completed from 2000 to 2005.

Ironically, having to comply with program requirements probably added to the difficulty, complexity, and costs already involved in doing a retrofit. Some owners evidently became so determined to get off the Inventory that they persisted in the face of these complications and escalating costs. It is possible that the extra scrutiny the retrofit plans received as a result of the program provided better assurance that retrofits were *designed* properly, but the program offered no extra protections from shoddy workmanship in execution. The long-term benefits of these retrofits are not yet known.

Berkeley's greatest hurdle in implementing the law was the development, communication, and consistent application of technical standards for the evaluating engineers to use. The city's secondary goal of analyzing the technical information it collected to help justify and facilitate the passage of a mandatory retrofit ordinance is not yet realized. Other cities face fewer obstacles now that a precedent has been established. However, the challenges of running an effective mandatory evaluation program are now more evident. Earlier in this chapter, I highlighted key implementation-related challenges and recommendations that the City of Berkeley and other jurisdictions can use to improve on or adapt Berkeley's program model.

I also laid out three criteria – legitimacy, procedural fairness, and commensurability – and used them to assess the "regulatory reasonableness" of Berkeley's approach relative to

three other possible approaches ranging from voluntary program to a mandatory retrofit program. I concluded that the program was reasonable and probably cost-effective from a societal point of view, but it did bring to light several issues about hazard evaluation and analysis that constitute real, but not insurmountable, challenges for future mandatory retrofit programs. The concept of a "reasonableness assessment" is broadly relevant to other health and safety policy settings where formal cost-effectiveness analyses are either not possible or desired.

Strong causal conclusions are not appropriate from this study design, but I did find evidence that the BSSO activated all four of my hypothesized Influence factors for belief and behavior change. From the narratives of the interviewed owners, it appears that the altered social context – instead of altered beliefs about the risk or increased capacity to take action – was central to the degree of success that the program was able to achieve. And, the evidence of program success is not just the many voluntary retrofits completed. Nearly all Berkeley soft-story owners now know a rental property retrofitter and think it's better to be one, even if they still have doubts about the earthquake risk or mitigation effectiveness. Implementation of the law was cut short by budget shrinkage, the 2008-2011 economic downturn, and the retirement of key personnel. Still, the BSSO represents an intriguing alternative policy path towards long-sought but elusive attitude, behavior, and policy change regarding earthquake safety.

Finally, the BSSO case affirms that opportunities for policy change exist outside of major earthquake events. However, it also highlights the need for seismic safety advocates and experts to develop and test out workable policy ideas in the interim. Post-event outrage may aid in stakeholder involvement and the allocation of attention, money, and will to an issue, but may not be a very constructive setting for policy deliberation and design. Incremental learning and long-term data collection efforts are key to enabling policy change moments. Benefits of policy experimentation. Just a handful of individuals took advantage of the favorable setting in Berkeley and worked hard for years to cultivate a politically attractive and technically sound policy proposal. On a tight budget, the program certainly had flaws, but the Berkeley Soft-Story ordinance created a learning opportunity that simply would not have been possible otherwise.

Reflections on the Research Process

Because this is one of the few in-depth studies ever attempted regarding earthquake preparedness and mitigation decisionmaking, it is worth noting several limitations and challenges encountered during the course of the project.

One of the fundamental methodological issues in this study is the difficulty of defining who or what is an "owner." I immediately encountered a mismatch between the relevant decision and behavior theories – which pertain to *individuals* – and the reality of property ownership, where I found a wide range of ownership types represented in the target population. Therefore, the hypotheses and data collection instruments were geared to "individuals" while the data clearly reflect the responses of people holding a range of different roles, authorities, incentives, and relationships to each property. However, it was not possible to shift the study methods to account for this part way into the research.

With more advanced planning, I could have either limited the inquiry to a more homogenous subset of "owners", or developed different approaches to reach and understand the thinking and decision processes of owners of different types. Certain this diversity makes the small sample size of this study even more problematic in terms of making comparisons across even smaller groups.

Some ownership types present special barriers to identifying and accessing the true "decisionmaker," "decisionmakers," or "decisionmaking process." This led me to interview some property managers who were empowered to act as decisionmakers on the behalf of the owners. I was not able to find or interview any of the six small business pre-law retrofitters I identified, even though that is an important sub-group to understand.

Another challenge was how to assess and makes comparisons among the very large range of variables and measures used, both qualitative and quantitative. By setting out to study all four influence factors, I had to cover risk perceptions, social perceptions, and individual differences (including demographic traits, personal background, and personality). Although I tried not to duplicate content between the survey and the interview, both were fairly long. I ended up with a daunting array of observations and yet the interviews were still too brief to cover all topics in depth with each owner. In trying to take advantage of the benefits of both types of data collection, I added to the richness but probably reduced the overall clarity of the study findings, particularly from a quantitative point of view.

In approaching and recruiting potential research subjects, I found it useful to mention my interest in evaluating the city's soft-story law. However, this did have the effect of priming subjects as to the purpose of my study. It also focused their attention on the pros and cons of *the law* as opposed to the pros and cons of *doing a retrofit*. In general, it was difficult to sustain and pursue both the historical and behavioral aims of the study simultaneously.

The small sample size is not because it was difficult to find subjects who were willing to speak with me. Rather, I simply ran out of money and time to recruit more subjects. As a one person operation, it was challenging to simultaneously recruit, keep field notes, conduct coding and analyses, and write out preliminary findings. Therefore, the project had to be conducted in sequence when a more parallel, iterative process would have been desirable.

I encountered some particular difficulties trying to use personality measures in this applied field setting. A handful of subjects balked at answering the personality items on the survey, and in one case this led to a request that an entire survey not be used. In general, I depended on the trust and rapport built up with the subject to carry them through a long survey that had many questions that some might view as oddly "unrelated," irrelevant, or too personal. The contrast struck some subjects as inappropriate.

I was reasonably successful in securing cooperation and data access working with city personnel to achieving my documentary aims. I kept the degree of contact fairly brief and professional between myself (the evaluator) and the staff about whose activities and performance I was going to report. However, when the key program staff retired, it became difficult to sustain the relationship and keep informed and up to date.

Ideas for Future Research

The list of policy recommendations and lessons outlined previously, as well as these comments on the research process, naturally lead to some potential future research directions. First, the diversity of ownership types and the importance of social influences, relationships and networks suggest a number of interesting avenues for further qualitative research. How does the risk management decision process unfold for properties owned by spousal partners, family trusts, and small business partnerships? How do the executive boards and staff of non-profit institutions view managing low probability high consequence hazards, and why do their retrofit projects seem to cost more and be more difficult to carry out?

Another obvious extension would be to interview or survey other stakeholders besides owners about the soft-story problem. In particular, very little qualitative information is available about how earthquake mitigation is viewed by property management agents and real estate brokers, contractors, and actors within the financial system such as insurance or mortgage brokers. Also under-studied are the perceptions of leases and renters, both about earthquake safety and preparedness and about different potential modes of public intervention. Furthermore, what is the true range of willingness to pay for increased earthquake safety? To my knowledge, no revealed preference pricing studies have been conducted to date of the marginal value of increased earthquake resilience in the housing marketplace.

This study qualitatively documented some of the social, technical, and logistical complexities of accomplishing an actual retrofit project. Behavior change theories are ill-fitting and need to be adapted for complex, costly, multi-step (one-time) behaviors. Further study of the dynamics between contractors, engineers, and owners could reveal practical ways to improve the level of follow through from intention to completion and also potentially also the retrofits being done.

My exploration of individual retrofit decisionmaking was relatively comprehensive relative to past research, but if I had more time and money to work with I would have recruited more subjects, attempted deeper and perhaps and more concrete analysis of the social networks involved, and created a formal mental models influence diagram. Another way to expand on this research would be to use the same survey and interview instruments to study analogous populations of soft-story owners in other Bay Area cities that have inventories, such as the cities of Oakland and Alameda, or in other cities that have not yet embarked in policy making (better for making causal inferences).

While the window of opportunity is essentially closed to study the decisions of Berkeley soft-story owners specifically, it would be interesting to re-interview a small sample in future to see whether the prolonged delay in implementation of the second (mandatory retrofit) phase in any way counteracts the apparent social norm shift. It would also be interesting to track the sales prices and seismic performance outcomes of the listed properties over time, and especially regarding the voluntary retrofits after a future major earthquake. Although that may seem like a grim research task, such information is very rare and absolutely critical to growing our capacity to remedy this social problem.

Given the potential importance of social influences on precautionary behavior, I recommend that more studies be done on belief formation, information exchange, and

persuasion in social relationships and organizations. In order to enrich and explore the generalizability of the four-influence framework, two obvious next steps would be cross-cultural studies and cross-risk studies.

REFERENCES CITED

ABAG (1999). Preventing the Nightmare: Designing a Model Program to Encourage Owners of Homes and Apartments to Do Earthquake Retrofits. Oakland, CA, Association of Bay Area Governments**:** 25.

ABAG (2003). Preventing the Nightmare: Designing a Model Program to Encourage Owners of Homes and Apartments to Do Earthquake Retrofits. Oakland, CA, Association of Bay Area Governments**:** 25.

Ajzen, I. (1991). "The theory of planned behavior." Organizational Behavior and Human Decision Processes **50**: 179-211.

Alesch, D. J., L. A. Arendt, et al. (2012). Natural Hazard Mitigation Policy: Implementation, Organizational Choice, and Contextual Dynamics. New York, NY, Springer Business Science.

Armitage, C. J. and M. Conner (2000). "Social Cognition Models and Health Behaviour: A Structured Review." Psychology and Health **15**: 173-189.

ATC (2009). Here Today—Here Tomorrow: Earthquake Safety for Soft-Story Buildings. Redwood City, CA, Applied Technology Council**:** 58.

Bandura, A. (1977). Social Learning Theory. Upper Saddle River, NJ, Prentice Hall.

Bandura, A. (2001). "Social Cognitive Theory: An Agentic Perspective." Annual Reviews of Psychology **52**: 1-26.

Bardach, E. and R. A. Kagan (2002). Going by the Book: The Problem of Regulatory Unreasonableness, Transaction Publishers.

Barzelay, M. (1993). "The Single Case Study as Intellectually Ambitious Inquiry." Journal of Public Administration Research and Theory **3**: 305-318.

Berke, P. R. and T. Beatley (1992). Planning for Earthquakes: Risk, Politics, and Policy. Baltimore, MD, Johns Hopkins University Press.

Berke, P. R., T. Beatley, et al. (1989). "Influences on Local Adoption of Planning Measures for Earthquake Hazard Mitigation." International Journal of Mass Emergencies and Disasters **7**(1): 33-56.

Birkland, T. A. (1997). After Disaster: Agenda Setting, Public Policy, and Focusing Events. Washington, D.C., Georgetown University Press.

Blais, A.-R. and E. U. Weber (2006). "A Domain-Specific Risk-Taking (DOSPERT) Scale for Adult Populations." Judgment and Decision Making **1**(1): 33-47.

Board, C. o. B. R. S. (2011). Debt Coverage Study for l93 Soft-Story Properties**:** 6.

Bonowitz, D. and S. Rabinovici (forthcoming). Soft Story Risk Reduction: Lessons from the Berkeley Data. Oakland, CA, Earthquake Engineering Research Institute Special Projects and Initiatives Report**:** 61.

Booth-Kewley, S. and R. R. Vickers (1994). "Associations between major domains of personal and health behavior." Journal of Personality **62**(3): 281-298.

Bostrom, A., R. M. R. Turaga, et al. (2006). "Earthquake Mitigation Decisions and Consequences." Earthquake Spectra **22**(2): 313–327.

Bourque, L. B., K. I. Shoaf, et al. (1997). "Survey research." International Journal of Mass Emergencies & Disasters **15**(1): 71–101.

Brookshire, D. S., M. A. Thayer, et al. (1985). "A test of the expected utility model: evidence from earthquake risks." Journal of Political Economy **93**(2): 369-389.

Burby, R., T. Beatley, et al. (1999). "Unleashing the Power of Planning to Create Disaster-Resistant Communities." Journal of the American Planning Association **65**(3): 247-258.

Camerer, C. and H. Kunreuther (1989). "Decision processes for low probability events: Policy implications." Journal of Policy Analysis and Management **8**: 565-592.

Celsi, R., M. Wolfinbarger, et al. (2005). "The Effects of Earthquake Measurement Concepts and Magnitude Anchoring on Individuals' Perceptions of Earthquake Risk." Earthquake Spectra **21**(4): 987–1008.

Chakos, A., P. Schulz, et al. (2002). "Making It Work in Berkeley: Investing in Community Sustainability." Natural Hazards Review **3**(2): 55-67.

Cohen, J. (1977). Statistical power analysis for the behavioral sciences. New York, NY, Academic Press.

Comerio, M. (1992). "Impacts of the Los Angeles Retrofit Ordinance on Residential Buildings." Earthquake Spectra **8**(1): 79-94.

Comerio, M. (2004). "Public policy for reducing earthquake risks: a US perspective." Building Research & Information **32**(5): 403–413.

Costa, P. T., Jr. and R. R. McCrae (1985). The NEO Personality Inventory Manual. Odessa, FL, Psychological Assessment Resources.

CSSC (1999). Earthquake Mitigation Success Stories. Can Buildings Be Made Earthquake-Safe? Sacramento, CA, California Seismic Safety Commission Report 99-05.

CSSC (2005). Homeowner's Guide to Earthquake Safety. Sacramento, CA, California Seismic Safety Commission**:** 53.

CSSC (2006). Status of the Unreinforced Masonry Building Law. Sacramento, CA, California Seismic Safety Commission**:** 95.

Detweiler, J. B., B. T. Bedell, et al. (1999). "Message Framing and Sunscreen Use: Gain-Framed Messages Motivate Beach-Goers." Health Psychology **18**(2): 189-196.

DeVries, F., K. Mannen, et al. (2000). Decision fault lines: Seismic Safety at Four California Universities. Berkeley, CA, Goldman School of Public Policy.

Dooley, D., Catalano, R., Mishra, S., and S. Semner (1992). "Earthquake preparedness: Predictors in a community survey." Journal of Applied Social Psychology **22**: 451-470.

Egbelakin, T., S. Wilkinson, et al. (2011). "Challenges to successful seismic retrofit implementation: a socio-behavioural perspective." Building Research & Information **39**(3): 286-300.

Egbelakin, T., S. Wilkinson, et al. (2011). "Enhancing Seismic Risk Mitigation Decisions: A Motivational Approach." Construction Management and Economics **29**: 1003-1016.

FEMA (2005). Earthquake Safety Guide for Homeowners. Washington, D.C., Federal Emergency Management Agency.

Field, E. H., T. E. Dawson, et al. (2008). The Uniform California Earthquake Rupture Forecast, Version 2. Menlo Park, CA, US Geological Survey Working Group on California Earthquake Probabilities**:** 104.

Fishbein, M. and I. Ajzen (1975). Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research. Reading, MA, Addison-Wesley.

Floyd, D. L., S. Prentice-Dunn, et al. (2000). "A meta-analysis of research on protection motivation theory." Journal of Applied Social Psychology **30**: 407-429.

Frederick, S., G. Loewenstein, et al. (2002). "Time Discounting and Time Preference: A Critical Review." Journal of Economic Literature **XL**: 351–401.

GAO (2002). Hazard Mitigation: Proposed Changes to FEMA's Multihazard Mitigation Programs Present Challenges. Washington, D.C., Government Accountability Office.

Gerend, M. A. and J. E. Shepherd (2007). "Using message framing to promote acceptance of the human papillomavirus vaccine." Health Psychology **26**(6): 745-752.

Godin, G. and G. Kok (1996). "The theory of planned behavior: A review of its applications to health-related behaviors." American Journal of Health Promotion **11**: 87-98.

Gosling, S. D., P. J. Rentfrow, et al. (2003). "A Very Brief Measure of the Big Five Personality Domains." Journal of Research in Personality **37**: 504-528.

Gupta, A. and H. C. Shah (1998). "The strategy effectiveness chart: A tool for evaluating earthquake disaster mitigation strategies." Applied Geography **18**(1): 55-67.
Hampson, S. E., J. A. Andrews, et al. (2006). "Personality Traits, Perceived Risk, and Risk-Reduction Behaviors: A Further Study of Smoking and Radon." Health Psychology **25**(4): 530-536.
Heller, K., D. B. Alexander, et al. (2005). "Social and Personal Factors as Predictors of Earthquake Preparation: The Role of Support Provision, Network Discussion, Negative Affect, Age, and Education." Journal of Applied Social Psychology: 399-422.
Helweg-Larsen, M. (1999). "(The Lack of) Optimistic Biases in Response to the 1994 Northridge Earthquake: The Role of Personal Experience." Basic and Applied Social Psychology **21**(2): 119-129.
Herman, F., J. Russel, et al. (1990). Earthquake Hazard Identification and Voluntary Mitigation: Palo Alto s City Ordinance. Sacramento, CA, California Seismic Safety Commission.
Higgins, E. T. (1997). "Beyond pleasure and pain." American Psychologist **52**: 1280–1300.
Higgins, E. T., R. S. Friedman, et al. (2001). "Achievement orientations from subjective histories of success: promotion pride versus prevention pride." European Journal of Social Psychology **31**: 3-23.
Higgins, E. T., J. Shah, et al. (1997). "Emotional Responses to Goal Attainment: Strength of Regulatory Focus as Moderator." Journal of Personality and Social Psychology **72**(3): 515-525.
Hogarth, M. and H. C. Kunreuther (1989). "Risk, Ambiguity, and Insurance." Journal of Risk andUncertainty **2**: 5-35.
Hsee, C. K. (1996). "The Evaluability Hypothesis: An Explanation for Preference Reversals between Joint and Separate Evaluations of Alternatives." Organizational Behavior and Human Decision Processes **67**(3): 247-257.
ICC (2009). Commentary on IEBC-A4, International Code Council.
Jackson, E. L. (1981). "Response to earthquake hazard: the West Coast of North America." Environment and Behavior **13**: 387-416.
Janz, N. K. and M. H. Becker (1984). "The Health Belief Model: A Decade Later." Health Education Quarterly **11**: 1-47.
John, O. (2000). The Big-Five Trait Taxonomy: History, Measurement, and Theoretical Perspectives. Handbook of Personality: Theory and Research (2nd Edition). L. Pervin and O. P. John. Ney York, NY, Guiliford.
Kahneman, D. and A. Tversky (2000). Prospect Theory: An Analysis of Decision under Risk. Choices, Values and Frames. D. Kahneman and A. Tversky. New York, Cambridge University Press**:** 17-43.
Kano, M., M. M. Wood, et al. (2008). Public Response to Terrorism: Findings from the National Survey of Disaster Experiences and Preparedness. Los Angeles, CA, National Consortium for the Study of Terrorism and Responses to Terrorism.
Karanci, A. N., B. Aksit, et al. (2005). "Impact of a Community Disaster Awareness Training Program in Turkey: Does it Influence Hazard-Related Cognitions and Preparedness Behaviors." Social Behavior and Personality **33**(3): 243-258.
Kingdon, J. W. (1995). Agendas, Alternatives, and Public Policies (2nd Ed.). New York, NY Harper Collins
Kleinman, M. A. (2009). When Brute Force Fails: How to Have Less Crime and Less Punishment, Princetion University Press.
Kuhberger, A. (1998). "The Influence of Framing on Risky Decisions: A Meta-analysis." Organizational Behavior and Human Decision Processes **75**(1): 23–55.
Kunreuther, H. (1978). Disaster Insurance Protection: Public Policy Lessons. New York, NY, John WIley & Sons.
Kunreuther, H. and M. Pauly (2004). "Neglecting Disaster: Why Don't People Insure Against Large Losses?" Journal of Risk and Uncertainty **28**(1): 5–21.

LAFD (2008). Guide to Emergency Preparedness. Los Angeles, CA, Los Angeles Fire Department**:** 40.
Latimer, A. E., P. Salovey, et al. (2007). "The Effectiveness of Gain-Framed Messages for Encouraging Disease Prevention Behavior: Is All Hope Lost?" Journal of Communication **12**: 645-649.
Lazarus, R. S. (1991). Emotions and adaptation. New York , NY, Oxford University Press.
Levin, I. P., G. J. Gaeth, et al. (2002). "A New Look at Framing Effects: Distributions of Effect Sizes, Individual Differences, and Independence of Types of Effects." Organizational Behavior and Human Decision Processes **88**(1): 411-429.
Levin, I. P., S. L. Schneider, et al. (1998). "All Frames are not created equal: A typology and critical analysis of framing effects." Organizational Behavior and Human Decision Processes **76**: 149-188.
Lind, E. A. and T. R. Tyler (1988). The Social Psychology of Procedural Justice. New York, NY, Plenum.
Lindell, M. K. and R. W. Perry (1992). Behavioral Foundations of Community Emergency Planning. Washington, DC, Hemisphere Press.
Lindell, M. K. and R. W. Perry (2000). "Household adjustment to earthquake hazard: A review of research." Environment and Behavior **32**: 461–501.
Lindell, M. K. and R. W. Perry (forthcoming). "The Protective Action Decision Model: Theoretical Modifications and Additional Evidence." Risk Analysis.
Lindell, M. K. and C. S. Prater (2000). "Household Adoption of Seismic Hazard Adjustments:
A Comparison of Residents in Two States." International Journal of Mass Emergencies and Disasters **18**(2): 317-338.
Lindell, M. K. and C. S. Prater (2002). "Risk area residents' perceptions and adoption of seismic hazard adjustments." Journal of Applied Social Psychology **32**: 2377–2392.
Lindell, M. K. and D. J. Whitney (2000). "Correlates of household seismic hazard adjustment adoption." Risk Analysis **20**: 13–25.
Loewenstein, G., T. O'Donoghue, et al. (2003). "Projection Bias in Predicting Future Utility." Quarterly Journal of Economics: 1209-1248.
Lombardi, A. M. and W. Marzocchi (2007). "Evidence of clustering and nonstationarity in the time distribution of large worldwide earthquakes." Journal of Geophysical Research -- Solid Earth **112**.
Maslow, A. H. (1943). "A Theory of Human Motivation." Psychological Review **50**: 370-396.
May, P. J. (1991). "Addressing public risks: Federal earthquake policy design." Journal of Public Policy Analysis and Management **10**: 263-285.
May, P. J. (2001). Organizational and Societal Considerations for Performance-Based Earthquake Engineering. Berkeley, CA, Pacific Earthquake Engineering Research Center.
May, P. J. (2004). "Making Choices about Earthquake Performance." Natural Hazards Review **5**(2): 64-70.
May, P. J. and T. A. Birkland (1994). "Earthquake Risk Reduction: An Examination of Local Regulatory Efforts." Environmental Management **18**(6): 923-937.
May, P. J., R. Burby, et al. (1998). "Policy design for earthquake hazard mitigation: Lessons from energy conservation, radon reducation, and termite control." Earthquake Spectra **14**(4): 629-649.
McClure, J., J. White, et al. (2009). "Framing effects on preparation intentions: distinguishing actions and outcomes." Disaster Prevention and Mangement **18**(2): 187-199.
McManus, S., E. Seville, et al. (2008). "Facilitated Process for Improving Organizational Resilience." Natural Hazards **9**: 81-91.
Meszaros, J. (1999). "Preventive choices: Organizations' heuristics, decision processes, and catastrophic risks." Journal of Management Studies **36**(7): 977–998.
Mileti, D., S. Nathe, et al. (2004). Public Hazards Communication and Education: The State of the Art.
Mileti, D. S. (1999). Disasters by Design: A Reassessment of Natural Hazards in the U.S. Washington, D.C., National Academy Press.

Mileti, D. S. and J. D. Darlington (1997). "The Role of Searching in Shaping Reactions to Earthquake Risk Information." Social Problems **44**(1): 89-103.
Mileti, D. S. and J. DeRouen-Darlington (1995). "Societal Response to Revised Earthquake Probabilities in the San Francisco Bay Area." International Journal of Mass Emergencies and Disasters **13**: 119-145.
Mileti, D. S. and C. Fitzpatrick (1992). "The Causal Sequence of Risk Communication in the Parkfield Earthquake Prediction Experiment." Risk Analysis **12**(3): 393-400.
Mileti, D. S. and C. Fitzpatrick (1993). The Great Earthquake Experiment: Risk Communication and Public Action. Boulder, CO, Westview Press.
Mileti, D. S. and P. W. O'Brien (1992). "Warnings during Disaster: Normalizing Communicated Risk." Social Problems **39**(1): 40-57.
Millman, J. W. and R. B. Roberts (1985). "Economic Issues in Formulating Policy for Earthquake Hazard Mitigation." Policy Studies Review **4**(4): 645-654.
Mintrom, M. (1997). "Policy entrepreneurs and the diffusion of innovation." American Journal of Political Science **41**(3): 738-770.
Morgan, M. G., B. Fischoff, et al. (2002). Risk Communication: A Mental Models Approach. New York, Cambridge University Press.
Mulilis, J.-P. (1998). "Persuasive communication issues in disaster management: A review of the hazards mitigation and preparedness literature and a look towards the future." Australian Journal of Emergency Management: 51-59.
Mulilis, J.-P. and T. S. Duval (1995). "Negative Threat Appeals and Earthquake Preparedness: A Person-Relative-To-Event (PrE) Model of Coping with Threat." Journal of Applied Social Psychology **25**(15): 1319-1339.
Mulilis, J.-P., T. S. Duval, et al. (1990). "The Effects of a Large Destructive Local Earthquake on Earthquake Preparedness as Assessed by an Earthquake Preparedness Scale." Natural Hazards **3**: 357-371.
Mulilis, J.-P. and R. Lippa (1990). "Behavioral Change in Earthquake Preparedness Due to Negative Threat Appeals: A Test of Protection Motivation Theory." Journal of Applied Social Psychology **20**(8): 619–638.
Nguyen, L., H. Shen, et al. (2006). "Exploring the Causal Relationship between Exposure to the 1994 Northridge Earthquake and Pre- and Post- Earthquake Preparedness Activities." Earthquake Spectra **22**(3): 569–587.
NIBS (2002). Parameters for an Independent Study to Assess the Future Benefits of Hazard Mitigation Activities. Washington, D.C., National Institute of Building Sciences, Multihazard Mitigation Council**:** 69.
O'Donoghue, T. and M. Rabin (1999). "Doing It Now or Later." The American Economic Review **89**(1): 103-124.
O'Donoghue, T. and M. Rabin (2001). "Choice and Procrastination." The Quarterly Journal of Economics: 121-160.
O'Hare, M. (1982). Information Strategies As Regulatory Surrogates. Social Regulation: Strategies for Reform. E. Bardach, R. A. Kagan and L. S. Bacow, Transaction Publishers**:** 420.
O'Keefe, D. J. and J. D. Jensen (2007). "The Relative Persuasiveness of Gain-Framed Loss-Framed Messages for Encouraging Disease Prevention Behaviors: A Meta-Analytic Review." Journal of Health Communication **12**: 623–644.
Olson, R. S., R. A. Olson, et al. (1999). Some Buildings Just Can't Dance: Politics, Life Safety, and Disaster. Stamford, CN, Jai Press Inc.
Ozdemir, O. and C. Yilmaz (2011). "Factors affecting risk mitigation revisited: the case of earthquake in Turkey." Journal of Risk Research **14**(1): 17-46.

Palm, R. and M. E. Hodgson (1992). After a California Earthquake: Attitude and Behavior Change. Chicago, IL, University of Chicago Press.
Platt, R. H. (1999). Disasters and Democracy: The Politics of Extreme Natural Events. Washington, D.C., Island Press.
Prochaska, J. O., C. C. DiClemente, et al. (1992). "In Search of How People Change." American Psychologist **47**(9): 1102-1114.
Prochaska, J. O. and W. F. Velicer (1997). "The transtheoretical model of health behavior change." American Journal of Health Promotion **12**: 38–48.
Rogers, R. W. (1983). "Cognitive and Physiological Processes in Fear Appeals and Attitude Change." Journal of Psychology **91**: 93–114.
Rogers, R. W. and S. Prentice-Dunn (1997). Protection motivation theory. Handbook of Health Behavior Research. D. S. G. (Ed.). New York, NY, Plenum Press. **1:** 113-132.
Rothman, A. J. and P. Salovey (1997). "Shaping Perceptions to Motivate Healthy Behavior: The Role of Message Framing." Psychological Bulletin **121**(1): 3-19.
RSB (2011). Rent Board Field Verification of Earthquake Warning Signs Required by the Soft Story Ordinance, City of Berkeley Rent Stablization Board**:** 2.
Russel, L. A., J. D. Goltz, et al. (1995). "Preparedness and hazard mitigation actions before and after two earthquakes." Environment and Behavior **27**(6): 744-770.
Sabatier, P. and H. Jenkins-Smith, Eds. (1993). Policy Change and Learning: An Advocacy Coalitions Approach. Boulder, CO, Westview.
Sadiq, A.-A. and C. M. Weible (2010). "Obstacles and Disaster Risk Reduction: Survey of Memphis Organizations." Natural Hazards Review **11**(3): 110-117.
Salovey, P. and P. Williams-Piehota (2004). "Field Experiments in Social Psychology: Message Framing and the Promotion of Health Protective Behaviors." American Behavioral Scientist **47**(5): 488-505.
Savage, L. J. (1954). The foundations of statistics. New York, Dover Publications.
Schneider, M. and P. Teske (1992). "Towards a theory of the political entrepreneur: Evidence from local government." American Political Science Review **86**(3): 737-747.
Shen, L. and J. P. Dillard (2007). "The Influence of Behavioral Inhibition/Approach Systems and Message Framing on the Processing of Persuasive Health Messages." Communication Research **34**(4): 433-457.
Sherman, D. K., T. Mann, et al. (2006). "Approach/Avoidance Motivation, Message Framing, and Health Behavior: Understanding the Congruency Effect." Motivation and Emotion **30**: 165-169.
Soffer, Y., A. Goldberg, et al. (2011). "The relationship between demographic/educational parameters and perceptions, knowledge, and earthquake mitigation in Israel." Disasters **35**(1): 36-44.
Solberg, C., T. Rossetto, et al. (2010). "The social psychology of seismic hazard adjustment: re-evaluating the international literature." Natural Hazards and Earth System Sciences **10**(8): 1663-1677.
Spittal, M. J., J. McClure, et al. (2008). "Predictors of Two Types of Earthquake Preparation: Survival Activities and Mitigation Activities." Environment and Behavior **40**(6): 798-817.
Spittal, M. J., F. H. Walkey, et al. (2006). "The Earthquake Readiness Scale: The Development of a Valid and Reliable Unifactorial Measure." Natural Hazards.
SPUR (2008). The Resilient City, Part I: Before the Disaster. San Francisco, CA, San Francisco Planning and Urban Research Association.
Teske, P. and M. Schneider (1994). "The bureaucratic entrepreneur: the case of city managers." Public Administration Review **54**(4): 331-340.
Thibaut, J. and L. Walker (1975). Procedural Justice: A Psychological Analysis. Hillsdale, NJ, Lawrence Erlbaum Associates.

Tierney, K., M. K. Lindell, et al. (1998). Facing the Unexpected: Disaster preparedness & response in the United States. Washington, D.C., Joseph Henry Press.
Turner, R. H., J. M. Nigg, et al. (1986). Waiting for Disaster: Earthquake Watch in California. Berkeley, CA, University of California Press.
Tversky, A. and D. Kahneman (1981). "The framing of decisions and the psychology of choice." Science **211**(4481): 453-458.
USEPA (2000). Guidelines for Preparing Economic Analyses. Washington, D.C., U.S. Environmental Protection Agency, Office of the Administrator.
USGS (2005). Putting Down Roots in Earthquake Country: Your Handbook for the San Francisco Bay Region. Reston, VA, US Geological Survey, with major funding from the California Earthquake Authority**:** 32.
USGS (2008). Forecasting California's Earthquakes-What Can We Expect in the Next 30 Years?, U.S. Geological Survey Fact Sheet 2008-3027.
von Neumann, J. and O. Morgenstern (1944). Theory of Games and Economic Behavior. New York, Wiley.
Weber, E. U. and E. J. Johnson (2009). "Mindful Judgment and Decision Making,." Annual Review of Psychology **60**.
Webler, T., H. Rakel, et al. (1995). "Eliciting and classifying concerns -- a methodological critique." Risk Analysis **15**(3): 421-436.
Weinstein, N. and M. Nicolich (1993). "Correct and Incorrect Interpretations of Correlations Between Risk Perceptions."
Weinstein, N. and M. Nicolich (1993). "Correct and Incorrect Interpretations of Correlations Between Risk Perceptions and Risk Behaviors." Health Psychology **12**(3): 235-245.
Weinstein, N. D. (1988). "The Precaution Adoption Process." Health Psychology **7**(4): 355-386.
Weinstein, N. D. (1993). "Testing four competing theories of health-protective behavior." Health Psychology **12**(4): 324-333.
Weinstein, N. D., J. Lyon, et al. (1998). "Experimental evidence for stages of health behavior change: The precaution adoption process model applied to home radon testing." Health psychology **17**(5): 445-453.
Weinstein, N. D. and P. M. Sandman (1992). "A Model of the Precaution Adoption Process: Evidence From Home Radon Testing." Health Psychology **11**(3): 170-180.
Whitney, D. J., M. K. Lindell, et al. (2004). "Earthquake Beliefs and Adoption of Seismic Hazard Adjustments." Risk Analysis **24**(1): 81-102.
Wood, M. M., M. Kano, et al. (2008). Questionnaire Specifications: Documentation of the National Survey of Disaster Experiences and Preparedness. Los Angeles, CA, National Consortium for the Study of Terrorism and Responses to Terrorism.
Wood, M. M., D. Mileti, et al. (forthcoming). "Communicating Actionable Risk for Terrorism and Other Hazards." Risk Analysis.

LIST OF APPENDICES

APPENDIX A — City of Berkeley Soft-Story Ordinance

Berkeley Municipal Code Chapter 19.39

ESTABLISHING AN INVENTORY OF POTENTIALLY HAZARDOUS BUILDINGS CONTAINING SOFT, WEAK, OR OPEN FRONT STORIES AND ADOPTING CHAPTER A4 OF THE INTERNATIONAL EXISTING BUILDING CODE WITH AMENDMENTS

Sections:

19.39.010 Title, findings, and purpose.

A. This Ordinance shall be known as the "Soft Story Ordinance."

B. The Council finds as follows:

1. A survey of Berkeley buildings in 1996 identified nearly 400 wood frame buildings with 5 or more units with a ground level containing large openings such as store fronts, garages, or tuck-under parking.

2. The openings on the ground floor of such buildings create a weak or soft, story.

3. Buildings with soft, weak, or open front ground stories are recognized by engineers and other seismic safety experts as having the potential for sustaining serious damage including collapse in the event of strong earthquakes.

4. Earthquakes in California and elsewhere have demonstrated such damage, injuring and killing people, displacing residents, and causing severe economic loss and disruption to communities.

5. The City of Berkeley conducted an assessment project in 2001 that identified approximately 5,000 residential units in buildings that may have such stories.

6. A sidewalk assessment was done of 150 identified buildings by professional engineers and found that 46% have severe or considerable vulnerability to damage in a major earthquake and that another 49% had moderate vulnerability.

7. Advances in the design of construction and retrofit of structures to better withstand seismic forces have occurred since such buildings were constructed and resulted in new requirements in current codes.

8. The establishment of an Inventory and notification of owners and residents is a necessary first step in developing a mitigation program and will provide the basis for obtaining input from affected parties for such a program.

9. Although the general vulnerability of such buildings is known, determining the seismic adequacy of each of the structures and the appropriate elements of a retrofit to remedy vulnerabilities requires a detailed evaluation by an approved licensed engineering design professional.

10. Such an evaluation is also necessary for the City Council and staff to identify fully the risks to the city and its inhabitants and to determine the feasibility of programs to address the vulnerabilities.

11. Model codes have been developed for analyzing and retrofitting such structures to provide for risk reduction with less design effort, construction cost, and tenant disruption than the Uniform Building Code.

12. While these codes are not intended to provide structural performance equivalent to that provided by new construction built to the current Building Code, they identify and provide for improving the structure's more vulnerable potions and, if identified improvements are made, can be expected to substantially reduce the likelihood of excessive building drift or collapse and substantially lessen the loss of human life.

C. The purpose of this Ordinance is to protect the public health, safety and welfare, to alert the general public and the owners and residents of certain types of existing multi-unit residential buildings to the vulnerability of such buildings in strong earthquakes, to determine the specific seismic vulnerabilities and necessary improvements for each such building, to inform decision-making about needed mitigation measures, and to promote such efforts.

D. This ordinance requires the establishment of an Inventory of Potentially Hazardous Buildings that contain a soft story on the ground floor and that have at least five residential units, provides for notification to the owners, residents and users of such buildings, adopts the International Existing Building Code, and requires owners to provide an analysis of their building's seismic adequacy.

19.39.020 Scope and applicability.

A. The provisions of this Chapter shall apply to all existing wood frame multi-unit residential buildings or portions thereof that contain five or more dwelling units, as defined in the City of Berkeley zoning ordinance, and that were designed under a building permit applied for before the adoption of the 1997 Uniform Building Code, where:

1. The Ground Floor, whether itself constructed of wood or other materials, of the wood frame structure contains parking or other similar open floor or basement space that causes Soft, Weak, or Open Front Wall Lines and there exists one or more levels above, or;
2. The walls of any story or basement of wood construction are laterally braced with Nonconforming Structural Materials as defined in this Chapter and there exists two or more Levels above.

B. Buildings listed on national, state or local historical registers shall also comply with the provisions of this Chapter. At the Building Official's discretion, modifications to the IEBC may be permitted when such modifications are consistent with the provisions of the State Historical Building Code.

19.39.030 Adoption and modifications of Chapter A4 of the 2003 IEBC.

A. Chapter A4 of the 2003 International Existing Building Code ("IEBC"), as published by the International Code Councilis hereby adopted by reference, except where this chapter provides alternative language. For purposes of this chapter, the standards in the IEBC shall be used for the analysis of seismic weakness and to formulate the elements of work required to remedy any identified weaknesses; but the submittal of an application for a building permit or the actual retrofit of a building is not required. For the purposes of this ordinance, the non-wood frame ground floor of a designated building shall also be analyzed.

B. The Building Official shall provide guidelines delineating the standards for the use of Chapter A4, including amendments for buildings with concrete podia and non-wood-frame ground floors, and for filing the report required by this ordinance. The guidelines shall provide details for items required in the report, procedures to be followed, and a framework for both the assembly of the required information by the professional and for the evaluation of the report by the City.

C. Terms in capital case used in this ordinance are as defined in Chapter A4 of the IEBC and FEMA 356, unless otherwise defined in this ordinance.

19.39.040 Establishment of the Inventory of Soft Story Potentially Hazardous Buildings.

Multi-unit wood frame residential buildings with five or more residential units identified by a 1996 survey conducted by the City as containing a Soft, Weak, or Open Front Ground Floor shall be placed on the Inventory of Potentially Hazardous Soft Story Buildings. Such buildings are designated soft story buildings. The Inventory shall be maintained and revised as necessary by the Building Official. A copy shall be available for inspection in the office of the Building Official and in the office of the City Clerk.

19.39.050 Notification of owners and administration.

A. **Contents of Notice and Order.** When the Building Official determines that a building is within the scope of this Chapter, the Building Official shall issue a notice and order as provided herein. The notice and order shall specify that the building has been determined by the Building Official to be within the scope of this Chapter, placed on the Inventory, and, therefore, is required to meet the seismic analysis and other provisions of this Chapter. The notice and order shall specify the building type classification, if known, and shall set forth the owner's obligations under this chapter, the time limits for compliance, and appeal rights The building official's determination shall be final at the end of 180 days unless a timely request for reconsideration is filed as provided below.

B. **Service of Notice and Order.** The notice and order shall be in writing and may be given either by personal delivery thereof to the owner or by deposit in the United States mail in a sealed envelope, postage prepaid, addressed to the owner of the property as shown on the last equalized assessment roll of the county, or as known to the Building Official, as well as to the following, if known or disclosed from official public records: the holder of any mortgage or deed of trust or other lien or encumbrance of record; the owner or holder of any lease of record; and the holder of any other estate or legal interest of record in or to the building or the land on which it is located. The failure to serve any person required herein to receive service shall not invalidate any proceeding hereunder as to any person duly served or relieve any such person from any duty or obligation imposed by the provisions of this section.

C. **Appeal to Building Official.** Any person entitled to service of notice under the preceding subdivision may request the Building Official to reconsider a determination to include a building on the Inventory by submitting information that the building's ground floor is not soft, weak, or open as defined by the applicable standard, that the building has been substantially reconstructed in accordance with the 1997 or later Uniform Building Code, or that the building has been retrofitted in compliance with Article 11 of the current Berkeley Building Code or the IEBC. The request for reconsideration shall be filed within 180 days from the date of the service of such notice and order of the Building Official.

D. **Appeal to Housing Advisory Commission.** Any person entitled to service of notice under the preceding subdivision who disagrees with the decision of the Building Official on reconsideration pursuant to that subdivision may appeal within 30 days of the date of notice of the Building Official's decision on reconsideration to the Housing Advisory Commission (HAC) as provided for in BMC Chapter 19.44. The appeal shall be set for hearing at the next regular HAC meeting more than 20, but not more than 60, days from the date of filing of the appeal, provided that the Commission may set the hearing at a different time for good cause.

E. **Recordation.** Once the Building Official's determination is final, the Building Official shall file with the Office of the County Recorder a certificate stating that the subject building is within the scope of this Chapter, unless the property has been removed from the Inventory. The certificate shall also state that the owner thereof has been ordered to conduct a structural analysis of the building in compliance with this Chapter. When a building is removed from the

Inventory, the Building Official shall promptly file with the Office of the County Recorder a certificate so stating.

F. **Costs of additional compliance actions.** In addition to any penalties authorized by the Berkeley Municipal Code, an owner who fails to comply with the provisions of this chapter may be charged reasonable fees, as adopted by City Council resolution, to compensate for staff time spent to bring the building into compliance.

19.39.060 Owner's and tenants' obligations.

A. **Obligation of owners to notify tenants and post building.** Once the Building Official's determination is final, owners of buildings on this Inventory shall do the following:

1. Within 30 days, notify each tenant in writing, using the form in Appendix A, , and notify each new tenant at a change of tenancy, that the building is included on the Inventory.

2. Post in a conspicuous place within five feet of each main entrance of the building, and maintain until the building is removed from the Inventory, a clearly visible warning sign not less than 8" by 10" the following statement, with the first two words printed in 50-point bold type and the remaining words in at least 30-point type:

> ''Earthquake Warning. This is a soft story building with a soft, weak, or open front ground floor. You may not be safe inside or near such buildings during an earthquake."

3. Mail, within thirty days of service, a copy of each tenant notification form in compliance with this section and a completed proof of service addressed to: Building Mitigation Manager, Building and Safety Division, 2120 Milvia Street, Berkeley, CA 94704. Any tenant's name so provided shall be used by the City only for purposes of confirmation and shall be rendered illegible in the filed document.

B. **Obligations of tenants to cooperate.** Each tenant of a building on the inventory shall cooperate with the owner and the owner's agents, including but not limited to engineers, contractors, and inspectors, to accomplish the required analysis. In so doing, tenants shall allow reasonable access to the building and their unit or space as needed and as permitted by California Civil Code 1954.

19.39.070 Analysis of structural seismic adequacy.

Within two years of the date of service of the notice of inclusion on the Inventory, the owner of each building on the Inventory shall submit an Initial Screening and a detailed seismic engineering evaluation report prepared by a qualified California licensed structural or civil engineer that: analyzes the structural ability of the building to resist the seismic effects of earthquakes and the extent to which the building meets the standards for structural seismic adequacy as set forth in Appendix Chapter 4 as modified by this ordinance, identifies any hazardous exterior design elements, describes the elements of work needed to remedy the identified weaknesses, and provides other relevant information as specified by the Building Official. This Chapter does not require the Retrofit of any building and does not require the submittal of plans of the type required with an application for a building permit. The purpose of the analysis is to investigate the structural systems of a building that resist forces imposed by earthquakes and to determine if any individual portion or combination of these systems is inadequate to prevent a collapse or partial collapse or other damge hazardous to life.

19.39.080 Removal of building from the inventory.

A building shall be removed from the inventory under the following circumstances:

A. A determination by the Building Official that the building does not contain a Weak, Soft, or Open Front Story and meets the applicable standards;

B. The satisfactory completion of a seismic retrofit and appropriate inspections bringing the Soft, Weak, or Open Front Story of the building up to the requirements of the applicable standards of Chapter A4;

C. A determination by the building official or a decision on appeal that the building is not a building with Soft, Weak, Or Open Front Stories; or

D. Lawful demolition of the building.

19.39.090 Compliance schedule for submittal of seismic analysis.

A. **Deadlines.** All owners of potentially hazardous soft story buildings shall submit the required analysis of structural seismic adequacy in accordance with this Chapter no later than two years from notice by the City of Berkeley.

B. **Acceleration of deadline**. Notwithstanding subdivision A of this section, this deadline shall be accelerated, and the owner shall submit the required analysis of structural seismic adequacy, whenever any one or more of the following occurs:

1. The Building Official determines that the building or any major portion thereof will be reoccupied after being vacant for six (6) months or longer.

2. The building will undergo a remodel, alteration, addition or structural repairs valued at more than $75,000, except for repairs found by the Building Official to be required for routine maintenance or emergency purposes or tenant improvements that the Building Official finds are not structural, will not hinder the required analysis, and are paid for by that tenant for that tenant's use.

3. Title to the building is transferred in whole or part or the building is sold to a new owner or owners, except that changes in title due to inheritances or transfers between spouses or registered domestic partners shall not require compliance with this part.

4. Additional financing is obtained which is secured by a deed of trust or mortgage recorded on the title to the building. Financing secured solely to refinance existing debt against the property shall not be considered as additional financing for the purposes of this Chapter.

5. The use of the building changes such that Section 502 of the Berkeley Building Code (BMC Chapter 19.28) applies.

6. The building is identified by the Building Official as an Unsafe Building as defined in Section 203 of the Berkeley Building Code (BMC Chapter 19.28).

C. **Extensions of deadline.** The City Manager or his/her designee may extend the deadline for the required analysis by up to six (6) months, and prior to expiration of that extension may grant up to two additional extensions of up to six (6) months each, if:

1. The owner submits to the City Manager a detailed written statement requesting the extension, explaining why it should be granted and clearly documenting the reasons therefore in accordance with the requirements of this part.

2. The owner agrees in writing to fully cooperate with the City in seeking all available financing, if the reason is lack of funds.

Extensions granted under this part shall not extend deadlines for correction of any other violations of any other ordinances.

D. **Required findings.** In order to grant an extension, the City Manager must find that:

1. The building does not present an imminent threat to life safety of occupants or the public, based on a report from a California licensed structural or civil engineer;

2. The building owner has complied with the requirements of Sections 19.39.060 and 19.39.070.

3. The owner has demonstrated there are unique and exceptional circumstances that prevent compliance.

19.39.100 Fifteen year exemption for retrofitted buildings Any building, or any portion of a building that is identified under this Chapter as being a Potentially Hazardous Soft, Weak, or

Open Front Story Building and is retrofitted in compliance with the applicable standards or the City of Berkeley Building Code shall not, within a period of 15 years, be identified as a Potentially Hazardous Building because of a Soft, Weak, or Open Front Story pursuant to any local building standards adopted after the date of the building retrofit unless such building no longer meets the standards under which it was retrofitted.

19.39.110 Public Nuisance. Any building for which the owner fails to file the required Analysis of structural seismic adequacy in compliance with Section **19.39.070 or fails to comply with Section .060** or fails to comply with any order of the Building Official is hereby declared to be a public nuisance. and may be abated pursuant to the procedures set forth in BMC Chapter 1.24.

19.39.120 Remedies Cumulative. Remedies provided by this ordinance are cumulative.

19.39.130 Severability. If any section, subsection, sentence, clause or phrase of this chapter is for any reason held to be invalid or unconstitutional, such decision shall not affect the validity of the remaining portions of this chapter. The council hereby declares that it would have passed this chapter, and each section, subsection, sentence, clause and phrase thereof, irrespective of the fact that any one or more sections, subsections, sentences, clauses or phrases had been declared invalid or unconstitutional.

Appendix A

Notice to Tenants re: Soft Story Building

This is to notify you that the building at _____, Berkeley, California is on the City of Berkeley's Inventory of Soft Story Potentially Hazardous Buildings and may constitute a severe threat to life safety in the event of an earthquake of moderate to high magnitude.

This notice is required by the Berkeley Municipal Code (BMC) Chapter 19.39.050. This chapter also requires that the building be analyzed by a civil or structural engineer to determine its seismic vulnerability.

For purposes of the program, Soft Story Buildings are those buildings constructed prior to 1997, containing at least five residential units and typically having tuck-under parking or a storefront on the first floor.

If you have any questions about the law, please contact Daniel Lambert, the project manager:

- by phone at (510) 981-7406,
- by e-mail at dlambert@ci.berkeley.ca.us,
- by mail at 2118 Milvia Street, Berkeley, CA 94704.

For questions about this particular building, please contact:

_____

(Name of owner or manager and how to contact)

_____

(signature of owner) (date) (print name)

Proof of service *(Return signed copy to Building Mitigation Manager, 2118 Milvia Street, Berkeley, CA 94704)*

On _____ , 2001 I delivered the above notice by:

❑ Placing it in the mail of the United States Postal Service addressed as follows:

_____.

❑ Personally delivering it to:

_____at_____.

_____ _____

(signature of server) (date)

_____

(print name)

APPENDIX B — Discussion Guide for Key Informant Interviews

A Study of Program History and Implementation of Berkeley's Soft-Story Ordinance

Participant Background

1. When and how did you first get involved in seismic safety issues in the Bay Area?
2. Tell me about how your involvement with soft-story buildings came about.
3. Please describe your role in the development of Berkeley's approach to soft-story buildings.

Program History & Politics

4. Tell me your understanding of the original intentions or goals of this law.
5. How did the idea for this law come about? In particular, please comment on the *timing*.
6. Who was involved in advocating for and against it and which people or groups (if any) were noticeably absent from the process?
7. What were the stakeholders' major goals, interests, rationales, or claims in taking the positions that they did?

Organization and Implementation

8. Who were the core people involved in carrying out the law and what are their different roles?
9. Describe the process, from your experience, of how an engineering report is submitted, reviewed, revised, and approved (or not).
10. How did these logistical details get worked out?
11. Did they change significantly over time?
12. How were communications handled (i.e., between owners, engineers, reviewing engineers -- both contracted and internal-- and permitting, inspection, and program officers)?

Program Evolution

13. How did the program concept evolve from its initial shape into the regulation in practice as we see today? Which aspects of the original vision, if any, had to be compromised?
14. What do you see as the major forces, decisions, or moments that led to the program taking the form it eventually did?
15. What were some of the key difficulties encountered in the program's operations and how were these obstacles overcome (or not)?
16. Did the program uncover any special "secrets to success", namely, specific attitudes or procedures that were helpful?

Take-Aways

17. What do you take away from this experience in terms of lessons learned for pursuing seismic safety at the local government level?

Referrals

18. Please recommend anyone else that I should be sure to speak with if my goal is to understand the history and implications of Berkeley's soft-story law.

APPENDIX C — Interview Guide for Owner Belief and Behavior Study – Non-Retrofitters

I would like to begin the interview now, is that ok?

OWNERSHIP STORY

1. *Tell me about how you came to own the rental property at […].*
   - Year, how it happened, who else involved
   - Purchase decision factors

PROPERTY MANAGEMENT

2. *Walk me through a typical day, week, or month for you as owner of this property.*
   - Other investment properties owned
   - Level of involvement
   - Typical tasks and decisions
   - Sources of help/assistance

EARTHQUAKE EXPERIENCES & BELIEFS

3. *Now let's turn to your life experiences so far with earthquakes. How, if at all, have earthquakes affected your thoughts and actions as owner or manager of this property?*
   - How long in Bay Area, level of concern/worry
   - Past quakes, other hazards
     - property purchase (was hazard disclosed/known then?)
     - loan, maintenance, and insurance
     - anticipated duration of ownership at time of purchase

MITIGATION

4.1 Tell me about how you first found out that your property might be vulnerable to earthquakes.

5.1 What eventually led you to invest in a structural repair (i.e., retrofit)?
   - Context: how decision came about
   - Other capital investments made (was the EQ work a single project, or combined w/other)?
   - **Types of goals, costs, benefits and drawbacks perceived**
     - Financial, emotional, social, other?
   - How they found/chose people to do the work

(i)

6.1 Imagine a major earthquake happening here in the future. What do you think WOULD HAVE happened to your rental property if you hadn't done a retrofit?
   - Imagined impacts to self, others, tenants, community

7.1 Given that you have made structural improvements, what do you expect WILL happen?

8.1 How do you feel in the mean time about having done a retrofit?
   - Impact on rents? Do tenants, bankers, or insurance agents notice or care?
   - Have you ever talked with others about the process you've gone through?

POLICY PERCEPTIONS

9. *Let's turn now to the topic of any experiences you've had with City of Berkeley policies related to earthquake safety.*
   - Information sources, communications, esp. re: building safety req's & permit process
   - Knowledge of special EQ policies for apartment buildings
   - Hazardous Bldg. Inventory:
     - recall of initial notification
     - what's happened since

POLICY OPINIONS

10. *In your opinion, how could local earthquake safety policies for apartment buildings be improved?*
    - What's working, if anything, and areas for improvement
    - Fairness; ideas for sharing the burden of responsibility for earthquake safety

PEER PERCEPTIONS

11. *What, if anything, do you think other landlords in Berkeley are doing about earthquakes? How do you get that impression?*
    - What other landlords and property owners they know are doing
    - Degree of contact with other landlords
    - What associations, trade groups belong to
    - Anyone else they talk with about EQs?

12. *If you were to guess, why do you think most landlords don't do a retrofit? Does the behavior of other landlords surprise you in any way?*

13. *If a friend of yours who owns a similar rental property asked for advice on what to do about the earthquake safety of their building, what would you tell him or her?*

Thank you for sharing this information.

Is there anything else you'd like to say before we move on to the next part of the interview?

CONCLUDING QUESTIONS:

A) Would you like to receive a summary of the results when this research is completed? (It might be 6 months to a year from now) Would you prefer it sent in the mail or as an email?

B) Is there anything else I can do to improve the experience of people being contacted for or participating in this study?

C) Which gift card would you prefer as a thank you for participating?

APPENDIX D — Interview Guide for Owner Belief and Behavior Study –Retrofitters

I would like to begin the interview now, is that ok?

OWNERSHIP STORY

1. *Tell me about how you came to own the rental property at […].*

- What year
- How it happened, who else involved
- Factors
- Other investment properties owned

PROPERTY MANAGEMENT

2. *Walk me through a typical week or month for you as owner of this property.*

- Level of involvement
- Typical tasks and decisions
- Sources of help/assistance

EARTHQUAKE EXPERIENCES & BELIEFS

3. *I'd now like to turn to your life experiences so far with earthquakes.*

- How long in Bay Area, level of concern/worry
- Past quakes, other hazards
    - property purchase (was hazard disclosed/known then?)
    - management, maintenance, and insurance
    - anticipated duration of ownership
- *How, if at all, have EQs affected thoughts and actions as an owner or manager?*

MITIGATION

4.2 *Please describe your thinking about earthquake retrofit for apartment buildings. What, if anything, does that phrase mean to you?*

- *Awareness of things that can be done to make buildings more EQ safe*

5.2 *Have you taken any steps to assess or repair your building for EQ safety? If yes, walk me through what you did and how it happened. If not, tell me more about why not. Do you <u>intend</u> to do any of these things in the future?*

6.2 *What do you imagine will happen to your rental property in a major EQ (next week)?*

- Imagined impacts to self, others, tenants, community
- Does EQ safety affect rents? Do tenants, bankers, or insurance agents notice/care?
- Talk with others about the issue?

7.2 *For your particular situation, what are the obstacles to retrofitting? What (kind of help or change in policies or circumstances) could make you change your mind?*

- **Goals, costs, benefits and drawbacks perceived to No Retrofit**
    - Financial, emotional, social, other?

POLICY PERCEPTIONS

9. *Let's turn now to the topic of any experiences you've had with City of Berkeley policies related to earthquake safety.*
   - Information sources, communications, esp. re: building safety req's & permit process
   - Knowledge of special EQ policies for apartment buildings
   - Hazardous Bldg. Inventory:
     - recall of initial notification
     - what's happened since

POLICY OPINIONS

10. *In your opinion, how could local earthquake safety policies for apartment buildings be improved?*
    - What's working, if anything, and areas for improvement
    - Fairness; ideas for sharing the burden of responsibility for earthquake safety

PEER PERCEPTIONS

11. *What, if anything, do you think other landlords in Berkeley are doing about earthquakes? How do you get that impression?*
    - What other landlords and property owners they know are doing
    - Degree of contact with other landlords
    - What associations, trade groups belong to
    - Anyone else they talk with about EQs?

12. *If you were to guess, why do you think most landlords don't do a retrofit? Does the behavior of other landlords surprise you in any way?*

13. *If a friend of yours who owns a similar rental property asked for advice on what to do about the earthquake safety of their building, what would you tell him or her?*

Thank you for sharing this information.

Is there anything else you'd like to say before we move on to the next part of the interview?

CONCLUDING QUESTIONS:

A) Would you like to receive a summary of the results when this research is completed? Would you prefer that to be sent in the mail or do you have an email address that would be convenient? (It might be 6 months to a year from now)

B) Is there anything I could do to improve the experience of persons like you that I am contacting about participating in this study?

C) Which gift card would you prefer in appreciation for your time?

APPENDIX E — Example Recruitment Letter

UNIVERSITY OF CALIFORNIA, BERKELEY

BERKELEY • DAVIS • IRVINE • LOS ANGELES • MERCED • RIVERSIDE • SAN DIEGO

SAN FRANCISCO • SANTA BARBARA • SANTA CRUZ

February 10, 2011

[OWNER NAME]
[BUSINESS NAME]
[STREET ADDRESS]
[CITY STATE ZIP]

Dear [OWNER NAME(S)]:

What do you think about the rules and requirements on owners of multifamily buildings in the City of Berkeley?

Want to learn what other landlords like yourself are doing to prepare for a future major earthquake?

My name is Sharyl Rabinovici and I am a PhD student in public policy at the University of California, Berkeley working under the supervision of Professor Michael O'Hare. The purpose of this letter is to invite you to participate in a research study I am doing about the thoughts and experiences of people who own apartment buildings located in Berkeley, California. I am contacting you because you are listed as the legal owner of:

[PROPERTY ADDRESS(ES)]

The above property was randomly selected from a public list of Berkeley apartment buildings. It is important for this study that I speak with the owner or a person who is authorized to make major financial decisions for each property in the selected sample. If you are not such a person for the property at **[PROPERTY ADDRESS(ES)],** please call 650-207-6544 so I can remove you from my list.

The purpose of my study is to learn what multifamily apartment owners like yourself are thinking and doing about earthquakes. I also want to understand how local building policies have affected you and hear your opinions about how such policies could be improved. You are the only person who has this information so I hope you will agree to share it!

If you agree, I will interview you at a time and location of your choice. You may choose any one of these four easy ways to find out more:

⇒ Call me at: 650-207-6544
⇒ E-mail me at: srabinovici@berkeley.edu
⇒ Mail back the enclosed pre-paid postcard, telling me how you prefer to be reached.
⇒ If I do not hear back from you, I will try to reach you by phone in the next few weeks.

Once we are in contact, we can set up a convenient way to do the interview. Depending on your answers, the interview will take about an hour. I will do everything I can to make the experience quick and interesting for you.

Who's behind this study and who will benefit? As a graduate student in public policy, it's my job to find out the effects that public programs are having on different kinds of people. This kind of information is critical to building better public agencies, laws, and programs in the future. This research will be used in my PhD dissertation.

I hope you will consider participating for the following reasons:

- This is the first study ever regarding earthquakes to focus on the experiences of people who own multifamily apartment buildings. This is a unique opportunity to express your views and add the strength of your own voice to those of your peers. I will be interviewing about 60 local owners in total.

- The knowledge gained from this study may eventually benefit others including residents of cities that are considering new earthquake safety policies as well as other owners and tenants. Please become a part of this effort to learn what's working or not. This can help good ideas spread faster and mistakes be avoided elsewhere.

- After the interview, you will receive a $25 gift card to a local hardware store.

- If you would like to receive a summary of the results of this research, I am happy to provide one after the study ends, regardless of whether you yourself participate.

Again, please ***fill out and return the enclosed postcard, call me at 650-207-6544 , or email me at srabinovici@berkeley.edu*** to find out more about the project and arrange an appointment. I look forward to the chance to meet you and hear your thoughts on this topic.

Sincerely,

Sharyl Rabinovici
Richard & Rhoda Goldman School of Public Policy
University of California, Berkeley
2607 Hearst Avenue
Berkeley, CA 94720
E: srabinovici@berkeley.edu
C: 650-207-6544
http://gspp.berkeley.edu

APPENDIX F — Example Reply Postcard

UC Berkeley Research Study
Earthquakes & Apartment Building Owners in Berkeley, CA

Owner Name(s) *(please add if missing)*: [OWNER NAME]
c/o Business Name *(if applicable):* [BUSINESS NAME]
Business Address: [STREET ADDRESS]
[CITY STATE ZIP]

Is the address above the best one to reach you by mail?
□ Yes
□ No ⇒ What is the best address to reach you at?
_____
_____

What is the best phone number to reach you at? (____) _____

Your E-mail address: _____

I prefer to be contacted by (check): □ *Phone* □ *E-mail* □ *Mail*

In reference to: **[PROPERTY ADDRESS]**

APPENDIX G — Survey Instrument for Retrofitters (Paper Version)

INTERVIEW DATE: _____ and Time: _____ AM / PM

INTERVIEW LOCATION: _____

Participant Name: _____

Business Address: _____

_____

Business Phone: _____ E-mail_____

Address of Rental Property: _____

----------*Please tell the interviewer if any of the above information is incorrect*.----------

Research Study about Earthquakes & Apartment Building Owners in Berkeley, CA

INSTRUCTIONS:

This questionnaire has four sections with 10-20 short questions each. When answering them

- Please consider a **major** earthquake to be one that causes significant damage and economic disruption to the region as well as human injuries and loss of life.
- When the question refers to **your rental property**, please answer in reference to the specific apartment building listed above.

Most of the questions involve checking a box or circling the answer that best represents your response to that question or statement. Please try to answer all the questions. You may ask the interviewer for clarification at any time.

In your opinion, how likely is it that a major earthquake will happen in the San Francisco Bay Area in the next 10 years?

- ○ VERY UNLIKELY.
- ○ NOT VERY LIKELY.
- ○ MODERATELY LIKELY.
- ○ LIKELY.
- ○ VERY LIKELY.

In your opinion, how likely is an earthquake that will cause significant damage to buildings in the City of Berkeley in the next 10 years?

- ○ VERY UNLIKELY.
- ○ NOT VERY LIKELY.
- ○ MODERATELY LIKELY.
- ○ LIKELY.
- ○ VERY LIKELY.

If a major earthquake were to occur in the San Francisco Bay Area, how serious do you think the damage would be to buildings in the city where you live?

- ○ VERY MINOR.
- ○ MINOR.
- ○ MODERATE.
- ○ SERIOUS.
- ○ VERY SERIOUS.

If a major earthquake were to occur in the San Francisco Bay Area, how serious do you think the damage would be to buildings in the City of Berkeley?

- ○ VERY MINOR.
- ○ MINOR.
- ○ MODERATE.
- ○ SERIOUS.
- ○ VERY SERIOUS.

1. Earthquake Risks and Experiences

How concerned are you about the possibility of a major earthquake in the San Francisco Bay Area?

- ○ NOT AT ALL CONCERNED.
- ○ SOMEWHAT CONCERNED.
- ○ CONCERNED.
- ○ VERY CONCERNED.
- ○ EXTREMELY CONCERNED.

How likely is it that your rental property has an earthquake-related structural weakness serious enough that you should do something about it?

- ○ NO CHANCE.
- ○ NOT VERY LIKELY.
- ○ SOMEWHAT LIKELY.
- ○ MORE LIKELY THAN NOT.
- ○ HIGH CHANCE.
- ○ CERTAIN.

How concerned do you think other people who own apartment buildings in the San Francisco Bay Area are about the possibility of a major earthquake?

- ○ NOT AT ALL CONCERNED.
- ○ SOMEWHAT CONCERNED.
- ○ CONCERNED.
- ○ VERY CONCERNED.
- ○ EXTREMELY CONCERNED.

If a major earthquake were to occur in the San Francisco Bay Area, how serious do you think the damage would be to the building where you live?

- ○ VERY MINOR – STILL HABITABLE.
- ○ MINOR – HABITABLE BUT NEEDING IMMEDIATE REPAIR.
- ○ MODERATE – NOT HABITABLE WITHOUT REPAIR.
- ○ SERIOUS – NOT HABITABLE WITHOUT REPAIR TAKING MONTHS.
- ○ VERY SERIOUS – TOTAL LOSS.

1. Earthquake Risks and Experiences

If a major earthquake were to occur in the East Bay, how serious do you think the damage would be to the rental property that you own?

- ○ VERY MINOR – STILL HABITABLE
- ○ MINOR – HABITABLE BUT NEEDING IMMEDIATE REPAIR.
- ○ MODERATE – NOT HABITABLE WITHOUT REPAIR.
- ○ SERIOUS – NOT HABITABLE WITHOUT REPAIR TAKING MONTHS.
- ○ VERY SERIOUS – TOTAL LOSS.

Given your rental property's current conditions, how likely is it that someone could be injured there on-site during a major earthquake?

- ○ NO CHANCE.
- ○ NOT VERY LIKELY.
- ○ SOMEWHAT LIKELY.
- ○ MORE LIKELY THAN NOT.
- ○ HIGH CHANCE.
- ○ CERTAIN.

In your opinion, how likely is it that you personally will be injured in major Bay Area earthquake in the next 10 years?

- ○ NO CHANCE.
- ○ NOT VERY LIKELY.
- ○ SOMEWHAT LIKELY.
- ○ MORE LIKELY THAN NOT.
- ○ HIGH CHANCE.
- ○ CERTAIN.

Have you ever personally experienced a major earthquake?

- ○ YES
- ○ NO

If so, please note where or which one(s)? _____

About how often do you think about earthquakes?

- ○ DAILY
- ○ WEEKLY
- ○ MONTHLY
- ○ YEARLY
- ○ NEVER

What kind of things or situations tend to remind you?_____

_____

_____

Have you ever owned a building that was damaged in an earthquake?

- ○ YES
- ○ NO
- ○ I HAVE NOT EXPERIENCED ANY EARTHQUAKES.

If YES, please circle the highest degree of damage ever experienced for each type of property:

Home/private residence:	NONE	LIGHT	MODERATE	SEVERE	DID NOT OWN
Income or rental property:	NONE	LIGHT	MODERATE	SEVERE	DID NOT OWN
Place of business/office:	NONE	LIGHT	MODERATE	SEVERE	DID NOT OWN

Thinking back, has any earthquake caused physical injury or death to you or an immediate family member?

- ○ YES
- ○ NO

Do you know a friend, relative, neighbor, or coworker who has experienced property damage caused by an earthquake?

- ○ YES
- ○ NO

Has a friend, relative, neighbor, or coworker of yours been physically injured or killed by an earthquake?

- ○ YES
- ○ NO

Do you know a friend, relative, neighbor, or coworker who has made structural repairs to his or her private residence to prevent earthquake damage?

- ○ YES
- ○ NO

.....please continue to the next page.....

3. Individual Goals & Decision Style

Please describe your level of knowledge about earthquakes:

- ○ I KNOW ALMOST NOTHING ABOUT EARTHQUAKES.
- ○ I KNOW ONE OR TWO THINGS ABOUT EARTHQUAKES – AVERAGE CALIFORNIA CITIZEN'S AWARENESS.
- ○ I AM KNOWLEDGEABLE ABOUT EARTHQUAKES – I KNOW MORE THAN MOST PEOPLE I KNOW.
- ○ I AM VERY KNOWLEDGEABLE ABOUT EARTHQUAKES – FRIENDS AND COLLEAGUES ASK ME FOR INFORMATION AND ADVICE.

About how often do you discuss earthquakes with other people (family members, coworkers)?

- ○ DAILY
- ○ WEEKLY
- ○ MONTHLY
- ○ YEARLY
- ○ NEVER

Thinking back, have you sought out information about earthquakes from publications, the internet, books, or other media sources?

- ○ YES
- ○ NO

If YES, from what source, who and when? _____

_____

Do you live in the apartment building we have been talking about today?

- ○ YES.
- ○ NO.

If NO, do you own the building in which you live?

- ○ YES.
- ○ NO.

Do you carry earthquake insurance on any properties that your own?

- ○ I DO NOT CARRY ANY EARTHQUAKE INSURANCE.
- ○ I CARRY EARTHQUAKE INSURANCE ON SOME BUT NOT ALL OF MY PROPERTIES.
- ○ I CARRY EARTHQUAKE INSURANCE FOR ALL OF MY PROPERTIES.
- ○ I DO NOT KNOW THE STATUS OF MY INSURANCE POLICIES FOR EARTHQUAKES.

Do you carry earthquake insurance on the rental property we are talking about today?

- ○ YES.
- ○ NO.

Do you carry earthquake insurance for the place in which you live?

- ○ YES, FOR BOTH CONTENTS AND STRUCTURE.
- ○ YES, FOR CONTENTS ONLY.
- ○ I HAD EARTHQUAKE INSURANCE IN THE PAST, BUT DO NOT HAVE IT NOW.
- ○ NO.

How familiar are you with how earthquakes can affect apartment buildings like the one you own?

- ○ NOT AT ALL FAMILIAR.
- ○ SLIGHTLY FAMILIAR.
- ○ MODERATELY FAMILIAR.
- ○ VERY FAMILIAR.
- ○ EXTREMELY FAMILIAR.

How familiar are you with the specific features or factors that can make an apartment building vulnerable to earthquake damage?

- ○ NOT AT ALL FAMILIAR.
- ○ SLIGHTLY FAMILIAR.
- ○ MODERATELY FAMILIAR.
- ○ VERY FAMILIAR.
- ○ EXTREMELY FAMILIAR.

Which statement best describes your thinking about hiring a professional such as an engineer, contractor, or architect to assess your apartment building's vulnerability to earthquake shaking?

- ○ I WAS UNAWARE THAT IT WAS POSSIBLE TO DO THIS.
- ○ I AM AWARE THAT I COULD HIRE A PROFESSIONAL, BUT AM UNDECIDED ABOUT WHETHER TO DO IT.
- ○ I AM AWARE THAT I COULD HIRE A PROFESSIONAL, BUT HAVE DECIDED NOT TO DO IT.
- ○ I INTEND TO HIRE A PROFESSIONAL BUT HAVE NOT YET DONE SO.
- ○ I HAVE TAKEN STEPS TO HIRE A PROFESSIONAL BUT THE ASSESSMENT IS NOT YET COMPLETE.

3. Individual Goals & Decision Style

○ I HAVE HIRED A PROFESSIONAL AND THAT PERSON HAS COMPLETED AN ASSESSMENT.

Please fill in the circle that best describes your opinion for each statement below.

	disagree strongly	disagree moderate-ly	disagree a little	neither agree nor disagree	agree a little	agree moderate-ly	agree strongly
IT IS EASY TO PREPARE FOR THE OCCURRENCE OF A MAJOR EARTHQUAKE.	○	○	○	○	○	○	○
PREPARING FOR A MAJOR EARTHQUAKE IS IMPORTANT.	○	○	○	○	○	○	○
MAJOR EARTHQUAKES CAUSE A GREAT DEAL OF DAMAGE AND INJURIES.	○	○	○	○	○	○	○
A MAJOR EARTHQUAKE WILL SOON OCCUR IN THE SAN FRANCISCO BAY AREA.	○	○	○	○	○	○	○
BEING PREPARED FOR A MAJOR EARTHQUAKE IS AN EFFECTIVE STRATEGY.	○	○	○	○	○	○	○
THERE IS A HIGH PROBABILITY OF A MAJOR EARTHQUAKE OCCURRING IN THE SAN FRANCISCO BAY AREA.	○	○	○	○	○	○	○
NOT VERY MANY PEOPLE TAKE STEPS TO MAKE THEIR PROPERTIES SAFER FOR EARTHQUAKES.	○	○	○	○	○	○	○
EARTHQUAKE INSURANCE IS A BETTER STRATEGY FOR PROPERTY OWNERS THAN MAKING STRUCTURAL IMPROVEMENTS.	○	○	○	○	○	○	○
I KNOW MANY PEOPLE WHO HAVE TAKEN STEPS TO PROTECT THEIR PROPERTIES FROM EARTHQUAKES.	○	○	○	○	○	○	○

3. Individual Goals & Decision Style

With professional input, some buildings can be structurally repaired or improved to better withstand the forces of earthquake shaking. In your opinion, that kind of STRUCTURAL REPAIR or RETROFIT, if it were possible for your rental property, would:

	do not agree at all	agree a little	agree moderate-ly	agree strongly	agree very strongly
COST A LOT OF MONEY.	○	○	○	○	○
BE USEFUL FOR MULTIPLE PURPOSES.	○	○	○	○	○
REQUIRE LOTS OF COOPERATION FROM OTHER PEOPLE.	○	○	○	○	○
PROTECT PERSONS EFFECTIVELY.	○	○	○	○	○
PROTECT PROPERTY EFFECTIVELY.	○	○	○	○	○
REQUIRE A LOT OF SPECIALIZED KNOWLEDGE OR SKILL.	○	○	○	○	○
REQUIRE A LOT OF TIME.	○	○	○	○	○
REQUIRE A LOT OF EFFORT.	○	○	○	○	○
BE RISKY.	○	○	○	○	○
BENEFIT THE COMMUNITY IN GENERAL.	○	○	○	○	○
BENEFIT TENANTS.	○	○	○	○	○
BENEFIT ME PERSONALLY AS AN OWNER.	○	○	○	○	○

3. Individual Goals & Decision Style

Suppose your community is planning a new program to encourage owners like you to modify your rental properties to prevent earthquake damage or injuries.

How likely would you be to retrofit your rental property to prevent earthquake damage or injuries if the following programs or incentives were offered? (Please answer for each separately).

	not at all likely	a little likely	moderately likely	highly likely	extremely likely
DISCOUNT ON INSURANCE PREMIUM.	○	○	○	○	○
TAX REBATES OR INCENTIVES.	○	○	○	○	○
FREE ITEMS OR EQUIPMENT NEEDED TO PREVENT DAMAGE.	○	○	○	○	○
FREE ADVICE TO ASSIST IN PREVENTION EFFORTS.	○	○	○	○	○
FREE LABOR OR SERVICES TO ASSIST IN PREVENTION EFFORTS.	○	○	○	○	○
MORE INFORMATION ON REGULATIONS AND CODES.	○	○	○	○	○
FINANCIAL ASSISTANCE THAT COVERED 5-10% OF THE COST OF THE PREVENTATIVE MEASURE.	○	○	○	○	○
PROGRAMS THAT MADE IT EASIER TO GET A LOAN FOR PREVENTION EFFORTS.	○	○	○	○	○
WAIVER OF BUILDING PERMIT FEES.	○	○	○	○	○
PERMISSION TO PASS ON COSTS TO TENANTS (RAISE RENTS).	○	○	○	○	○

3. Individual Goals & Decision Style

Each item on the following list is a statement that a person may either agree with or disagree with. For each item, indicate how much you agree or disagree with what the item says. Please respond to all the items; do not leave any blank. Choose only one response to each statement. Please be as accurate and honest as you can be. Respond to each item as if it were the only item. That is, don't worry about being "consistent" in your responses. Choose the single, best fit from among the four response options.

	very true for me	somewhat true for me	somewhat false for me	very false for me
A PERSON'S FAMILY IS THE MOST IMPORTANT THING IN LIFE.	○	○	○	○
EVEN IF SOMETHING BAD IS ABOUT TO HAPPEN TO ME, I RARELY EXPERIENCE FEAR OR NERVOUSNESS.	○	○	○	○
I GO OUT OF MY WAY TO GET THINGS I WANT.	○	○	○	○
WHEN I'M DOING WELL AT SOMETHING I LOVE TO KEEP AT IT.	○	○	○	○
I'M ALWAYS WILLING TO TRY SOMETHING NEW IF I THINK IT WILL BE FUN.	○	○	○	○
HOW I DRESS IS IMPORTANT TO ME.	○	○	○	○
WHEN I GET SOMETHING I WANT, I FEEL EXCITED AND ENERGIZED.	○	○	○	○
CRITICISM OR SCOLDING HURTS ME QUITE A BIT.	○	○	○	○
WHEN I WANT SOMETHING I USUALLY GO ALL-OUT TO GET IT.	○	○	○	○
I WILL OFTEN DO THINGS FOR NO OTHER REASON THAN THAT THEY MIGHT BE FUN.	○	○	○	○
IT'S HARD FOR ME TO FIND THE TIME TO DO THINGS SUCH AS GET A HAIRCUT.	○	○	○	○
IF I SEE A CHANCE TO GET SOMETHING I WANT I MOVE ON IT RIGHT AWAY.	○	○	○	○
I FEEL PRETTY WORRIED OR UPSET WHEN I THINK OR KNOW SOMEBODY IS ANGRY AT ME.	○	○	○	○
WHEN I SEE AN OPPORTUNITY FOR SOMETHING I LIKE I GET EXCITED RIGHT AWAY.	○	○	○	○
I OFTEN ACT ON THE SPUR OF THE MOMENT.	○	○	○	○
IF I THINK SOMETHING UNPLEASANT IS GOING TO HAPPEN I USUALLY GET PRETTY "WORKED UP."	○	○	○	○

3. Individual Goals & Decision Style

	very true for me	somewhat true for me	somewhat false for me	very false for me
I OFTEN WONDER WHY PEOPLE ACT THE WAY THEY DO.	○	○	○	○
WHEN GOOD THINGS HAPPEN TO ME, IT AFFECTS ME STRONGLY.	○	○	○	○
I FEEL WORRIED WHEN I THINK I HAVE DONE POORLY AT SOMETHING IMPORTANT.	○	○	○	○
I CRAVE EXCITEMENT AND NEW SENSATIONS.	○	○	○	○
WHEN I GO AFTER SOMETHING I USE A "NO HOLDS BARRED" APPROACH.	○	○	○	○
I HAVE VERY FEW FEARS COMPARED TO MY FRIENDS.	○	○	○	○
IT WOULD EXCITE ME TO WIN A CONTEST.	○	○	○	○
I WORRY ABOUT MAKING MISTAKES.	○	○	○	○

Below are a number of traits that may or may not apply to you. Please fill in the circle in the column next to each statement that indicates the extent to which you agree or disagree with that statement. You should rate the extent to which the overall pair of traits applies to you, even if one characteristic applies to you more strongly than the other.

I SEE MYSELF AS:

	disagree strongly	disagree moder-ately	disagree a little	neither agree nor disagree	agree a little	agree moder-ately	agree strongly
EXTROVERTED, ENTHUSIASTIC.	○	○	○	○	○	○	○
CRITICAL, QUARRELSOME.	○	○	○	○	○	○	○
DEPENDABLE, SELF-DISCIPLINED.	○	○	○	○	○	○	○
ANXIOUS, EASILY UPSET.	○	○	○	○	○	○	○
OPEN TO NEW EXPERIENCES,	○	○	○	○	○	○	○
RESERVED, QUIET.	○	○	○	○	○	○	○
SYMPATHETIC, WARM.	○	○	○	○	○	○	○
DISORGANIZED, CARELESS.	○	○	○	○	○	○	○
CALM, EMOTIONALLY STABLE.	○	○	○	○	○	○	○
CONVENTIONAL, UNCREATIVE.	○	○	○	○	○	○	○

4. General Questions

What was your age at your last birthday? _____

What is the highest level of schooling you have completed?

- ○ SOME HIGH SCHOOL.
- ○ HIGH SCHOOL.
- ○ SOME COLLEGE OR ASSOCIATE'S DEGREE.
- ○ FOUR YEAR COLLEGE.
- ○ SOME GRADUATE SCHOOL.
- ○ GRADUATE OR PROFESSIONAL DEGREE. (please specify:_____)

Are you currently married or living with a domestic partner?

- ○ YES
- ○ NO

Are you a parent?

- ○ YES
- ○ NO

How many children age 18 or under currently live with you?

- ○ 0
- ○ 1
- ○ 2
- ○ MORE THAN 2

Please write down the 5-digit ZIP code where you live: ___ ___ ___ ___ ___

How many years have you lived at your current residence? _____

How many years in total have you lived within the San Francisco Bay Area? _____

Have you ever lived in the rental property we've been talking about today?

- ○ YES
- ○ NO

4. General Questions

What was the approximate vacancy rate in your rental property over the last 12 months? _____ %

What was the lowest unit rent in the building in the last month? $ _____

What was the highest unit rent in the building last month? $ _____

What is your current thinking about selling the rental property we've been discussing today?

- ○ I WILL PROBABLY SELL IT WITHIN 12 MONTHS.
- ○ I WILL PROBABLY SELL IT 1-5 YEARS FROM NOW.
- ○ I WILL PROBABLY SELL IT 6-10 YEARS FROM NOW.
- ○ I WILL PROBABLY SELL IT MORE THAN 10 YEARS FROM NOW.
- ○ I DO NOT INTEND TO SELL IT.

This is the end of the questionnaire.

Thank you for providing this information.

APPENDIX H — Letters of Approval for Human Subjects Research

UNIVERSITY OF CALIFORNIA AT BERKELEY

BERKELEY • DAVIS • IRVINE • LOS ANGELES • MERCED • RIVERSIDE • SAN DIEGO

SAN FRANCISCO • SANTA BARBARA • SANTA CRUZ

COMMITTEE FOR PROTECTION OF HUMAN SUBJECTS
OFFICE FOR THE PROTECTION OF HUMAN SUBJECTS
University of California, Berkeley
2150 Shattuck Avenue, Suite 313
Berkeley, CA 94704 -5940

(510) 642-7461
Fax: (510) 643-6272
Website: http://cphs.berkeley.edu
FWA#00006252

NOTICE OF APPROVAL FOR HUMAN RESEARCH

DATE:	*May 18, 2010*
TO:	*Michael O'HARE, Pub Plcy* *Sharyl Jean Marie Rabinovici, Pub Plcy*
CPHS PROTOCOL NUMBER:	*2010-01-555*
CPHS PROTOCOL TITLE:	*What Motivates Apartment Owners to Invest in Structural Mitigation for Earthquakes? The Relative Roles of Risk Perceptions, Social Influences, Decision Framing, and Personality*
FUNDING SOURCE(S):	*(SPO Proposal# 20100461)*

A *amendment* application was submitted for the above-referenced protocol. The Committee for Protection of Human Subjects (CPHS) or Office for the Protection of Human Subjects (OPHS) has reviewed and approved the application by *expedited* review procedures.

Effective Date: May 18, 2010
Expiration Date: March 10, 2011

This approval is issued under University of California, Berkeley Federalwide Assurance #00006252.

If you have any questions about the above, please contact the Office for the Protection of Human Subjects staff at Tel (510) 642-7461; Fax (510) 643-6272; or Email ophs@berkeley.edu .

Thank you for your cooperation and your commitment to the protection of human subjects in research.

Sincerely,

Jane MAULDON
Committee for Protection of Human Subjects

UNIVERSITY OF CALIFORNIA AT BERKELEY

BERKELEY • DAVIS • IRVINE • LOS ANGELES • MERCED • RIVERSIDE • SAN DIEGO

SAN FRANCISCO • SANTA BARBARA • SANTA CRUZ

COMMITTEE FOR PROTECTION OF HUMAN SUBJECTS
OFFICE FOR THE PROTECTION OF HUMAN SUBJECTS
University of California, Berkeley
2150 Shattuck Avenue, Suite 313
Berkeley, CA 94704 -5940

(510) 642-7461
Fax: (510) 643-6272
Website: http://cphs.berkeley.edu
FWA#00006252

NOTICE OF APPROVAL FOR HUMAN RESEARCH

DATE:	*September 17, 2010*
TO:	*Michael O'HARE, Pub Plcy* *Sharyl Jean Marie Rabinovici*
CPHS PROTOCOL NUMBER:	*2010-08-2053*
CPHS PROTOCOL TITLE:	*History and Implementation of Berkeley's 2005 Soft-Story Engineering Study Ordinance*
FUNDING SOURCE(S):	*NONE*

A *new* application was submitted for the above-referenced protocol. The Committee for Protection of Human Subjects (CPHS) or Office for the Protection of Human Subjects (OPHS) has reviewed and approved the application by *exempt* review procedures.

Effective Date: September 17, 2010

This approval is issued under University of California, Berkeley Federalwide Assurance #00006252.

If you have any questions about the above, please contact the Office for the Protection of Human Subjects staff at Tel (510) 642-7461; Fax (510) 643-6272; or Email ophs@berkeley.edu .

Thank you for your cooperation and your commitment to the protection of human subjects in research.

Sincerely,

Rebecca Dianne ARMSTRONG
Committee for Protection of Human Subjects