MONTEREY-SEASIDE QUADRANGLES: EARTHQUAKE FAULT ZONES AND THE LOCAL BUILDING POLICY

Liquefied ground near Moss Landing after the 1989 Loma Prieta Earthquake

A Capstone Project

Presented to the Faculty of Earth Systems Science and Policy
in the
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in Partial Fulfillment of the Requirements for the Degree of
Bachelor of Science

By

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Dear Faculty,

My Project is entitled “Monterey-Seaside Quadrangles: Earthquake Fault Zones and the Local Building Policy”. I have examined both State and County policies to determine what level of restriction due to seismic potentials are imposed on building and planning sites.

The population of the Monterey Peninsula is increasing and is expanding into previously undeveloped areas. To prevent unnecessary losses, it is important to realize the geological restraints in an area before developing.

For this project, I did not collaborate with any outside agencies. The project is intended to create an awareness of the potential hazards and determine any inadequacies in the current policies. It is intended to inform the community of the existence of potential seismicity and the impacts it could have on a region undergoing population increase and expansion. I would like to show the citizens that there is an excellent opportunity to get involved and let the building and planning departments know there is a concern about a seeming lack of county-specific policies that pertain to faulting.

Reasons for choosing this project are that I believe governmental agencies should protect their citizens through well developed policies. I believe it is a waste of finite resources to build in potentially hazardous regions without adequate mitigation proposals (all the world is seismic). My biases and assumptions did not change through the development of this project. Prior to project commencement, I believed that the agencies responsible for maintaining public safety through policy creation and implementation are inadequate. After much research I still hold my assumptions to be true.

The areas I would like to be assessed in are; Major learning outcome number three, application of knowledge in the physical sciences, and; number four, the application of economic/political knowledge.

Sincerely,

Chris Pilson

cc: Sharon Anderson and Dan Shapiro

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ABSTRACT

The population of the Monterey peninsula is increasing. Developers are looking to expand housing and other commercial and public building into previously undeveloped areas. Because faults cut through the peninsula and surrounding areas, the possibility of building on potentially seismically hazardous areas increases as the population expands. Upon examination of the current Monterey County policies on building and planning I found those policies did not fully reflect the current scientific knowledge about active faults in the region. The Monterey County General Area Plan is currently being revised as a normal process of revising the Plan every 20 years. The last Plan was written in 1982. However the County does not have a full time geologist working on the Monterey County General Plan update. Economics and workload are the determining factors for using a consultant versus a full time county employee. The known faults that were deemed inactive by the State Geologist at the time of the last Plan are generally accepted to be active by geologists who have mapped the region both before and after the implementation of the 1982 Greater Monterey Peninsula Area Plan (Greater Monterey Peninsula Area Plan, 1982). Although the State encourages cities and counties to be more stringent in their zoning than what is mandated as the minima by the Legislature, Monterey County has not created policies that are more conservative than the State's. The most current geological studies of the area have identified more than a single fault with the potential to inflict severe loss of life and property. It is uncertain to what extent these findings will be implemented in the current revision of the Monterey County General Area Plan.

INTRODUCTION

Planning and building policies in a region with seismic potential should ideally be based on work by geologists. Policy makers should develop plans to protect its citizens from the results of seismic activity by identifying potentially hazardous areas, publishing those findings and taking whatever other proscriptive remedies are necessary to restrict development on and around those areas. Site failure resulting in the loss of lives and property is possible when geologic constraints are not fully considered prior to project commencement. The Monterey Peninsula is a region with seismic potential.

Monterey County, like most coastal regions in California, has been experiencing steady population growth in the past few decades. The California Department of Housing and Community Development (HCD) released a report, "Raising the Roof, California's Housing Development Projections and Constraints 1997-2020", in which it estimated that by 2007 Monterey County will have an added 22,000 to 28,000 thousand new housing units added to the existing 125,768 housing units (California Department of Housing and Community Development).

The population influx has not resulted in greater population density in previously developed areas. Monterey's population is instead expanding into hitherto undeveloped areas of the County. Identifying active faults and other areas of potential seismic activity on the Monterey Peninsula has become increasingly urgent as the demand for new housing and commercial structures mount. Increased risk of failures arise due to expansion of development into previously unexploited areas without clearly identifying areas that may lie along or around active faults.

The 7.5 minute Monterey and Seaside quadrangles encompass the towns of Monterey, Pacific Grove, and Seaside. The Monterey Peninsula is located on the Salinian block which is bound by two major faults; the San Gregorio to the southwest and the San Andreas to the northeast. The Salinian block is being tectonically compressed and torqued. The San Gregorio fault shows right-lateral strike slip displacement. However since most of the fault is located under water it has been difficult to assess.

Joseph Clark's United States Geological Survey (USGS) mapping of the Monterey and Seaside 7.5 minute quadrangles (1974) closely examined the active faults. In 1985 William A. Bryant of the California Department of Mines and Geology (CDMG) performed a limited field reconnaissance survey and concluded the faults were not sufficiently active to warrant review by the State Geologist (Clark, Dupre & Rosenberg, 1997).

In 1994 Clark and Lew Rosenberg published a technical report on the geology of the greater Monterey area for the National Earthquake Hazards Reduction Program (NEHRP). They documented the stratigraphy, structure, fault geometry and activity (Rosenberg and Clark, 1994). In 1997 they published an updated report for the USGS. This mapping confirmed the faults described by Clark and Rosenberg in the Monterey and Seaside 7.5 minute quadrangles as active (Clark et al, 1997)

An active fault is one that has experienced Holocene movement (i.e. within the past 11,000 years). This is the definition accepted by the State of California (CDMG). Although the accepted definition seems clear-cut, the interpretation and connotations associated with "active fault" is open for interpretation, particularly when a fault is officially deemed active under State policy. Clark's mapping identifies several faults on the Monterey Peninsula as active. However,

in 1982 the County of Monterey omitted these active faults because “the process for adding faults to the list of active faults is so complex” (Greater Monterey Area Plan, 1982).

PROJECT PURPOSE, GOALS & QUESTIONS TO ANSWER

The initial purpose of this project was to determine whether Monterey County building and planning policies reflect current knowledge of potential seismicity as well as to examine what connections exist between State and local agencies over current geologic research.

Questions that arose from the initial purpose were: Has there been enough recent seismic activity on the Monterey peninsula to justify a policy to restrict development in and around potentially hazardous seismically active areas? If so, does Monterey have such a policy? If the policy or policies exist, how are the local faults addressed with respect to development? What are the limitations or omissions in such a policy? If no such policy or policies exists, is it necessary to create them? Assuming such a policy exists, are potential building sites being examined closely enough to warrant them safe for human habitation?

TYPES OF SEISMIC HAZARDS

Types of seismic hazards are liquefaction, mass wasting, and structural damage. Many other destructive events are associated with earthquakes such as fires and pipe ruptures.

Liquefaction occurs during or as a result of an earthquake, when saturated unconsolidated material turns into liquid and flows. Underground tanks and piping can shift surface-ward while large surface structures sink and crumble under their own weight (Lutgens and Tarbuck, 1992).

Mass wasting is the process by which material moves down slope from its original location. Mudflows, slumping, and rockslides are all mass wasting processes. These events

occur because of changes in the angle of repose of a hillside and or the viscosity of the material (Lutgens and Tarbuck). These changes in ground stability can lead to structural damage and collapse of human-made constructions.

Structural damage is one of the main reasons for examining the policies that pertain to future development. Unreinforced masonry buildings and wood structures are prone to damage during shaking. Many residents in the Santa Cruz Mountains lived in wooden homes thinking they were safe from the earthquake damage because of the perceived notion that wood would absorb the shaking and move with the earth. The 1989 Loma Prieta earthquake proved this to be a fallacy as many of these homes were destroyed.

Damages can be incurred many miles from the actual fault movement. For example, Moss Landing, approximately twenty miles from the San Andreas Fault, suffered liquefaction, destruction of buildings, bridges and other man-made structures as a result of the Loma Prieta Earthquake.

TYPES OF FAULTS

A common type of fault in the Western United States is a right-lateral fault. When viewed from either side of the fault it appears the opposite side is moving to the right. Conversely, a left-lateral fault appears that the opposite side is moving to the left. A strike-slip fault has displacement only in the horizontal plane. A reverse fault is when the upper block moves up over the lower block placing older material over younger. A thrust fault is a reverse fault that has an angle of thirty degrees or less (Bolt, 1993). The Monterey Peninsula displays several types of faults.

GEOLOGICAL CONDITIONS OF THE MONTEREY AREA

The Monterey Peninsula is situated within the Salinian Block, which is undergoing compression between the San Andreas Fault, approximately 35 km to the northeast, and the San Gregorio Fault zone, approximately 9 km to the southwest (Rosenberg and Clark). The Salinian block is composed of a crystalline basement of granitic and regionally metamorphosed rocks (Clark, et al). The area has numerous high-angle, discontinuous faults less than 1 km long.

The Tularcitos fault zone is located in the southern portion of the Seaside quadrangle and spans southeastward down the Carmel Valley. The Tularcitos fault meets the Navy fault and passes north through the hills in Monterey and seen again in Seaside where the fault enters the bay. Rosenberg and Clark (1994) radiocarbon dated colluvium and found there to have been movement along the Tularcitos fault within the past 7780 years. Figures 1 and 2 show the extent of the faults and the positioning of the faults with respect to the peninsula.

The Navy fault is a northwest-striking steeply southwest-dipping fault. It extends from Carmel Valley to the Monterey Bay. It is believed the Navy fault is a continuation of the Tularcitos fault (Clark et al., 1997).

The Sylvan Thrust fault is located in the Monterey foothills. This fault is actually a group of shorter thrust faults that offset terrace deposits by 1-2m and up to 15-20m in some areas. This area is thought to be responsible for the group of 21 small earthquakes during the later part of 1975 and the early portion of 1976. Of the faults examined Clark et al. in 1997, the Sylvan Thrust fault has the “highest rate of uplift and the greatest number of earthquakes”. The fault has been active at least within the past 4890 years.

The Hatton Canyon fault is located south of the Sylvan Thrust and northeast of the town of Carmel. It spans from Carmel Valley in the south and northwestward to Point Joe. It shows displacement within the past 2080 years.

METHODS USED TO DETERMINE FAULT ACTIVITY

Rosenberg and Clark dated the deposits from marine terraces on the peninsula. They examined soil profile development and used Carbon 14 to determine the ages. For areas with higher elevations they extrapolated from the uplift rates of lower marine terraces to determine an approximate age of the deposits. In the past quarter century there has been much research devoted to the potential seismicity of the Monterey area as described below.

HISTORICAL EVIDENCE

Historical records of seismic activity are varied and often anecdotal. In 1887, Edward S. Holden compiled a List of Recorded Earthquakes in California, Lower California, Oregon and Washington Territory from published as well as private information. Holden was President of the University of California and Director of the Lick Observatory. He thought generating a list of all reported earthquakes west of the Sierras was an important framework for interpreting the data being recorded on then newly installed seismographs(Holden 1887).

Several entries in Holden's compilation indicate there had been significant seismic activity in the Monterey area within the previous 50 years. The earliest listed earthquake in the Monterey area was at 5pm on April 25,th 1836 as reported in H.H. Bancroft's History of the Pacific (Holden, 1887). Bancroft also reported destructive earthquakes from Monterey northward on June 9th and 10th of that year. The events were described as "severe shocks from

Monterey northward". Other significant events occurred during the summer of 1841 in which "The shocks of one hundred and twenty earthquakes were felt during two successive months of summer."

The largest most recent recorded earthquake in the Monterey area was in 1926 at an estimated 6.1 on the Richter scale (Griggs, 1973). This earthquake was felt over an area of 100,000 square miles (Bolt and Miller, 1975). It is now thought that this earthquake was possibly related to the San Gregorio fault (Clark et al., 1997).

SCIENTIFIC EVIDENCE

Since the mid-seventies there has been more scientific research performed throughout the area. The first significant project was Joseph Clark's USGS mapping. During Clark's 1974 work on the preliminary geologic map of the Monterey and Seaside 7.5 minute quadrangles, he mapped and indicated that the faults in the Monterey area were potentially active (Clark, 1974). Eleven years later, the head of the Alquist-Priolo Earthquake Fault Zoning program for the California Division of Mines and Geology, William A. Bryant, performed a limited survey of the area and deemed these same faults to be "not sufficiently active" to warrant zonation by the State Geologist (Bryant, 1985).

Rosenberg and Clark extensively mapped the faulting of the Monterey area in 1994. They found enough evidence of recent movement of the faults to justify the classifying the Hatton Canyon, Sylvan Thrust, Navy and other faults as active under State standards (Rosenberg and Clark, 1994).

In 1994 the National Earthquake Hazards Reduction Program (NEHRP) of the USGS formed the Working Group on Northern California Earthquake Potential to assist the National

Seismic Hazard mapping project. The Working Group is comprised of twenty-nine individuals from various public agencies, universities, and private consulting firms. One notable member is William A. Bryant of the California Division of Mines and Geology.

In 1996 they published the USGS open-file report "Database of Potential Sources for Earthquakes Larger than Magnitude 6 in Northern California". The area covered by this report spans from Big Sur north to Gualala and Stockton in the East. They created a model to determine the probability of seismic activity along the major faults in the area. In the probability model they used both California Division of Mines and Geology (CDMG) databases as well as historical and paleoseismological data. They concluded that the Monterey Bay-Tularcitos fault has the potential for a 7.1 (M_W) earthquake. They found that the fault has an effective recurrence rate of 2600 years and a slip rate of .5mm/yr. From the Working Group's findings, they did not predict when the next one will occur but instead, the potential magnitude and the recurrence interval based on regional models.

The methods of the Working Group were similar to those of Clark et al. (1997). Both groups used regression equations developed by Wells and Coopersmith (1994) to find the Moment Magnitude(M_W) for the Monterey Bay-Tularcitos fault, however Clark et al. concluded the greatest earthquake would be a 6.8.

STATE POLICIES

There are two main policies regarding faulting and seismicity in California; the Alquist-Priolo Act (A-P Act) of 1972 and the Seismic Hazards Mapping Act of 1990. Earthquakes instigated both of these policies.

The A-P act resulted from the San Fernando earthquake of 1971 with a moment magnitude (M_W) of 6.6 which caused over 500 million dollars in damage and 65 fatalities, a majority of which were caused by the collapse of the Veteran's Administration Hospital.

The Seismic Hazards Mapping Act was in response to the Whittier (1987) and Loma Prieta (1989) earthquakes, which caused $358 million and $6 billion in damages respectively (Tarbuck and Lutgens, 1992).

ALQUIST-PRIOLO ACT

Now entitled The Alquist-Priolo Special Studies Zone Act Earthquake, the act mandated the identification of surface ruptures of faults in the State in order to restrict building of most human inhabited structures on the surface trace of active faults.

The A-P Act required restrictions on building most human inhabited structures within a one-quarter mile wide area around active faults except where the State Geologist designated a wider zone. No structure intended for human occupancy may be built across active faults. Within the surrounding quarter-mile zone, structures must be able to withstand direct fault offset. Project sites must be reviewed by geologists to determine whether the projects are located on or near active faults. In most cases, buildings must be set back from an active fault by at least 50 feet. There are exemptions from these laws such as one to two story single-family dwellings constructed of wood or steel. If the project is not part of a multi-family dwelling or development it may also be exempt from the necessary 50-foot fault boundary setback.

SEISMIC HAZARDS MAPPING ACT

The Seismic Hazards Mapping Act was created to help alleviate problems encountered with earthquake-related effects such as liquefaction and other non-surface earthquake hazards. The two main areas of concentrated mapping are San Francisco and Los Angeles. Figure 3 shows that the current mapping schedule for the Monterey Peninsula is planned but not actually scheduled. The map shows that 2004 is the last year that has been actually scheduled leaving many areas only as "planned".

IMPLICATIONS OF ALQUIST-PRIOLO ACT FOR MONTEREY COUNTY

The A-P Act states that county and city regulations may be more restrictive than those of the State. Monterey County chose not have more restrictive regulations than the State in the 1982 Greater Monterey Peninsula Area Plan.

The Plan regulates such things as traffic, housing, and development, including identification of and zonation around active faults. The Plan refers to the Alquist-Priolo Act and identifies only the San Andreas Fault, concluding that it, "is generally agreed that the San Andreas is capable of producing an earthquake of up to 8.5 Richter". Although many of the faults were determined to be active by Clark's 1974 work, they were omitted from the list of active faults because the process for adding new faults to the list of active faults was complex. No faults in the Monterey area would be classified as "active by the Alquist-Priolo act but will be considered by geologists to be active and capable of inflicting severe loss of life and property" (Greater Monterey Area General Plan). Figure 4 shows the extent of the A-P maps for Monterey

County. It is uncertain whether the County was specifically excluded or rather the County was not proactive in the policy creation process.

IMPLICATIONS OF THE SEISMIC HAZARDS MAPPING ACT FOR MONTEREY

The State's implementation of the Seismic Hazards Mapping Act has been slow. Though the State legislature mandated that most of the potential seismic hazards in the State be mapped, the project "has not been adequately funded or carried out." (California Seismic Safety Commission, 1994). State-sponsored mapping of the Monterey area will not be considered for scheduling until at least 2004, leaving the core responsibility for assuring current seismic information up to the county and local governments.

REVIEW OF POTENTIAL BUILDING SITE

State regulations covering the process of potential development sites have been inconsistent. Evaluation begins with a geotechnical report detailing the potential natural and seismic hazards. As defined by the State an adequate level of safety "provides reasonable protection of public safety", though it does not necessarily ensure the structure integrity and functionality of the project.

However, Title 14, Article 10, Section 3725 of the California Code of Regulations states that the necessity for a geotechnical report can be waived. To waive the necessity for a geotechnical report the lead agency or the governmental agency with the authority to approve projects refers to areas in the vicinity with similar geologic features. The next step requires the project to be assessed and mitigation solutions proposed to maintain an adequate level of safety.

Without a clear identification of geologically significant features in the area surrounding a proposed project, there is no method of ensuring that potentially seismically active areas are differentiated from inactive areas. Without that identification and differentiation, waiving a geotechnical report based on Title 14, Article 10 may overlook potentially significant information, defeating the intent of the regulations, and allow projects to proceed in potentially hazardous areas.

SOCIETAL IMPORTANCE

The Monterey Peninsula's population is increasing and more undeveloped areas of the region are undergoing development. Monterey is one of the few counties in California that have actually had a decrease in gross population density (persons/acre) over the past couple of decades. From 1984 to 1996 the population of Monterey County increased by 42,000 people and almost 7 thousand more acres were urbanized. The population is expanding outward from the old population centers throughout the County in a continuous search for new lands to exploit.

Development on and around active faults would seem to be inevitable if zonation does not incorporate current geological information. Until now the Monterey County planners have opted to use Bryant's 1985 findings of no active faulting in the area.

Although the State has not identified active faults in the Monterey area, the A-P Act leaves the counties free to adopt more conservative fault zoning regulations based on locally sponsored identification of active faults not identified by the State. The County and local governments could choose to incorporate the detailed studies of the area to regulate building, particularly in the 2001 revision of the Greater Monterey County General Area Plan.

There is precedent for the Monterey County planners to adopt zoning policies that are more conservative than the State guidelines. On May 19, 2000 the California Department of Housing and Community Development (HCD) released an update of the California Statewide Housing Plan entitled "Raising the Roof, California's Housing Development Projections and Constraints 1997-2020". The HCD report determined land availability by excluding sites if they had a slope greater than 15% or were: wetlands, endangered species habitat, flood zones, prime agricultural land, greater than 10 kilometers from a major highway or urban center, public or government land. The HCD classified land as potentially developable that is undeveloped or privately owned. It concluded that Monterey had 1,100,311 acres of land available for development. This number is over half of the 2,127,360 acres of land in Monterey County.

Figure 5 shows the map HCD produced by the State of California displaying the developable lands in pale yellow. To generate the maps the HCD used a variety of sources such as USGS, National Wetlands Bureau, California Farmland Mapping and Monitoring Project (CFMMP).

The Monterey County determined that it had only 330,000 acres of potentially developable land, a difference of 770,311 acres or 36% of the land in Monterey County that would be potentially developable under State standards. Figure 6 is a similar map that Monterey County created to identify developable land. Comparing the two maps, one key factor that accounts for the difference in acreage is the calculation of slope. The County calculated a larger acreage of land to have a slope of 15% or greater than had the State. The discrepancy in areas with a slope greater than 15%, shown in red on both maps.

RECOMMENDATIONS AND REAL WORLD APPLICATIONS

To broaden the impact of this project, I spoke with Traci Hukill, the news editor of the Coast Weekly which has a circulation of 42,000, about doing a story on the potential seismicity of the Monterey Peninsula and the local policies relating to the development of areas with faults. She was very interested in the matter. We spoke for approximately a half an hour. After describing the polices or conspicuous lack thereof, she remarked that this would be an interesting article if there was faulting in the area. I described the extensive faulting and their historical context.

Another option, if for some reason the Weekly decides not to write such an article, I will approach the Carmel Pine Cone with a circulation of 25,000. While the former venue is preferred, any exposure would be beneficial to the cause. Should neither of the papers want to write such an article I would then draft an opinion piece and submit it to both of the weeklies and the Monterey Herald. The goal is to reach the community to create an awareness of local faulting, development constraints and respective policy concerns.

FUTURE OF POLICIES IN MONTEREY

The Monterey County General Area Plan is currently undergoing revision. Monterey County does not have a full-time geologist "because the County doesn't rely on employees for specialty knowledge, but rather relies on consultants. It is a matter of workload and economics." (Mounday, L. Monterey County Building and Planning Department). The County has hired Lew Rosenberg as its consulting geologist. Rosenberg and Clark reported in 1994 that there was enough evidence of recent movement of the Hatton Canyon, Sylvan Thrust, Navy, and other faults to classify them as active under State standards. Rosenberg is preparing a technical report

to assist county administrators to revise the Plan. It is unknown at this time whether the report will be fully incorporated into the currently scheduled update.

FURTHER RESEARCH NEEDS/GAPS IN KNOWLEDGE/STILL UNANSWERED

There are a number of open questions concerning Monterey County's lack of proper identification and classification of active faults. The most pressing is whether Monterey was intentionally excluded from the A-P Act. It is unclear whether Monterey was excluded from the A-P mapping or whether the A-P Act felt no necessity to actively study Monterey. No maps exist for the Monterey Peninsula and the bulk of the county within the published mapping for the A-P Act.

During the current revision to the Monterey County General Area Plan, the County has a chance to incorporate Rosenberg and Clark's 1994 report on active faulting. No information about the incorporation of the Rosenberg and Clark report in the Plan has been reported, and County officials have not responded to questions about any plan to reclassify faults Rosenberg and Clark identified as active that were excluded from the 1982 revision of the Plan.

This project was effective in determining the existence of faults on the Monterey Peninsula. A major weakness was that it did not fully address who bears the responsibility for the lack of Alquist-Priolo maps, or why the faults are so complex that they have a variety of classifications ranging from inactive but generally considered active, potentially active, active, and active but too complex to register as active. These discrepancies do not provide a robust and persuasive argument to encourage proactive policy creation and implementation. The County agencies were not particularly forthcoming with detailed information regarding what their responsibilities are to ensure public safety with respect to potential seismicity. It is possible I did

not direct the right questions to the right individuals. It is also possible that the County does not have a policy for anyone person to take responsibility for policy creation or development. There could be a lack of communication between various departments and so no one person or entity is responsible for the policies regarding faulting and seismic potential.

DISCUSSION

There should be restrictions on building in areas with known faults or areas prone to liquefaction. Individuals alone do not suffer the financial burden for damages caused by earthquakes. Also, the County government assumes the legislatively-mandated role of protection of public health and safety.

A troubling area of confusion is the dispute concerning active faults. The State has created a definition but the faults in Monterey County are not treated as active faults. Clark's active fault mapping over twenty-five years ago is still not widely accepted and therefore preparation and mitigation proposals have not been created. Investigations after the 1974 mapping, specifically Bryant's reconnaissance survey concluded something entirely different.

The difference between deeming the faults active or not sufficiently active could be in the interpretation of the definition or possibly the survey in 1985 was not sufficiently thorough to warrant accurate results. It is possible that issues much larger than those addressed in this paper are the causes of varying conclusions. Political boundaries or affiliations may lead to decreasingly robust findings. Also, financial support of research may hinder the completeness of the endeavor.

PREPARATION AND MITIGATION

The Strong-Motion Instrumentation Program was created in 1971 by California Legislature and was implemented in 1972. It prescribes the installation of strong motion recorders throughout the State. It is overseen by CDMG and was initially funded by the Earthquake Insurance Fund and by a portion of construction building permit fees. Program funding was drastically cut when construction of new projects slowed due to recession of the early 1990's. The Earthquake Insurance Fund was eventually cancelled.

The Federal Emergency Management Agency (FEMA) now provides the necessary resources for the program's continuance. The fees are collected on building permits as a certain percentage of the project's total cost. The amount can range from 10 to 21 dollars for every 100,000 dollars of project cost. A range of 3 dollars to 6 dollars of those fees per 100,000 dollars is directly deposited into the Seismic Hazards Identification Fund. The money goes to the purchase, installation and maintenance of strong motion instruments. There are strong motion recorders installed in representative areas throughout the state.

A city or county may elect to retain up to 5 percent of the total fees collected for the purpose of implementing their own seismic damages preparedness, mitigation or education through incorporating the data from the strong motion instruments. The remaining portion goes to the State Treasury in the Strong-Motion Instrumentation Special Fund. Throughout the State there are over 600 stations with a goal of over 1000 stations.

CONCLUSIONS

There has been much research dedicated to the faulting in the Monterey area. The work of Clark et al. concludes the faults to be active, yet there has been no proactive policy creation in

Monterey County. The planning and building policies in Monterey County do reflect acknowledgment that there are faults present. However, they are not designated as active but are believed to have the potential for causing severe damages. The policies are not county specific but rather are State policies that the County supports and enforces. The County does not detail exact actions to be taken to avoid damages by these faults. The population density of Monterey County is decreasing while total population is increasing. The change in population distribution demands development of previously unexploited regions. Since the Greater Monterey Peninsula Area Plan is being revised there is an opportunity for changes to be implemented.

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