Oroville, a small Northern California community approximately 70 miles north of Sacramento, experienced a 5.7 Richter magnitude earthquake on Friday, August 1, 1975 at 1:20 p.m. PDT. The epicenter was located 5 miles south of Oroville in Palermo at a focal depth of about 5 miles. The intensity of damage for the area was estimated to be VI to VII, Modified Mercalli intensity, with Palermo having the more intense shaking.

Oroville's downtown area had slight to moderate structural damage which consisted of cracked walls and parapets, and toppled chimneys. The downtown buildings are generally 60 to 100 years old, 1 and 2 story unreinforced masonry structures with wood floors and roofs of Type III construction. This type of construction is similar to that which would be found in other areas of the Western United States. The few modern engineered structures in and around Oroville suffered only architectural and other non-structural damage. Wood frame houses in the residential communities experienced typical non-structural earthquake damage and damage due to fallen chimneys.

This earthquake did not offer any new lessons from the structural engineering viewpoint, but the social science aspects will serve as a case history which should be studied by those seriously concerned with earthquake hazard abatement programs. The significance of this earthquake lies in the procedures used by the City immediately after the event to safeguard the public safety from dangerous buildings.

Oroville is one of the gold towns of the Mother Lode Country. It grew out of a mining camp along the Feather River during the mid-1800's. It rapidly grew into a trading center for Butte County and soon became the county seat. Today, Oroville stands at the base of the mammoth Oroville Dam complex. Agriculture, wood treatment, a railroad repair yard and recreation are among its principal industries. The City is served by a Council-Administrator form of government with an elected mayor and 7 member council. Oroville has a city population of approximately 7,000 and supports a metropolitan area of 20,000. The residents form a balance of farmers, industrial workers, merchants and retired people, who, prior to the earthquake, were not particularly aware that they lived in an earthquake prone area.

4. Structural Engineer, McClure and Messinger, Oakland, CA

University of California Seismographic Station, Berkeley, CA
The authors, out of interest in what had occurred to structures in Oroville, decided to spend the weekend in the Oroville area. We arrived in Oroville the day after the main event and while there maintained contact with the joint California Division of Mines and Geology and Earthquake Engineering Research Institute (DMG-EERI) Clearinghouse.

The authors spent Saturday morning making a reconnaissance survey of the six block downtown area. An antique shop proprietor and his wife offered us an inspection tour of their building, a typical unreinforced masonry structure. Their reactions were typical of many of the Oroville residents. He spoke excitedly about the earthquake and the soundness of his building. She was petrified by the whole experience and would have gladly left town on a moment's notice. It is important to note that Mayor Robert A. Winston was very effective in calming the people following the earthquake by carefully prepared radio, television and press releases.

Throughout the downtown area there were varying degrees of masonry parapet and wall damage to the Type III buildings. The City Officials, including the Building Official, Fire Chief, and the Director of Public Works with their staffs, were conducting preliminary inspections of all the buildings that morning and had posted a few buildings to be closed to occupancy. Their decisions appeared to be based mainly on the interior and exterior evidence of damage and the presence of potential falling hazards. They used a "cherry picker" type of vehicle with an extended arm to gain access to the walls, parapets and roof areas. Using this procedure, they were able to discover significant damage which was not evident from observations on the ground.

One of Butte County complexes is located within the downtown area. It consists of an old jail and courthouse (Type III) built in the late 1800's and a reinforced concrete courthouse addition built in 1951. The old courthouse had experienced damage to the ceilings, parapets and cracking of the walls as well as separation of the roof and floor construction from the masonry walls. The new reinforced concrete addition showed no exterior damage.

From our inspection of the downtown area, it became obvious that the structural damage was not spectacular, but extensive enough to require structural repair to many buildings. Experienced earthquake damage investigators have pointed out, however, that even though earthquake damage short of collapse is not spectacular, consideration must be given the continuing damage during the after shock period. Throughout the balance of the weekend, the increasing amount of earthquake damage due to relatively high magnitude aftershocks confirmed this previous observation.
Saturday afternoon, August 2, was set aside for inspection of the areas adjoining downtown. A department store of panelized roof and tilt-up wall construction that had been built in 1965 was viewed in the early afternoon. Damage was confined to the non-structural elements and involved buckling of the "T-bar" ceiling grid, cold joint working of the ground floor slabs on grade, failure of light wood storage racks on the second floor, and separation cracks between the interior partitions and the exterior walls. The heavy steel storage racks on the first floor were well braced and suffered no damage.

The Oroville City Administrator, John D. Nolan, had become aware of our presence in the area through the DMG-EERI Clearinghouse sign-in sheet, and contacted us early that afternoon. We explained that our interest in what could be learned from the inspection of earthquake damage was the sole purpose of our being in Oroville. He indicated that he was interested in engaging professional engineers to review their Building Official and Fire Chief's recommendations to post certain downtown buildings as unsafe to enter in accordance with Section 203 of the 1973 Uniform Building Code.

We indicated that we would be willing to assist the City because of a long standing tradition of the Structural Engineers Association of California to aid an earthquake-ridden city if that city was unable to obtain assistance from other local, State or Federal agencies. The authors became concerned about opening the damaged buildings on Monday morning, August 4, since a viable plan for having the buildings investigated on Sunday, August 3, was not foreseeable unless it was done by the engineers that were already in Oroville.

There was substantial concern expressed by the engineers available concerning the possible liability for performing this "Good Samaritan" professional service. After careful review of Section 202 of the Oroville Building Code (1973 Uniform Building Code), it was mutually agreed that the liability problem would be removed by deputizing the engineers participating as Deputy City Building Inspectors for their term of service.

Having resolved the question of liability and level of involvement, it was necessary to meet with the City Officials to establish the criteria for the evaluation. In attendance were John D. Nolan, City Administrator; Eugene Ludwig, Fire Chief; George Barr, Building Official; Harold Kroger, Public Works Director; and the authors. It was established that Oroville had recently adopted the 1973 Uniform Building Code and the Uniform Code for Abatement of Dangerous Buildings. This was a critical item in that it offered a sound legal basis for evaluating the damaged buildings. In the most general sense, we based our review criteria on subsections 3, 4, 6 and 9 of Section 302 of the Uniform Code for the Abatement of Dangerous Buildings.
For assistance in establishing the specific criteria for review, those assembled chose to consult by conference telephone with Henry J. Degenkolb. This conference call provided a common basis of understanding among all the City Officials, their staffs and ourselves. Having worked with the City of Santa Rosa in establishing criteria for the evaluation of earthquake damage structures following their 1969 earthquake, Mr. Degenkolb was most helpful in establishing both specific review criteria and long reconstruction and recovery plans for the city. It was established that the main concern of the inspections would be a determination of the extent of the potential falling hazards, such as parapets and walls, and checking to see if the wood floors and roofs were tied to the masonry walls. There was particular concern about potential falling hazards from higher adjacent buildings which could fall through lower buildings or onto sidewalks.

It was determined that damaged parapets would be either removed or strengthened under the direction of a civil or structural engineer. Generally undamaged parapets were to be reviewed in terms of the "Dangerous Building Ordinance" and not for compliance with the current building code provisions for new buildings. It was also stressed that the City Officials understand that a 15 to 30 minute cursory inspection of any structure could offer no more than an indication of its potential hazard. The field investigations were to be based on our recommendation that the City require the owners of all buildings posted as unsafe to retain a civil or structural engineer to review their buildings and make written reports to the owner and the City as to their recommendation for corrective measures. Following the emergency recovery period the City would then have to establish additional criteria for the evaluation and abatement of all hazardous buildings. For reference, the City was subsequently supplied the various Santa Rosa emergency and long range reconstruction and recovery resolutions.

Having established the review philosophy and evaluation criteria, the next task involved developing a method of field investigation. It was agreed that a basic understanding of the City of Oroville, its downtown area, construction and geotechnical history were important. A brief summary of this information was gained from the City Officials and a current set of Sanborn Maps.

It was decided that, due to the number of buildings to be reviewed and the available time, the review would be made by two teams. Each team was comprised of a licensed Structural Engineer, an engineering assistant, and representatives from the Building and Fire Departments. The Fire Chief and the Public Works Director went with one team while the Building Official and the Battalion Chief accompanied the other team. This division of the City's Officials was desirable to provide each team with proper balance. In many cases the decisions concerning the safety of the buildings were directly related to exit and fire requirements, and thus the fire service personnel were of substantial assistance to the teams.
The inspections were made on Sunday morning, August 3, the second day after the main event. This made admittance to some buildings difficult or impossible, but on the other hand, it minimized the teams being delayed due to questions from the public. Since the Fire Chief and the Building Official had inspected the selected buildings in considerable detail the day before, they were able to pinpoint the serious damage on each building during the review.

In order to provide review continuity and ease of later interpretation, we chose to use the "Emergency Earthquake Damage Inspection Form" developed for ATC III by David L. Messinger and Frank E. McClure. We had other forms available to us but chose to use this form because of its ease in recording pertinent information. Each form was supplemented by a Polaroid photograph to insure proper building identification.

Because of the importance of consistent evaluation of the buildings, both teams inspected the first two buildings.

The two teams did not inspect all of the estimated 100 old buildings in downtown Oroville. They only reviewed the twenty-seven buildings specifically designated by the City Officials. These buildings generally were commercial occupancies and assembly occupancies, such as restaurants, bars and auditoriums. They were mainly one and two story unreinforced masonry construction. This set of buildings had been selected by the Fire Chief and Building Official either because they had observed a change in their condition due to the earthquake or were of the type of construction or age which would indicate that they could be potentially hazardous.

Each building reviewed was ultimately rated by the teams in one of the following three ways:

GREEN - No hazardous conditions observed. Does not require further investigation at this time.

BLUE - There are hazardous areas that must be taken care of immediately. However, since they do not directly endanger public safety, the building may continue to be occupied if the owner engages an engineer to investigate and report on the building. If the owner has not engaged the services of an engineer within one week, the classification would be changed to RED.

RED - Investigation found the building unsafe for occupancy in accordance with the Uniform Code for Abatement of Dangerous Buildings. It is to be posted and to remain closed to occupancy until it has been reviewed by a civil or structural engineer, a report prepared, and the necessary corrections made by the owner and accepted by the City.
After the inspection was completed, a meeting was held at the City Hall with all of the concerned City Officials, the Mayor and the team members to review the findings building by building. As may be expected in a small town where everybody is known, there were comments such as "You can't close Joe's place" or Ed is a big man in this town. He'll fight the closing of his building to the end." Fortunately, however, the City Officials did not allow their personal acquaintances to interfere with their responsibility for public safety.

The presentation of the findings to the City Officials was a very important part of establishing a common basis of understanding the rating of certain buildings. It had to be fully understood why the buildings were rated "RED", "BLUE", or "GREEN" since the professional engineer members of the team would not be in Oroville to answer the questions concerning the buildings. But of even more importance, the City Officials had to understand what the rating "RED" and subsequent posting of the building meant. It was stressed that to post or "Red-tag" a building did not mean demolish it. It meant that the owner had been put on notice that his building was declared a "dangerous building" and it was his responsibility to abate the hazard. The City Officials were urged to implement the Dangerous Building Ordinance and require a licensed civil or structural engineer to be retained by the owner to do an extensive review of the building and to make recommendations as to how to best abate the hazardous condition. This recommendation has been subsequently followed with the adoption of Resolution 3121-A by the City Council on August 12, 1975, eleven days after the earthquake. A copy of this resolution is contained in the Appendix.

The City of Oroville acted prudently and promptly to abate the clear and present hazards created by the earthquake. The City Officials moved swiftly in isolating the hazardous buildings from the public, and they also recognized the need for professional advice in evaluation of the damaged structures. At this point, the available engineers were able to assist in the development and application of a methodology for systematically dealing with the evaluation of a large number of damaged structures. Combining the experience of the 1969 Santa Rosa earthquake as well as over fifty years of experience of other earthquake damage investigators, the provisions of the 1973 Uniform Building Code for the Abatement of Dangerous Buildings, the efforts of a very competent Mayor and Building Official, Fire Chief, Director of Public Works, City Administrator and their staffs, the City was able to develop a reasonable and prudent procedure for the identification and abatement of dangerous buildings.

Given the short recurrence interval of moderate earthquakes and the similarity of older Type III construction in California and the other Western United States, it is obvious that the same situation will continue to occur elsewhere in seismically active areas. We are convinced that a reasonable procedure for dealing with this situation was implemented in Oroville and we commend it for study to concerned professionals in the field of earthquake engineering in all its aspects.
(LEFT) DAMAGE TO ORNAMENTAL PILASTER AGGRAVATED BY ANCHORED WIRES (SEE ARROW).

(BELOW) STREET CLOSURE BY CITY OFFICIALS ON AUGUST 2, 1975, IN AREAS OF POTENTIAL FALLING HAZARDS.

(ABOVE) TOPPLED CHIMNEY AT REAR WALL OF BUILDING. WALL WAS FURTHER DAMAGED WITH CRACKED SPANDRELS.

(RIGHT) REAR BEARING WALL FAILURE WITH OUT OF PLANE DISPLACEMENT.
APPENDIX A

RESOLUTION NO. 3121-Å

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OR OROVILLE ADOPTING AN EMERGENCY POLICY RELATIVE TO BUILDINGS "RED-TAGGED" AS DANGEROUS TO ENTER FOLLOWING THE EARTHQUAKE OF AUGUST 1, 1975.

WHEREAS, earthquakes with damaging results occurred in the City of Oroville on August 1, 1975 and subsequently; and

WHEREAS, subsequent to the major shock of 1:20 p.m. on August 1, 1975 the City of Oroville caused its Chief Building Official and others to examine buildings and improvements within the City and to place "Red-Tags" on those found to be in such state of repair that no occupancy should be allowed until immediate hazards could be eliminated; and

WHEREAS, the Chief Building Official of the City of Oroville is charged with the enforcement of the Uniform Building Code (1973 Edition) and the Uniform Code for the Abatement of Dangerous Buildings (1973 Edition); and

WHEREAS, the critical emergency existing in the City of Oroville as set forth in the Proclamation of Emergency dated August 4, 1975 led to discussions held in public meeting of August 5, 1975 which pointed out that there was no suitable policy regarding "Red-Tagged" buildings; and

WHEREAS, it is in the public interest for the City Council of the City of Oroville to set forth policies which will properly balance the interest of private property owners within the City of Oroville against considerations for the safety and welfare of the public which may enter such property or pass thereby in its use of public thoroughfares; and

WHEREAS, the City Council of the City of Oroville, in public meetings duly assembled after hearing from knowledgeable officials, consultants and City officials, has determined that an emergency situation does exist relative to the "Red-Tagged" buildings and that an interim emergency policy should be adopted so as to fully inform the general public, private property owners, building officials, engineers, architects, contractors and the City of Oroville as to the policy of the City in dealing with the buildings "Red-Tagged" as a result of the damages sustained by the buildings as a result of the August 1, 1975 earthquake and its aftershocks;

NOW, THEREFORE, BE IT HEREBY RESOLVED, by the Oroville City Council that the following policy be administered as an emergency policy, to be effective only for the duration of the emergency caused by the August 1 earthquake as said duration is declared by the Mayor and City Council on August 4 or subsequently:

1. If a property owner having a "Red-Tagged" building does not object to being deprived of its use, he need not do anything, and the provisions of the Uniform Code for the Abatement of Dangerous Buildings will be automatically invoked as if the building had been declared a public nuisance subject to abatement.

2. If a property owner having a "Red-Tagged" building does object to being deprived of its use during the emergency he shall, at his expense, have the building examined by a civil or structural engineer who shall evaluate the building as to its degree of hazard and report thereon to the Owner and the City. Regardless of any other contents of this report, it shall contain the
independent statement of the engineer as to his professional opinion regarding
the risk and the occupancy of the building in regard to fire, panic, moderate
and major earthquake with reasons for his opinion, without regard to code
requirements. If, in the opinion of the engineer there are special or unusual
factors that alleviate or intensify the risk, he shall so state.

3. If the report called for above recommends that the building can
have certain emergency repairs or shoring done which will reduce the risk to
an acceptable level to enter even though not complying with either the Uniform
Building Code (1973 Edition), see page 1, or Uniform Building Code for Abate-
ment of Dangerous Buildings (1973 Edition), see page 1, and if the Chief
Building Official of Oroville agrees that were these emergency repairs or
shoring done he would not have "Red-Tagged" the building, then the Chief
Building Official may remove the "Red-Tag" if these be done.

4. Adoption of this emergency policy for removal of "Red-Tags"
upon completion of emergency repairs or shoring is not a waiver or
suspension of the fire safety or sanitation regulations of the City of Oroville
or the applicable requirements of housing regulations in the State of California.

5. This policy is not an amendment or alteration in the Uniform
Building Code (1973 Edition) or the Uniform Code for the Abatement of
Dangerous Buildings (1973 Edition), as adopted by the City of Oroville, but
only an emergency policy intended to encourage rapid and orderly return to
implementation of those Codes.

AND, BE IT FURTHER RESOLVED, by the Oroville City Council that
the Council cause further study to be made during the next thirty (30) days
leading to the promulgation of additional interim guidelines for City officials,
City Employees, Private Engineers, Private Property Owners and other
interested citizens of the community relative to all buildings damaged by the
earthquake of August 1, 1975 and its aftershocks, regardless of whether the
buildings were "Red-Tagged" or not; and

BE IT FURTHER RESOLVED, by the Oroville City Council that the
Council study, consider and establish by February 15, 1976, CRITERIA to be
used for the Inspection of Buildings within the City of Oroville including but
not limited to the following:

1. Preliminary Review by City.
2. Priority of Review by City.
3. Scope of Preliminary Investigation by City.
4. Further Investigations Required of Property Owner.
5. Scope of Property Owners Investigation;
6. Requirements for Continued Long Term Use of Structure.
7. Criteria for Occupancy for a Term Not to Exceed Five Years.
8. Criteria for Occupancy for a Term Not to Exceed One Year.
9. Disposition of Buildings Which Fail to Meet Criteria for
One Year Occupancy.
10. Disposition of Buildings Which Meet Criteria for a Term not to Exceed Five Years but Fail to Meet Requirements for Continued Long Term Use.

PASSED AND ADOPTED by the Council of the City of Oroville at a meeting on the day of

by the following vote:

AYES:

NOES:

ABSENT:

Approved as to form:

Mayor

Attest:

Passed: August 12, 1975