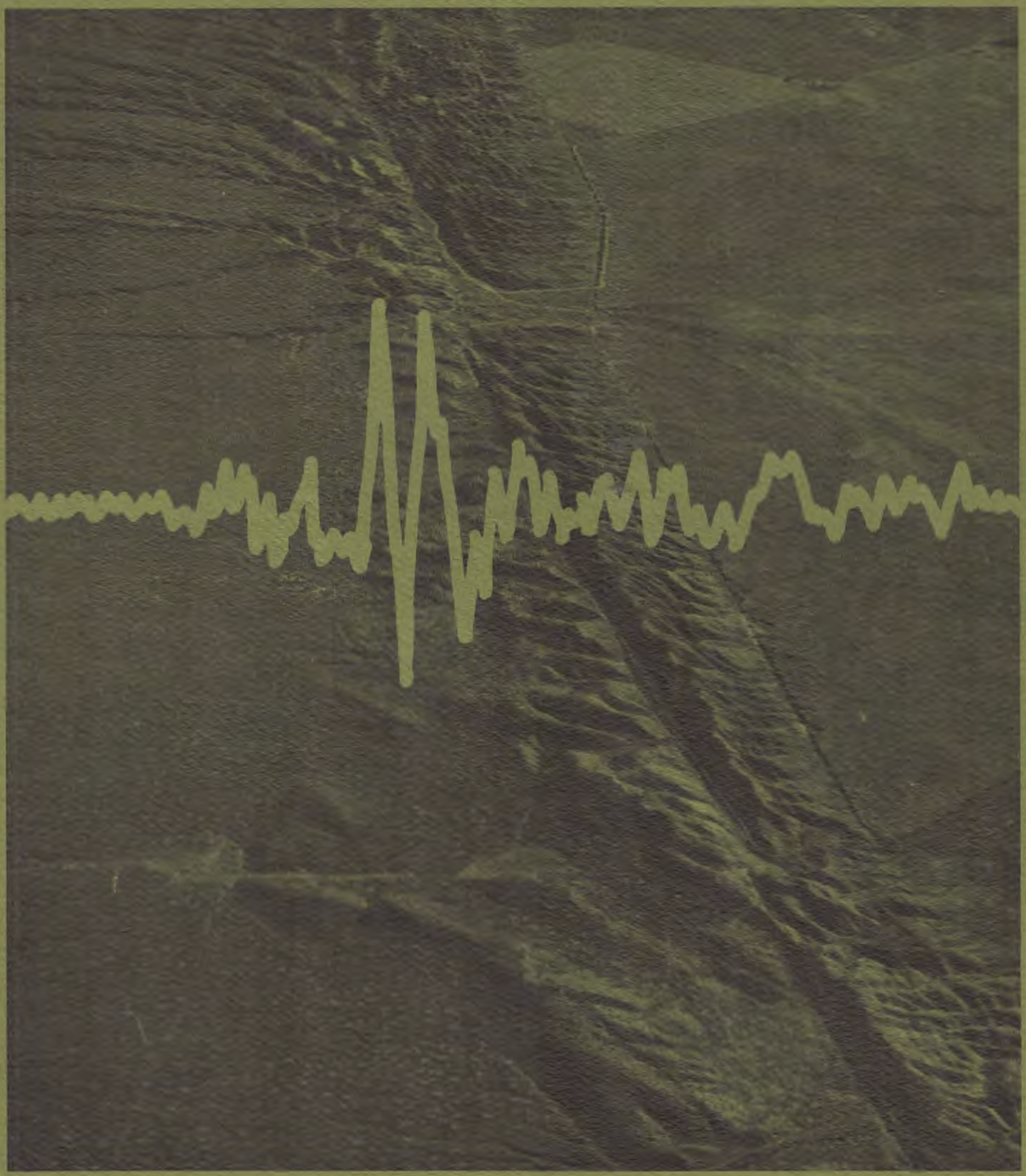
Second Report of the Governor's Earthquake Council

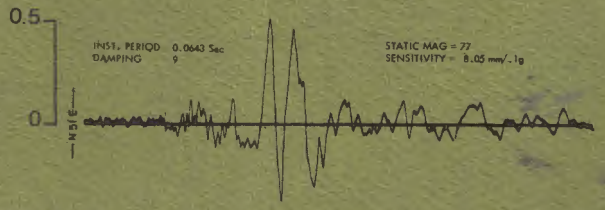
September 1974



ON THE COVER...

An aerial view of California's San Andreas fault where it passes through the desolate Carrizo Plain west of Taft. During the great earthquake of 1857, the surface is believed to have ruptured along this fault from the vicinity of Cholame to the outskirts of present day San Bernardino--a distance of possibly more than 200 miles. In the area here shown the fault may have offset laterally as much as 30 feet in this one seismic event. In 1906 another great San Andreas earthquake and consequent conflagration destroyed much of the City of San Francisco.

Imposed on the photo is the historic record from a strong motion seismograph of the California Department of Water Resources showing the ground motion that occurred during the Parkfield, California, earthquake of June 28, 1966. The earthquake was estimated at 5.5 magnitude (Richter scale), and the maximum ground acceleration of 0.5g was the greatest recorded up to that time. Prior to the Parkfield shock it was generally believed that only large magnitude earthquakes would produce ground accelerations of this severity.



Since 1906 there have been no further great earthquakes in California, i.e., shocks exceeding magnitude 8.0; however, geologists and seismologists agree that such events will occur in the future at dates that are presently unpredictable. Furthermore, California has grown and continues to grow in population. Many municipalities and residential districts now exist in highly seismically active areas, and some have encroached on active fault zones including the San Andreas. Also, the life lines of civilization--aqueducts, pipelines, highways and tunnels--have been constructed across or through the San Andreas and other active faults. Consequently, more people, structures, and utilities will be exposed to the next major temblor.

The acquisition of records such as the Parkfield seismogram and other research efforts is advancing the state-of-the-art of earthquake engineering leading to improvements in aseismic design. Through implementation of Recommendation 10(a) of the Governor's Earthquake Council, the California Division of Mines and Geology has undertaken a program for installation and maintenance of strong motion seismographs throughout California. This program is financed from fees for building permits and consequently the instrumentation of larger buildings is stressed. Similar programs applicable to dams, highway structures, and other critical facilities must be encouraged financially by the State. (Photo courtesy DWR)

OFFICE OF GOVERNOR RONALD REAGAN
Sacramento, California 95814
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RELEASE: Immediate

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California remains one of the most earthquake-prone places in the world, but strides toward preparedness for that next unpredictable big temblor are being made by the Governor's Earthquake Council.

The council was formed by Governor Ronald Reagan following the disastrous San Fernando Valley quake of February 1971, which claimed 64 lives, injured more than 1,000 and caused damage in excess of $500 million.

In its second report to the governor, issued today, the council related what has been accomplished toward implementing the 26 specific recommendations it made in its first report two years ago.

Among the major concerns of the council are the design and construction of earthquake-resistant public utilities systems, including those used for the supply of water, gas, electricity, communications, transportation and the disposal of sewage.

"These are the life lines of civilization," said Governor Reagan, "and many of the state's aqueducts, pipelines, highways and tunnels have been built across or through seismically active areas, most notably the San Andreas Fault."

Although the council is aware of progress in such design and construction in recent years, the report concludes that more research and specific studies will be needed to insure continued operation of the complicated utilities systems without serious disruption during a quake.

Measures designed to make dams safer, improve emergency operations procedures, provide disaster communications and effectively plan for land use are included in the report.

"There always has been a great deal of interest in earthquake preparedness immediately following a catastrophic temblor," the governor said, "but enthusiasm usually has dwindled soon after the immediate impact has passed.

"This is regrettable because being prepared for quakes has to be a never-ending task in California." He noted that the 1971 quake registered 6.4 on the Richter scale, making it relatively mild in comparison to the Fort Tejon (1857) and San Francisco (1906) earthquakes---both of which are believed to have exceeded 8 on the same scale.

In order to continue the council's work (its two-year assignment expires soon), a permanent Seismic Safety Commission was created. The new commission will also continue the work of the legislature's Joint Committee on Seismic Safety.

# # #

Walthall

SECOND REPORT

OF THE

GOVERNOR'S EARTHQUAKE COUNCIL

September 1974

RONALD REAGAN, GOVERNOR
STATE OF CALIFORNIA

GOVERNOR'S EARTHQUAKE COUNCIL

ROOM 1115 RESOURCES BUILDING • 1416 NINTH STREET • SACRAMENTO 95814

September 30, 1974

The Honorable Ronald Reagan
Governor, State of California
State Capitol
Sacramento, California 95814

Dear Governor Reagan:

The Second Report of the Governor's Earthquake Council is transmitted herewith. It contains a summary of the progress that has been achieved on the 26 recommendations that were set forth in the first report of the Council submitted to you November 24, 1972.

Since its appointment by you in January 1972 your Earthquake Council and its several committees, subcommittees, and task forces have identified the major earthquake-related problems that beset California and have implemented activities aimed to alleviate or eliminate them. The Council has worked with the Legislature's Joint Committee on Seismic Safety toward this end. Considerable progress has been made, but the mission is by no means completed. Earthquake preparedness is a never-ending responsibility.

In the last few years rapid strides have been taken in the advancement of earthquake engineering, and serious attention has been focused on socioeconomic problems relating to future disasters in the State. These advances were stimulated by the San Fernando earthquake of February 9, 1971, which was particularly distressing not only due to the death and destruction wrought but also because of the realization that this was a comparatively mild shock (magnitude 6.4, Richter scale) by comparison with the great historical California earthquakes such as the 1857 Tehachapi and 1906 San Francisco temblors, both of which are believed to have exceeded magnitude 8 on this same scale. Great earthquakes will occur again in California at times presently unpredictable. Because of the increased population and consequent developments, more people and facilities will be exposed to their ravages. Therefore, a continuous effort to increase our preparedness for these future events must be sustained. This effort deserves our support.

Sincerely yours,

James G. Stearns
Chairman

Enclosure

SECOND REPORT OF THE GOVERNOR'S EARTHQUAKE COUNCIL
September 1974

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SECOND REPORT OF THE GOVERNOR'S EARTHQUAKE COUNCIL

LIST OF ILLUSTRATIONS

ABBREVIATIONS USED

ANRC	American National Red Cross
ATC	Applied Technology Council, SEAOC
CALTRANS	California Department of Transportation
CAP	Civil Air Patrol
CDA	California Division of Aeronautics
CDF	California Division of Forestry
CDH	State Division of Highways, CALTRANS
CDMG	California Division of Mines and Geology
CIR	Council on Intergovernmental Relations
CIT	California Institute of Technology
DCPA	U. S. Defense Civil Preparedness Agency
DGS	State Department of General Services
DIR	State Department of Industrial Relations
DOH	State Department of Health
DRE	State Department of Real Estate
DWR	State Department of Water Resources
EERI	Earthquake Engineering Research Institute
EMAC	Emergency Medical Advisory Committee
FCC	Federal Communications Commission
FDAA	Federal Disaster Assistance Administration, HUD
FRC	Federal Regional Council, HEW
GEC	Governor's Earthquake Council
GIEC	Governor's Interagency Earthquake Committee
HCD	State Department of Housing and Community Development
HEW	U. S. Department of Health, Education, and Welfare
HUD	U. S. Department of Housing and Urban Development
JCSS	Legislature's Joint Committee on Seismic Safety
NASA	National Aeronautics and Space Administration
NBS	National Bureau of Standards
NOAA	National Oceanic and Atmospheric Administration
NSF	National Science Foundation
OAC	State Office of Architecture and Construction, DGS
OCJP	Office of Criminal Justice Planning
OES	State Office of Emergency Services
OPR	State Office of Planning and Research
PUC	State Public Utilities Commission
RACES	Radio Amateur Civil Emergency Service
SEAOC	Structural Engineers Association of California
SFM	State Fire Marshal
SRCC	State Regulation Conformance Committee
SSC	California Seismic Safety Commission
UCB	University of California at Berkeley
UCEER	Universities Council for Earthquake Engineering Research
UCSD	University of California at San Diego
USBR	U. S. Bureau of Reclamation
USC	University of Southern California
USCE	U. S. Corps of Engineers
USFS	U. S. Forest Service
USGS	U. S. Geological Survey

INTRODUCTION

Following the disastrous San Fernando earthquake of February 1971, Governor Ronald Reagan created the Governor's Earthquake Council, which he charged with responsibility for preparing recommendations of whatever kind for reducing losses in future California earthquakes.

The Council has consisted of 35 members representing federal, state, and local agencies, universities, and representatives of the public and private sectors. The tasks of the Council have been determined and directed by a Steering Committee composed of representatives from the interests noted. Working committees on Research and Investigation and on Preparedness and Response (see organization chart) considered the needs for further research in the fields of seismology, engineering, and geology and proposed procedures for reducing earthquake hazards in structures and improving response to earthquake emergencies.

Through the efforts of these committees the First Report of the Governor's Earthquake Council was distributed in November 1972. That report consists of 26 major recommendations for reducing earthquake losses. Recommendations 1 through 14 were developed primarily by the Research and Investigations Committee and Recommendations 15 through 24 by the Preparedness and Response Committee. Recommendations 25 and 26, which concern the term of the Governor's Earthquake Council and consideration of a successor body, were originated by the Steering Committee. All 26 recommendations were approved by the Governor, who issued instructions that steps be taken to assure their implementation.

Recommendation No. 1 of the First Report called for the creation of a coordinating body consisting of representatives from state agencies and universities to assist with the implementation of the remaining recommendations. The Governor's Interagency Earthquake Committee was appointed for this purpose. A number of task forces and subcommittees were also formed to consider specific recommendations (see table of organization).

The Second Report of the Governor's Earthquake Council was assembled by the Committee from reports submitted to it by the working groups. It consists of abstracts of these reports and contains for each recommendation a brief introductory statement, a review of progress achieved during 1973-74, and a summary of proposed future actions. The complete reports of the task forces and subcommittees upon which these abstracts are based are preserved in Sacramento in the files of the Committee.

RECOMMENDATION NO. 1
FROM THE 1972 REPORT

STATE INTERAGENCY COORDINATION

A coordinating body, with representatives from state agencies and universities that deal in a major way with earthquake problems and from local government, should be established administratively.

A coordinating body was needed to function as both the coordinator and catalyst for implementing and carrying out the recommendations of the Governor's Earthquake Council (GEC) and to create general awareness in state public service of interagency responsibilities, available information and expertise, and procedures related to earthquakes.

1973-74 Progress

The Governor approved the First Report of the GEC on December 12, 1972, and requested that its recommendations be implemented, thus conveying the necessary direction and authority to administratively organize an interagency coordinating body. Subsequently, the Chairman of the GEC convened an organizational meeting. The recommended coordinating body was formed on January 12, 1973, and designated as the "Governor's Interagency Earthquake Committee" (GIEC). The Committee is comprised of membership representing state agencies, local government, and universities. Several specialized coordinating subcommittees and task forces were formed with specific responsibilities assigned by the various recommendations.

Future Action

The GEC and the Legislature's Joint Committee on Seismic Safety (JCSS) have been succeeded by the Seismic Safety Commission (SSC), which has been established legislatively (Senate Bill No. 1729, Alquist). All initial appointments to the Commission are to be made prior to July 1, 1975. In the interim, the GIEC will continue to coordinate the activities and monitor the progress of the GEC recommendations. The GIEC also maintains a file of correspondence and other documents relative to both the GEC and the GIEC. These files and records will be available to the successor body.

RECOMMENDATION NO. 2
FROM THE 1972 REPORT

POSTEARTHQUAKE STUDIES

Postearthquake studies should begin immediately after any significant earthquake, and the resulting data should be disseminated quickly.

Lessons learned from each disastrous earthquake can be applied to reduce losses from subsequent earthquakes. Many earthquake effects are ephemeral; ground displacements in urban and agricultural areas are quickly and deliberately obliterated by repaving, releveling, or reploughing, or are obscured by action of the elements; structural effects are soon lost to demolition and removal, or to remodeling or reconstruction; aftershocks diminish rapidly in magnitude and frequency; and the later appraisal of the effectiveness of response and recovery operations is dependent largely on the reports and other records prepared during and immediately following the event. Postearthquake studies must therefore commence immediately. In may cases as much may be learned from a major earthquake outside of California as from one within the State's boundaries.

(a) OUT-OF-STATE INVESTIGATION TEAM

Potential members of an out-of-state or foreign destructive-earthquake investigation team should be designated in advance for immediate dispatch anywhere in the world, and contingency funds should be provided for the investigation.

1973-74 Progress

"Out-of-State Earthquake Investigation Team Procedures" have been prepared by the State Office of Emergency Services (OES) and reviewed by GIEC. The procedures provide guidance in the areas of team selection, organization, dispatch, passports and visas, and medical requirements. A list of potential members for assignment to the investigation team is also included.

Managua Earthquake - Following the December 23, 1972, earthquake in Managua, Nicaragua, team members representing the University of California at Berkeley (UCB), the State Office of Architecture and Construction (OAC), and the Fire and Rescue and the Planning & Operations Divisions of OES visited the affected area and prepared independent reports covering their investigations. The OAC representative returned to Managua in March 1974 to evaluate the progress in rebuilding and rehabilitation.

Orizaba Earthquake - The Research Director, Structural Safety Section, OAC, made a reconnaissance trip to Orizaba, Mexico, and prepared a report following the August 28, 1973, earthquake in the Mexican states of Puebla and Veracruz.

Future Action

The significant problem remaining concerns the procurement of funds for financing these investigations. The very nature of funding for an emergency assignment, particularly one requiring out-of-state or foreign travel, and the inherent problems of obtaining rapid authorization to expend funds for such assignments require special administrative or legislative action.

Until such time as the SSC is organized and functioning, OES will continue efforts to resolve funding problems. Some options (which are applicable to subsequent recommendations also) are:

1. Amendment to the Emergency Services Act to include legislative intent for such activities;

2. Specific statement in the Budget Bill describing use of Emergency Fund for such purposes; and/or

3. Standing arrangements with the State Department of Finance that funds will be made available expeditiously from the Emergency Fund.

OES will update the procedures for out-of-state investigation teams and report annually to the SSC. The report will include a current list of potential team members.

The California Division of Mines and Geology (CDMG) maintains an inventory list of seismological instruments available for rapid deployment in California (Rec. No. 2(h)). The use of these instruments by an out-of-state investigation team could be very helpful. CDMG will determine which instruments are available for out-of-state or foreign use and report to the SSC.

Each member of an investigation team will submit a detailed report covering his trip and observations to the SSC.

(b) EARTHQUAKE NOTIFICATION

Procedures should be developed to insure that those vitally concerned with earthquakes receive prompt and accurate notification of damaging or potentially damaging earthquakes in California and of major out-of-state (including foreign) earthquakes.

1973-74 Progress

Primary notification to those vitally concerned with earthquakes in California is provided from seismograph networks operated by UCB, California Institute of Technology (CIT), National Oceanic and Atmospheric Administration (NOAA), and the State Department of Water Resources (DWR). Information from these networks and other sources is relayed by OES to those concerned for responsive action.

OES notification and alerting procedures have been updated to include:

1. Direct reports via the National Warning System from 27 local warning points whenever seismic events occur, and from Palmer Observatory in Alaska for major seismic events.

2. Interties with DWR's automatic alarm and display, which is an integral part of the statewide seismograph network.

3. Liaison with CIT, UCB, and DWR to receive notification of significant earthquakes detected by the seismograph networks operated by these agencies.

4. Investigation, to extent necessary, by OES warning center personnel to obtain a reasonable estimate of the severity of each seismic occurrence.

5. Additional earthquake information is obtained directly over Associated Press teletype net.

6. Immediate notification to designated persons and agencies.

Future Action

The National Warning System should be expanded to include all 58 California counties. OES is pursuing this objective with the Federal Government and has applied for additional terminals to provide each county with this coverage.

Alternate communication channels should be established with California's seismology laboratories. OES will continue efforts to secure funds for this purpose.

OES will report annually to the SSC on these activities and will update the notification and alerting procedures when appropriate.

(c) CLEARINGHOUSE - EARTH SCIENCE INVESTIGATIONS

For significant earthquakes within the State, the California Division of Mines and Geology should be established as the clearinghouse for the progress and results of postearthquake seismological and geological investigations.

1973-74 Progress

By letter dated January 16, 1973, the State Geologist offered CDMG services and suggested procedures to be followed in the establishment of temporary headquarters for postearthquake geological and seismological investigations. These procedures were tested following the Point Mugu earthquake of February 21, 1973, and functioned effectively. Subsequently, by letter dated

September 4, 1973, CDMG effected an "Interim Earthquake Response Plan" which incorporates the "clearinghouse function" for post-earthquake earth science investigations. This is included as Section V in the Earthquake Engineering Research Institute's (EERI) Earthquake Response Procedures.

Future Action

CDMG will continue as the on-site clearinghouse for the progress, results, and coordination of postearthquake seismological and geological field investigations. CDMG will keep its procedures current, as dictated by experience and knowledge acquired during these events, and inform all participating agencies of any changes. CDMG will report annually and after each major earthquake to the SSC.

(d) CLEARINGHOUSE - ENGINEERING INVESTIGATIONS

For damaging earthquakes within the State, the Earthquake Engineering Research Institute should be established as the clearinghouse for the progress and results of postearthquake structural engineering and soils engineering investigations.

1973-74 Progress

By letter dated March 12, 1973, the President of EERI accepted the role of serving as a clearinghouse for postearthquake engineering investigations and outlined the procedures to be followed by investigators in postearthquake coordination. This letter was widely distributed to and acknowledged by concerned organizations. Subsequently, by letter dated January 1974, EERI published its "Earthquake Response Procedures". Section III thereof contains "Special Procedures for Engineering Clearinghouse for California Earthquakes".

Future Action

EERI will continue as the on-site clearinghouse for the progress, results, and coordination of postearthquake structural engineering and soils engineering field investigations. EERI will keep its procedures current, as dictated by experience and knowledge acquired during these events, and inform all participating agencies of any changes. EERI will report annually, and after each major earthquake, to the SSC.

(e) FUNDS FOR SCHOOLHOUSE STUDIES

Contingency funds should be available to the State Office of Architecture and Construction for conducting comprehensive postearthquake school building and site inspections, in-depth structural and site studies of selected school buildings, and the preparation of reports thereon.

1973-74 Progress

Efforts to determine availability of, and authorization to expend, emergency funds, in accordance with the intent of this recommendation, are continuing.

Future Action

Until such time as the SSC is organized and functioning, OES will continue efforts to resolve funding problems for these investigations and studies. Funding options listed under Recommendation 2(a) are applicable here also. OES will report annually to the SSC.

(f) COORDINATION OF ENGINEERING STUDIES

Prior arrangements should be made for coordinated early postearthquake engineering inspections and studies.

1973-74 Progress

In response to this recommendation, EERI appointed a Committee on Planning Earthquake Investigations in January 1973. The Committee's charge was to advise the EERI Board relative to accomplishing the Recommendations 2(d), 2(f), and 2(h). Upon advice from this committee and after soliciting response from interested agencies, EERI published its "Earthquake Response Procedures", Section IV of which is a "Special Plan for Coordination of Engineering Investigations of California Earthquakes".

Future Action

EERI will periodically update its Earthquake Response Procedures by either publishing a revised procedure or notifying all participants, annually, that the procedures are current.

A number of state agencies have earthquake damage assessment responsibilities. These include in part: DWR (dams); OAC and the Department of Housing and Community Development (HCD) (schools and other structures); California Department of Transportation (CALTRANS) (bridges, roads, and overpasses); and OES, Utilities Division (Utilities). OES is developing a plan to utilize individuals from private engineering firms to assist these public agencies and local governments to determine which facilities can be safely used immediately after an earthquake. OES will report to the SSC by March 1, 1975.

(g) SOCIOECONOMIC STUDIES

Postearthquake socioeconomic studies should be given more emphasis.

1973-74 Progress

A meeting was held with the Federal Regional Council (FRC) on June 19, 1973. At that time it was decided that FRC would initiate a study and report thereon. The study has been completed; however, the report has not been released.

The report, when released, will undertake to:

1. Identify the principal socioeconomic problems that can be anticipated following a major earthquake in California.

2. Indicate which of these problems will be most critical and which will be somewhat less critical and when their primary impact will be felt, i.e., in the emergency period and/or the restoration period.

3. Identify the types of data needed to assess the magnitude and character of these problems.

4. Sort the types of necessary data into:

   (a) Those which are collected routinely and could be quickly updated.

   (b) Those which are not routinely collected and would require special gathering procedures.

5. Identify the types of additional data needed to assess the consequences of governmental action taken to cope with the various postquake socioeconomic problems.

Future Action

FRC is reviewing this report and will decide on the appropriate mechanism and magnitude of federal participation. OES will monitor this review and report to the SSC.

(h) DEPLOYMENT OF INSTRUMENTS

Preparations should be made to deploy promptly and effectively appropriate instrumentation on ground and structural sites for measuring the effects of aftershocks.

1973-74 Progress

An inventory list of seismological instruments available for rapid deployment in California has been compiled. The list is comprised of instruments available from NOAA, DWR, UCSD (University of California at San Diego), CIT, UCB, and CDMG which can be used for both crustal movement and structural response studies.

CDMG has accepted responsibility for the coordinated deployment of the instruments as a part of the clearinghouse function under Recommendation 2(c). The instrument deployment procedure was tested during the Oxnard, California, earthquake of February 1973 and proved effective.

Future Action

The CDMG "Interim Earthquake Response Plan" will be updated to include detailed procedures for prompt deployment of seismological instrumentation to ground and structure sites for measuring the effects of aftershocks.

CDMG will update the inventory of available seismological instruments annually and notify all cooperating agencies of any changes. CDMG will report annually to the SSC.

(i) POSTEARTHQUAKE AERIAL PHOTOGRAPHY

Prior arrangements and provisions for funding should be made for immediate aerial photographic surveys and for appropriate aerial remote-sensing surveys of the affected area.

1973-74 Progress

The State of California and the National Aeronautics and Space Administration (NASA) entered into an agreement whereby OES and Ames Research Center are to jointly develop a program of disaster assessment techniques and systems. Under the program the "Disaster Assessment Committee" has prepared specific plans for aerial photographic surveys and remote sensing of areas struck by earthquakes. In addition, OES has prepared procedures to insure immediate response. The system and procedures were tested by U-2 photography of the flooded areas in Northern California during January 1974 and found to be satisfactory.

Under an agreement with OES, the California Wing, Civil Air Patrol (CAP), provides aerial photographic and reconnaissance flights upon request. The agreement is currently being updated.

Future Action

CALTRANS has initiated facilities for rapid retrieval of photographic coverage available throughout the State. When developed, this retrieval system will permit comparison of postearthquake with pre-earthquake conditions.

OES will continue efforts towards maintaining service agreements (or additional interagency agreements) which will permit employment of aerial survey equipment and aircraft on short notice.

Until such time as the SSC is organized and functioning, OES will continue to explore the availability of emergency funds for this purpose and will report annually to the SSC. Funding options are outlined in 2(a).

(j) ACCESS TO DAMAGE AREAS

Provision should be made in advance for legitimate postearthquake investigators to have ready access to areas affected by earthquakes.

Previous disasters have demonstrated that there is no lack of identification cards which imply authorization to enter disaster areas. The problem is proper accredited identification of the investigators which is readily recognizable by public protection personnel.

1973-74 Progress

OES Law Division has developed a plan recommending standard procedures to be followed to gain access to disaster areas and to provide for crowd control. The plan proposes a standard identifying arm band for use throughout the State. Local authority would have responsibility for properly issuing the arm band.

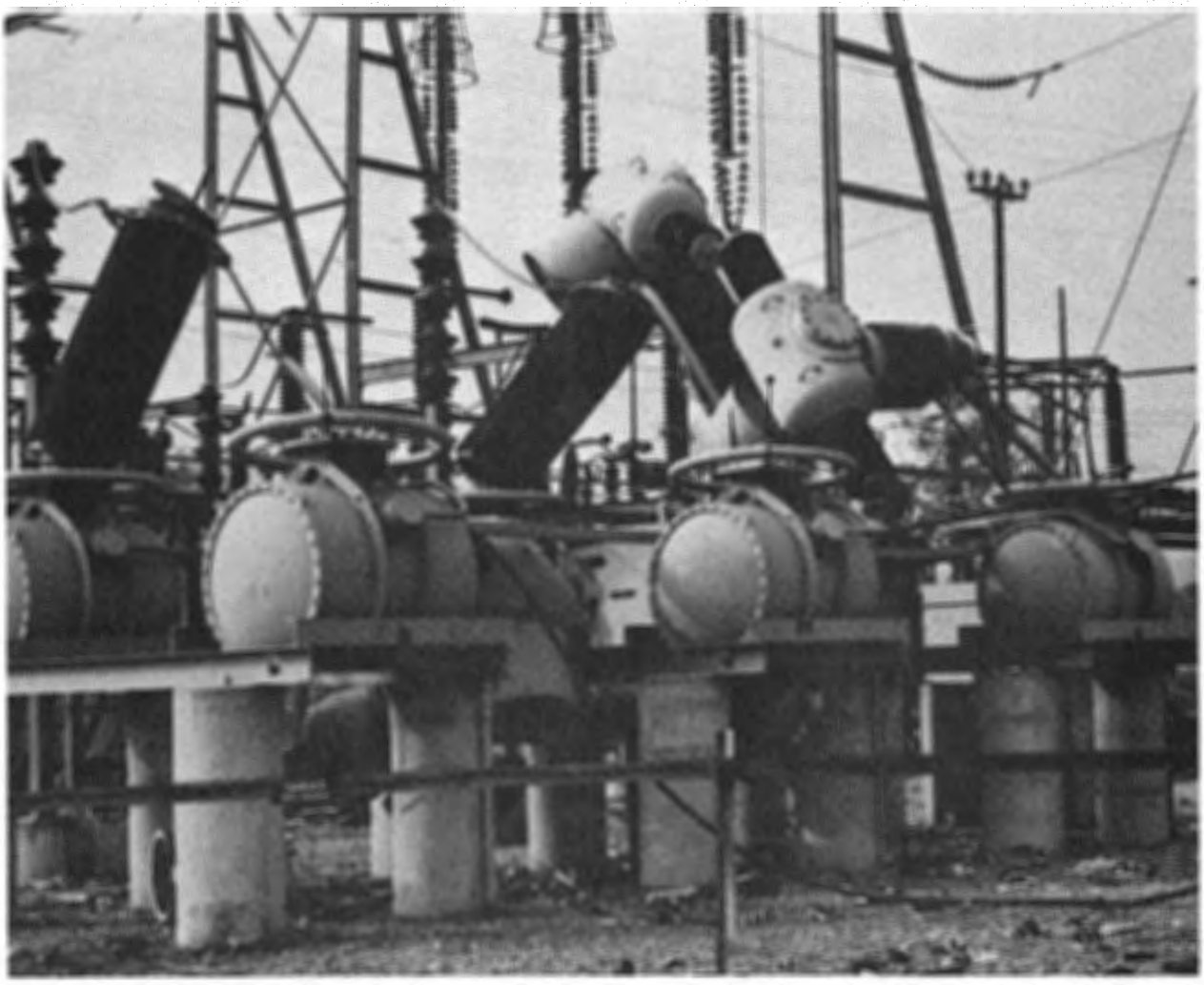
Future Action

OES will continue to promote acceptance of the plan by local public protection agencies and will report annually to the SSC.

HIGHWAY 5 INTERCHANGE FOLLOWING THE SAN FERNANDO EARTHQUAKE OF FEBRUARY 9, 1971--AN AERIAL VIEW
(Recommendation No. 2)

Critical facilities such as this severely damaged highway interchange must be cleared and service restored as rapidly as possible after an earthquake. Technical studies must therefore begin immediately before useful data are obliterated by the emergency operations.

Recommendation No. 2 provides for expeditious and coordinated postearthquake investigation and prompt dissemination of information. Arrangements have been made with the California Wing, Civil Air Patrol, to provide aerial photographic surveys on short notice thereby preserving observations of damaged facilities which could be destroyed before ground parties have an opportunity to conduct on-site examinations. (Photo courtesy DWR)



CONVERTER STATION AT SYLMAR, CALIFORNIA DAMAGED DURING THE FEBRUARY 9, 1971 EARTHQUAKE
(Recommendation No. 3)

Past earthquakes have demonstrated that community life lines are particularly susceptible to disruption. Damage to utility systems such as water supply, sewers, gas, electricity, communications and transportation creates serious hardships and may take months to repair. The GEC is exploring the needs for research to improve the resistance of facilities to severe earthquakes and ways of improving coordination and dissemination of newly developed technology among the major utilities. (Photo courtesy OAC)

RECOMMENDATION NO. 3
FROM THE 1972 REPORT

EARTHQUAKE RESISTANCE OF PUBLIC UTILITY SYSTEMS

Special research should be directed to economically improving the earthquake resistance of Public Utility Systems.

Public welfare depends so greatly on the functioning of utility systems, such as water supply, sewers, gas, electricity, communications, and transportation, that California should give special attention to insuring that their operation will not be seriously disrupted during an earthquake. Utilities are, in general, such complicated systems that special studies should be made on how adequate earthquake resistance can best be achieved at economical cost. The State of California should take the lead in initiating and sponsoring such research.

1973-74 Progress

A representative from the State Public Utilities Commission (PUC) chaired the "Subcommittee on Earthquake Resistance of Public Utility Systems", comprised of representatives from publicly and privately owned electric, gas, sewer, water, telephone, and transportation utilities and of governmental agencies and earthquake research organizations. Subcommittee members provided information concerning their organizations' policies and programs with respect to earthquake resistance in utility design and construction, divided into five major topics: (1) Current criteria, (2) Present research, (3) Recommendations for further research, (4) Funding of research, and (5) General recommendations.

An extensive report covering these topics was submitted to the GIEC on June 7, 1974, concluding the subcommittee assignment under Recommendation No. 3. The "need for and scope of further research" is defined in considerable detail under four topics: (1) Site conditions, (2) Materials, (3) Structural response to seismic-induced motion, and (4) Equipment. Sources of research funding explored by the subcommittee are: (1) Public and private earthquake research organizations, including the National Science Foundation (NSF), U. S. Geological Survey (USGS), and budget item allocations for state agencies; (2) State funding of university-conducted research; (3) Private grants to CIT and the University of California; and (4) Combinations of utilities, private vendors, and public groups providing funds, facilities, materials, and personnel for joint research projects.

Future Action

In its report, the subcommittee recommended that it should be established as a permanent entity meeting annually or oftener to coordinate future research and disseminate the products of current research regarding earthquake-resistant design and construction of

utility systems. If established as a permanent entity by the SSC, the subcommittee would develop a program to:

1. Improve the coordination of earthquake resistance research and the application of advances in utility design and construction developed by that research.

2. Coordinate earthquake resistance criteria accepted by California utilities for specified equipment and construction, and the standardization of specifications to vendors for design of earthquake-resistant equipment most frequently used by utilities in all categories of service--gas, electric, telephone, water, sewer, and transportation.

3. Assure that existing utility systems operated by private and public institutions or by large apartment and condominium complexes have the benefit of continuing information on earthquake resistant design and construction.

RECOMMENDATION NO. 4
FROM THE 1972 REPORT

SAFETY OF DAMS

The relative dam safety programs of the State and Federal Governments should be assessed and contingency plans for areas below dams should be prepared and adopted.

Failure of a dam could be one of the most catastrophic results of an earthquake in the State. Vigorous efforts by appropriate public agencies working in this area must be made to insure that such an event will not occur or that ensuing damage and loss of life will be minimal.

DWR, under Division 3 of the State Water Code, has jurisdiction over all nonfederally owned dams in California of greater than 6 feet in height storing 50 or more acre-feet of water and of 25 or more feet in height storing more than 15 acre-feet of water. Principal federal agencies which design and construct or operate dams within California are the U. S. Bureau of Reclamation (USBR), the U. S. Corps of Engineers (USCE), and the U. S. Forest Service (USFS).

1973-74 Progress

DWR obtained a description of current dam safety practices from each of the federal agencies, and DWR personnel accompanied federal personnel from each of those agencies on at least one detailed dam inspection. Because of organizational and staffing variations among these separate jurisdictions, there is some uniqueness in each respective approach to dam safety. Primary differences exist in the frequency of detailed technical inspections of operational dams and, in some cases, the use of interdisciplinary inspection teams. The federal dam safety procedures and inspections were thoroughly evaluated and were found to be generally comparable in extent and quality to those of the State. DWR has completed its final report to the GEC entitled "Assessment of State and Federal Dam Safety Programs, July 1974".

Closely associated with the second part of this recommendation is Section 8589.5 of the Government Code and its subsequent amendment, Senate Bill 1266, Chapter 726, Statutes of 1973. Under the provisions of this Code Section, OES, after consultation with DWR, identifies those dams the partial or total failure of which would result in death or personal injury due to flooding of the area below the dam. The owner of each dam so identified must prepare and file an inundation map which shows the area of such potential flooding. The inundation maps provide the basis for evacuation planning under Recommendation No. 15(b). Local jurisdictions are then required

to adopt procedures for the emergency evacuation and control of those areas. Approval authority of both the inundation maps and evacuation procedures is vested in OES.

SB 1632 further amends Section 8589.5 of the Government Code to give OES discretionary power to waive the mapping requirement in certain carefully defined cases. It also provides a system under which OES will reevaluate all exempted dams every two years and will insure that all new dams will be evaluated to determine mapping requirements. Counties and cities are required to report changes in development below exempt dams.

Out of the approximately 1,100 (nonfederal) dams in California, it is estimated that about 750 will require inundation maps under this program. To date nearly 260 maps have been submitted for engineering review. Federal agencies, although not bound by California law, also are participating on a voluntary basis.

Future Action

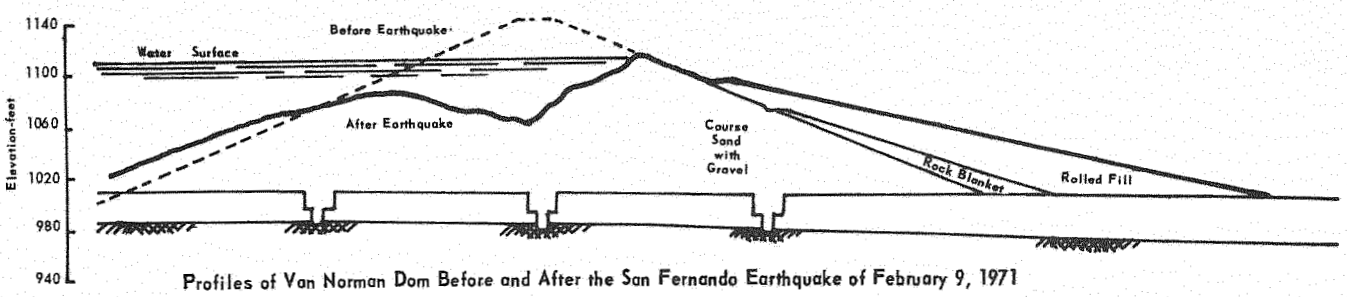
As a result of the assessment of state and federal dam safety programs, DWR is considering adopting some federal practices.

OES will work toward completion of the estimated 750 inundation maps by December 1975 and will review those remaining dams, which have been exempt, for possible future mapping.

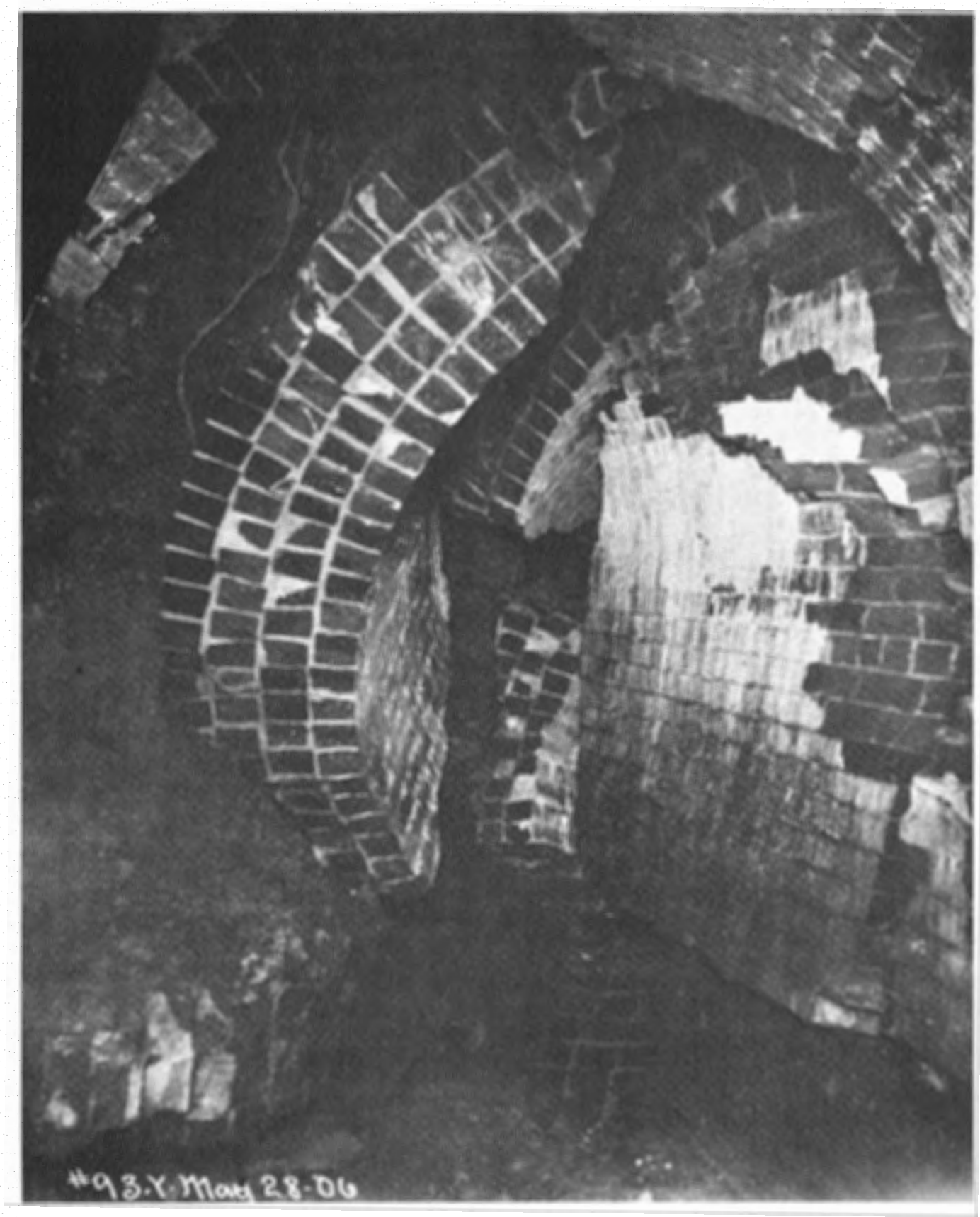
Congress has directed the USCE to inspect or survey all dams in the United States. The first phase, that of inventorying all dams, has been completed in California but is still in progress nationwide. The second phase consists of field investigations to determine the condition of each dam with respect to potential hazards. California has requested exemption from this phase. The Secretary of the Army is to report to Congress in midsummer, 1974, on the status of the program.

LOWER SAN FERNANDO DAM, LOS ANGELES COUNTY
(Recommendation No. 4)

This dam, which was severely damaged during the San Fernando earthquake of February 1971, is typical of the hydraulic fill dams which were constructed between 1870 and 1935. The susceptibility of this type dam to liquefaction during an earthquake is clearly evident. As a result of the near failure of Lower San Fernando Dam. DWR has required the owners of each of 29 such dams in the State to conduct dynamic stability analyses. In general, although all studies have not been completed, those dams in the Sierra Nevada have been found satisfactory; whereas most of those in the coastal areas, where seismic expectancy is greater, have been found deficient. Removal, repair, or replacement is being considered for the potentially unstable structures. (Photo courtesy DWR)



Profiles of Van Norman Dam Before and After the San Fernando Earthquake of February 9, 1971



RUINS OF THE TUNNEL SPILLWAY AT THE CITY OF SAN FRANCISCO'S SAN ANDREAS DAM FOLLOWING THE GREAT EARTHQUAKE OF 1906.

TUNNEL SPILLWAY AT SAN ANDREAS DAM FOLLOWING THE 1906 EARTHQUAKE (Recommendation No. 5)

This tunnel, which penetrated the San Andreas fault, was offset laterally about seven feet during the temblor. The dam, which was of earth construction, withstood the severe shaking, sustaining only minor damage.

The following quote relates the damage sustained by the Pilarcitos pipeline, one of the principal water conduits to the City of San Francisco:*

> "The earthquake having torn a crack or fault, several miles in length, along and across the upper or 30-inch Pilarcitos pipeline, had either completely destroyed it, tearing and telescoping it in a number of places, or at least had so injured it, that it would be many, many months, to say the least, before it could be put into service again, if at all. At the large Frawley Canon (sic) the Pilarcitos 30-inch pipe was thrown some 60 feet to one side. It was torn in two for over 100 feet and thrown bodily, in two parts and about at right angles to its original line; so that no matter what construction could have been put there, it could not have been maintained there, owing to the evidently great violence of the shock. Other portions of the Pilarcitos 30-inch pipe were destroyed by the earthquake, pulling the pipe apart in many places, while at other places, it was telescoped."

Fortunately, water supply to San Francisco was restored within 62 hours after the shock through an alternate 37-inch line.

These observations illustrate the importance of identifying and defining active faults and avoiding where possible the construction of facilities upon or through them. Earthquake geologic hazards maps are being prepared by the California Division of Mines and Geology in response to Recommendation No. 5. These maps will show those faults that appear most likely to offset during future seismic events.

*Source: "The Water Supply of San Francisco Before, During and After the Earthquake of April 18, 1906" by Hermann Schussler, Chief Engineer, Spring Valley Water Co., July 23, 1906.

RECOMMENDATION NO. 5
FROM THE 1972 REPORT

EARTHQUAKE GEOLOGIC HAZARDS MAPS

The State should accelerate preparation of comprehensive maps of earthquake geologic hazards.

Earthquake geologic hazards mapping involves accurate and detailed interpretation of geologic data and is absolutely essential to the evaluation of earthquake risk. Such maps are invaluable as a guide to local and regional planning and building code development as well as providing information for land-use decisions at all levels of government.

1973-74 Progress

A Fault and Geologic Map of California, at a scale of 1:750,000, was published in 1974 by CDMG as "Preliminary Report 13, State of California, Preliminary Fault and Geologic Map". In its preliminary form it is essentially a fault map, with faults color coded as to recency of movement. Those faults that have moved historically are shown in red, while those that have cut Quaternary deposits but have not moved historically are shown in orange. Eventually the map will be published with geology shown in full color.

Pursuant to the Alquist-Priolo Geologic Hazard Zones Act of 1973, CDMG has delineated the mapped traces of the San Andreas, Hayward, Calaveras, and San Jacinto faults, including zones one-fourth mile or more wide and centered on these faults. These maps, depicting "Special Studies Zones", became official on July 1, 1974; however, they have been available to the public since December 1973.

In January 1973 CDMG completed a preliminary map entitled "Maximum Expected Bedrock Accelerations from Earthquakes in California". This mapping was done for the California Division of Highways (CDH) under contract. The map was printed at a scale of 1:2,000,000 and widely distributed to interested persons, chiefly consulting geologists and engineers.

Future Action

The "Fault and Geologic Map" will be completed by CDMG to include geologic features and will be published in full color, along with a text and source index. New and more accurate fault data will continue to be collected so that revised editions can be published from time to time.

CDMG will prepare additional maps of "Special Studies Zones" for other active and potentially active faults as information and topographic maps are made available. CDMG estimates that at least $100,000 is needed annually for the next 10 years to complete this work.

CDMG is revising the map entitled "Maximum Expected Bedrock Accelerations from Earthquakes in California" and expects to republish it, along with an accompanying report, in the fall of 1974.

CDMG will report annually to the SSC.

RECOMMENDATION NO. 6
FROM THE 1972 REPORT

DISSEMINATION OF EARTHQUAKE-RELATED
EARTH SCIENCE INFORMATION

(a) COLLECTION AND DISSEMINATION OF EARTHQUAKE DATA

The State should develop additional capability in the collection, summarization, organization, and dissemination of earthquake-related earth science data.

A vast quantity of earthquake-related earth science information is being developed and accumulated by various organizations such as the USGS, NOAA, CDMG, DWR, universities, local agencies, private firms, and professional societies. Usually, these same organizations disseminate such information and data through numerous allied publications, some with limited distribution, and in response to specific requests.

1973-74 Progress

CDMG began publishing a quarterly entitled "California Earthquake Science Newsletter" in February 1973. Seismologists and others conducting earthquake-related research were contacted by CDMG staff members and asked to contribute news items. The concept of the newsletter was well received; however, actual contributions of news items were sparse, and those received were essentially duplications of other publications having similar distribution. For these reasons the newsletter was discontinued after February 1974. Articles related to earthquakes will continue to appear in "California Geology", a monthly publication of CDMG.

The Public Resources Code charges CDMG with responsibility to maintain a file of information concerning resources and geology which should be available to assist the residents of the State. CDMG has developed an electronic data storage and retrieval system which will contain earthquake-related data (Recommendation No. 8). Other data relative to boreholes, geochemistry, physical testing, etc., is maintained in a form suitable for EDP storage.

Future Action

CDMG will continue to publish "California Geology" on a monthly basis and will strive for complete coverage of the entire earthquake-related earth science field.

CDMG will continue its development and implementation of an electronic data storage and retrieval system and will report annually to the SSC.

(b) EARTHQUAKE HAZARDS CRITERIA

The State should develop criteria for the detailed delineation and evaluation of geologic earthquake hazards by local government.

The "safety element" and "seismic safety element" of general plans (Government Code Section 65302) require the development of policies for the protection of the community from geologic hazards and an identification and appraisal of seismic hazards, respectively. Local governments control zoning, siting, and construction within their respective jurisdictions. A few local governments have expertise in delineating and evaluating geologic earthquake hazards; most do not.

The GEC prepared "Suggested Interim Guidelines for the Seismic Safety Element in General Plans". These guidelines were distributed in July 1972 to all local governments in California by the State Council on Intergovernmental Relations (CIR).

1973-74 Progress

In September 1973 CIR issued its "General Plan Guidelines" which covers the seismic safety element.

Future Action

CIR will update the seismic safety element of its General Plan Guidelines periodically as dictated by experience and available information and report to the SSC.

OLIVE VIEW HOSPITAL FOLLOWING THE SAN FERNANDO
EARTHQUAKE OF FEBRUARY 9, 1971
(Recommendation No. 7)

Three people were killed at this facility and damage was estimated at about $60 million.

Research programs are now proceeding with the objectives of developing better understanding of the ground motions that occur during severe earthquakes and improving the seismic criteria required for designing structures to withstand them.

Plans submitted for all new hospitals in California now must be accompanied by a report which evaluates geologic hazards including seismic history of the sites proposed. These reports are prepared in accordance with guidelines published by CDMG. (Photo courtesy CDMG)

RECOMMENDATION NO. 7
FROM THE 1972 REPORT

EARTHQUAKE ENGINEERING RESEARCH

Research on earthquake engineering should be greatly augmented so as to obtain the most needed and most beneficial results in the development of safe and economical design criteria.

Universities, both public and private, are the main source of basic research. Several years ago CIT and UCB took the lead in forming the Universities Council for Earthquake Engineering Research (UCEER) which has played an important role in coordinating basic research. Government agencies and private organizations in California also have been leaders in sponsoring and conducting intermediate and applied research. However, all groups - government agencies, private organizations, and universities in particular - have a potential for a much stronger research program than has been carried on in the past.

1973-74 Progress

The Subcommittee for Coordination of State-Sponsored Earthquake Engineering Research formulated lists of earthquake engineering research needs, including specific types of basic and practical applied research. Some of these research items stem from Recommendation No.9 (a), which concerns design related geologic studies.

A research project entitled "An Evaluation of Seismic Codes" has been funded by NSF through the National Bureau of Standards (NBS) and is being conducted by the Applied Technology Council (ATC). This project requires that a panel of engineers prepare a draft of a seismic code; another group of engineers will then reanalyze existing buildings to conform to the new code requirements and determine its economic and design impact. The project is essentially complete.

ATC is also conducting a program (funded by NSF) to improve and update the present recommended lateral force requirements code of the Structural Engineers Association of California (SEAOC). The program encompasses all aspects of building and geotechnical practices necessary to mitigate the effects of earthquake disasters on a national scale. Required loading and resistance criteria will be explored in depth and written for easy adoption into building codes. This study is scheduled for completion in two years.

Senate Bill No. 2149 (Alquist) has been introduced, providing for the development of recommended minimum design and construction standards relating to seismic safety. This bill is a direct result of a report and proposal for seismic code revision prepared by SEAOC.

DWR contracted with Stanford University for measurement of dynamic characteristics of switchyard electrical equipment relative to the California Water Project. The tests determined natural frequencies and damping characteristics, with and without pilot modifications, of the structures. Final modifications are being incorporated into the equipment to improve seismic resistance.

CALTRANS has installed strong-motion earthquake recorders on three bridges and developed (1) techniques to determine shear velocities in soils, (2) additional expertise in predicting the behavior of embankment and cut slopes to earthquake motion, and (3) additional computer programs to determine the behavior of structures in the inelastic region.

Future Action

The State must continue to encourage the financial support of earthquake engineering research. It is anticipated that the SSC will lend active support to this effort.

RECOMMENDATION NO. 8
FROM THE 1972 REPORT

SEISMICITY MAPS AND CATALOGS

A comprehensive earthquake catalog should be compiled and various seismicity and seismic probability maps should be prepared for California.

Where earthquakes have occurred in the past, more can be expected in the future. In the study of earthquakes, understanding the past is the key to present and future understanding. A detailed compilation of all known earthquake history in the State would be an invaluable aid to researchers in seismology and earthquake engineering, planners, engineers, and various governmental officials whose responsibilities are affected by seismic hazards. Detailed seismic history for given areas is essential to aid municipalities in preparing seismic elements.

1973-74 Progress

CDMG is completing a catalog of damaging earthquakes in California (MM intensity VI or greater) to be published jointly with USGS.

CDMG has developed a data storage and retrieval system which will contain three files of earthquake-related data. The first file will contain information related to individual earthquakes such as hypocenter, felt area, lives lost, dollar damage, and information about surface faulting. This file should be complete by late 1974 and will be used to provide various kinds of information lists relating to earthquakes in specific areas.

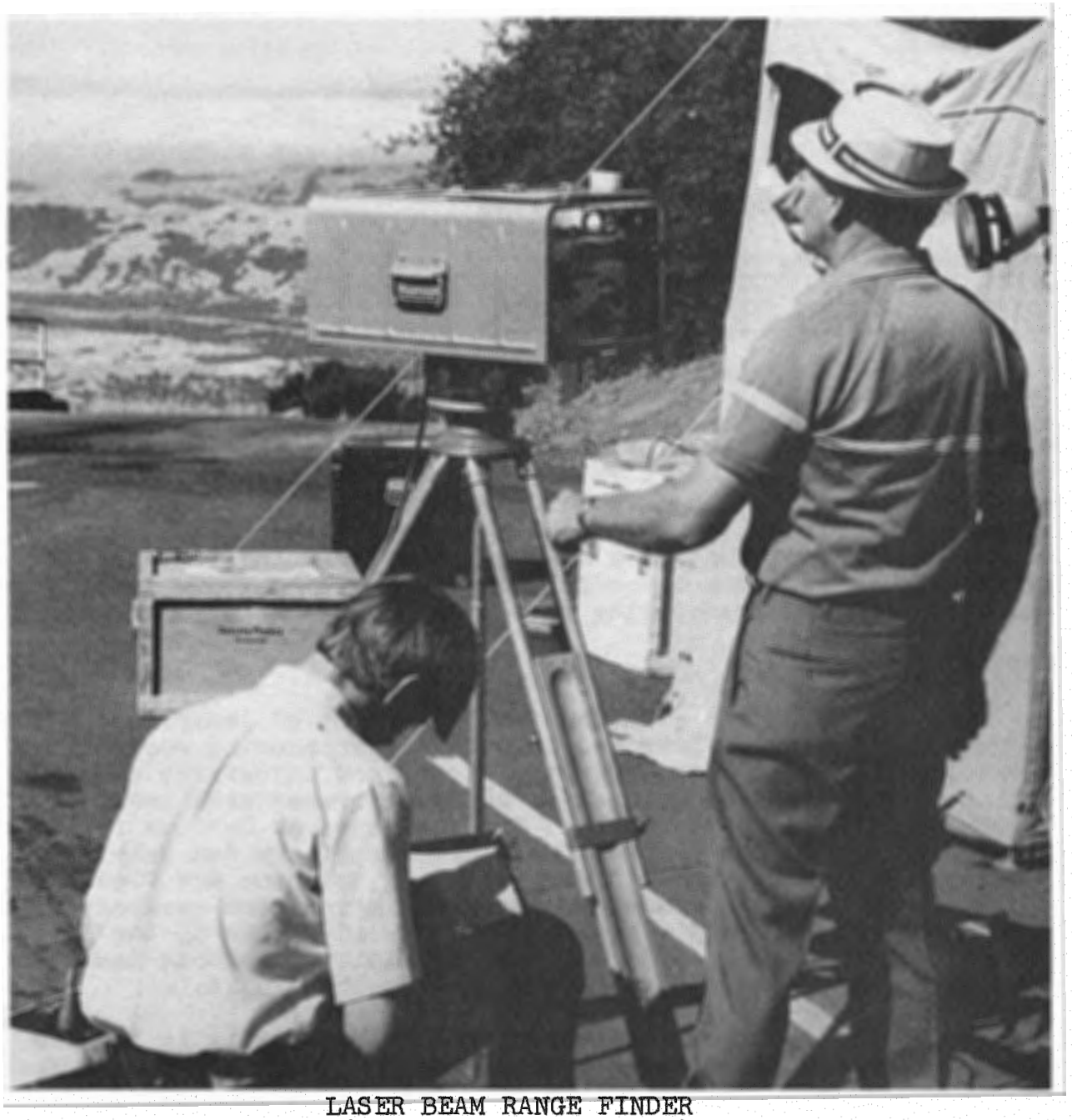
The second file will contain all the available intensity and acceleration data for each event in the first file. The file should be complete by late 1975 and will be used to prepare isoseismal maps for individual earthquakes and as input for the third file.

The third file will contain intensities sorted as to location. The data for this file will be obtained directly from the second file; thus, no work can be done on this file until the second is complete. This file will be used to compute recurrence intervals for intensities at any location in the State. It will also allow maps to be drawn showing (maximum and mean) intensities throughout the State.

CDMG has published a preliminary fault and geology map of California and a preliminary map showing maximum expected bedrock acceleration from earthquakes in California (Recommendation No. 5).

Future Action

CDMG will work towards completion of the earthquake catalog and the files for the data storage and retrieval system, prepare seimicity and seismic probability maps, and report annually to the SSC.



LASER BEAM RANGE FINDER
(Recommendation No. 9)

This instrument is used for measuring precisely the distances between widely spaced survey monuments, usually located on mountain tops. Repeated measurements are made to detect changes in these distances and thus reveal the strains occurring in the earth's crust. Collection of these data is part of the CDMG program to develop an earthquake warning capability. (Photo courtesy CDMG)

RECOMMENDATION NO. 9
FROM THE 1972 REPORT

RESEARCH ON FAULTS, CRUSTAL STRAIN, AND FAULTING

(a) RESEARCH ON FAULTS AND FAULTING

Coordinated research on the nature of faults and fault displacement, and on the histories of fault displacemements through the recent geologic past should be increased.

During recent years the geosciences have experienced an increase in public awareness, particularly in populated areas subject to recurring earthquake disasters. The high incidence of earthquake occurrence and the association of earthquakes with faults have induced the State of California to enact regulations requiring evaluation of the geologic environment of proposed construction sites for hospitals, schools, and emergency structures. Overall, an increased effort has been made to understand individual faults, systems of faults, the inter-relationship between tectonic provinces, and the earthquake generating processes.

1973-74 Progress

The USGS has expanded investigations of important faults by increasing its own efforts and by actively sponsoring cooperative investigations with other federal, state, and university organizations. Many tens of kilometers of fault traces have been examined in the San Francisco Bay region, the Elsinore and Garlock fault zones, and within the frontal fault systems of the San Gabriel and San Bernardino mountains. Efforts to date Holocene and Pleistocene sediments have been performed, providing information necessary for reconstruction of the displacement history of faults in the San Francisco Bay region. Acoustic profile plotting methods have been applied to evaluate the continuity of offshore faults.

DWR has contracted with Stanford University to prepare seismic microzonation of designated regions of the California Water Project which will depict future probable peak ground accelerations in those regions. When completed, this seismic risk program will determine the level of risk and probable consequence of failure of each component of the Project.

Future Action

The USGS will continue its seismic research activities and sponsorship of similar research projects by others. The San Andreas seismic network will be extended southeastward along the San Andreas and San Jacinto fault zones. Geodetic measurements of the numerous survey lines crossing faults in California will continue.

CDMG will continue activity in defining geologically hazardous zones and active faults, in the preparation of maps showing

Special Studies Zones (Recommendation No. 5), and in conducting studies related to active faults, seismic elements, and geologic hazards.

DWR will actively pursue research programs similar to and including its seismic risk program (with Stanford University).

(b) CONTINUE CRUSTAL STRAIN MEASUREMENTS

Large-scale crustal strain measurements along the state "geodimeter" network should be continued at a high level for at least the next decade.

In order to detect strain changes in the earth's crust along the San Andreas Fault zone (and related zones), the State has made periodic geodimeter measurements since 1959. The program was instigated and conducted by DWR, in connection with the California Water Project, until 1968, at which time it was transferred to CDMG. These crustal strain measurements have been fundamental in the understanding of faulting and earthquake generation, and the results of the program suggest that its continuation may eventually lead to the development of an earthquake warning system.

1973-74 Progress

CDMG and USGS are continuing a cooperative program of crustal strain measurements along the "geodimeter" network with new and intensified effort being made by both agencies in areas of particular interest. CDMG is concentrating its efforts in the southern part of the net, along the San Andreas and San Jacinto faults from southern Monterey County and the Anza Borrego Desert; USGS conducts periodic remeasurements of selected lines in the network northerly from Monterey County to the San Francisco Bay region. Both agencies have developed more comprehensive data in selected areas--CDMG in the Parkfield-Cholame Valley segment of the San Andreas fault; USGS in the Hollister, Antelope Valley, and San Bernardino-Riverside region.

A schedule of frequent reobservations (3-4 month intervals) was initiated by CDMG in the Parkfield-Carrizo Plain region of the San Andreas Fault in 1972 and is continuing. Also, measurements have been initiated on an array of lines established by CDMG/USGS in the San Juan Bautista-Watsonville region. Quarterly measurements on this latter net are being continued by USGS.

Precise leveling at selected fault locations is being performed principally by NOAA, USGS, and DWR; but thse sites are generally of limited areal extent. Thus at present there appears to be no agency with available capability or funding to accomplish precise leveling surveys of the desired scope without major new support. An alternative measure of vertical deformation is afforded by the deployment of tiltmeters. The use of this instrumentation is being actively expanded by USGS with a few instruments being operated by CDMG.

The UCSD long base strain meter program has been financially supported by NSF and USGS. Over $150,000 has been expended during 1973 and 1974.

Future Action

CDMG and USGS will maintain their present cooperative effort on the geodimeter net and will seek increased support to permit increasing the geodimeter net program to the same level previously conducted by DWR (1959-1969).

Relatively new highly accurate short-ranged and distance-ranging instrumentation provides additional capability for crustal strain measurements. Both CDMG and USGS plan additional measurement activity utilizing this instrumentation.

CDMG will pursue the possibility of purchasing and installing additional tiltmeters for determination of vertical crustal deformation.

Both NSF and USGS are expected to continue their support of the UCSD long base strain meter program. NSF has approved $50,543 for fiscal year 1974-75.

RECOMMENDATION NO. 10
FROM THE 1972 REPORT

SEISMOGRAPH NETWORKS AND BASIC RESEARCH
IN SEISMOLOGY

(a) STRENGTHEN BASIC RESEARCH PROGRAMS

Basic research programs in seismology should be strengthened.

A healthy research program in seismology is essential to the understanding of earthquakes and consequently the reduction of earthquake hazards. Particular emphasis should be placed on research of unique value to California that can best be carried out by California agencies and institutions.

1973-74 Progress

Under the Strong Motion Instrumentation Program, CDMG has installed a network of approximately 200 instruments. Siting emphasis in order of priority has been on: (a) critical geographic areas not yet instrumented, (b) representative soil and rock sites, (c) fault zones, and (d) selected structures; and includes installation of a large number of array sites. The occurrence of a significant earthquake, almost anywhere in the State, should now provide researchers with valuable data concerning ground response to strong earthquake shaking.

Future Action

CDMG's plans for next year emphasize the instrumentation of selected structures, i.e., buildings of different heights, types of framing, materials of construction, design and construction dates, and architectural concept. In addition, it is proposed that selected dams, offshore drilling platforms, and down-hole arrays be instrumented during this next year.

(b) SEISMOGRAPH NETWORK EXPANSION, MODERNIZATION, SUPPORT

Seismograph networks in the State should be expanded, adequately supported, and certain of their facilities modernized.

The State has a responsibility to insure that a long-term record of basic information on California earthquakes be properly kept. This requires continuously monitoring and analyzing seismic events, both on land and offshore. UCB in the northern part of the State, and CIT in the southern part, have a long history of meeting this responsibility. The expansion of seismograph networks in the State involves increased coverage of certain parts of the State and conversions of some of the present seismograph stations into more modern facilities.

California is the most intensively monitored seismic area in the world with the possible exception of Japan. Several agencies operate sensitive seismograph networks, i.e., UCB, CIT, USGS, DWR, and the University of Southern California (USC). All the agencies, except USC, record telemetered seismic data from one or more sister agencies through the DWR seismograph recording center in Sacramento. Other seismic data are freely exchanged between the networks.

1973-74 Progress

Seismic recording and analysis capabilities have been improved largely through federal research grants. Modernization of analysis facilities has been made possible by a capital equipment grant of $180,000. The most recently developed broadband seismographs have been installed at the first-grade Jamestown station in the central part of the State. Networks of strong motion instruments are now operated on the San Andreas fault, south of Hollister in Bear Valley.

The CIT seismograph station operational budget was augmented by $57,000, as recommended by the GEC, through contractual arrangement with CDMG. The CIT telemetered sensitive seismograph network was effectively expanded with the installation of USGS stations in the Imperial Valley, the Mojave Desert, and the San Bernardino area.

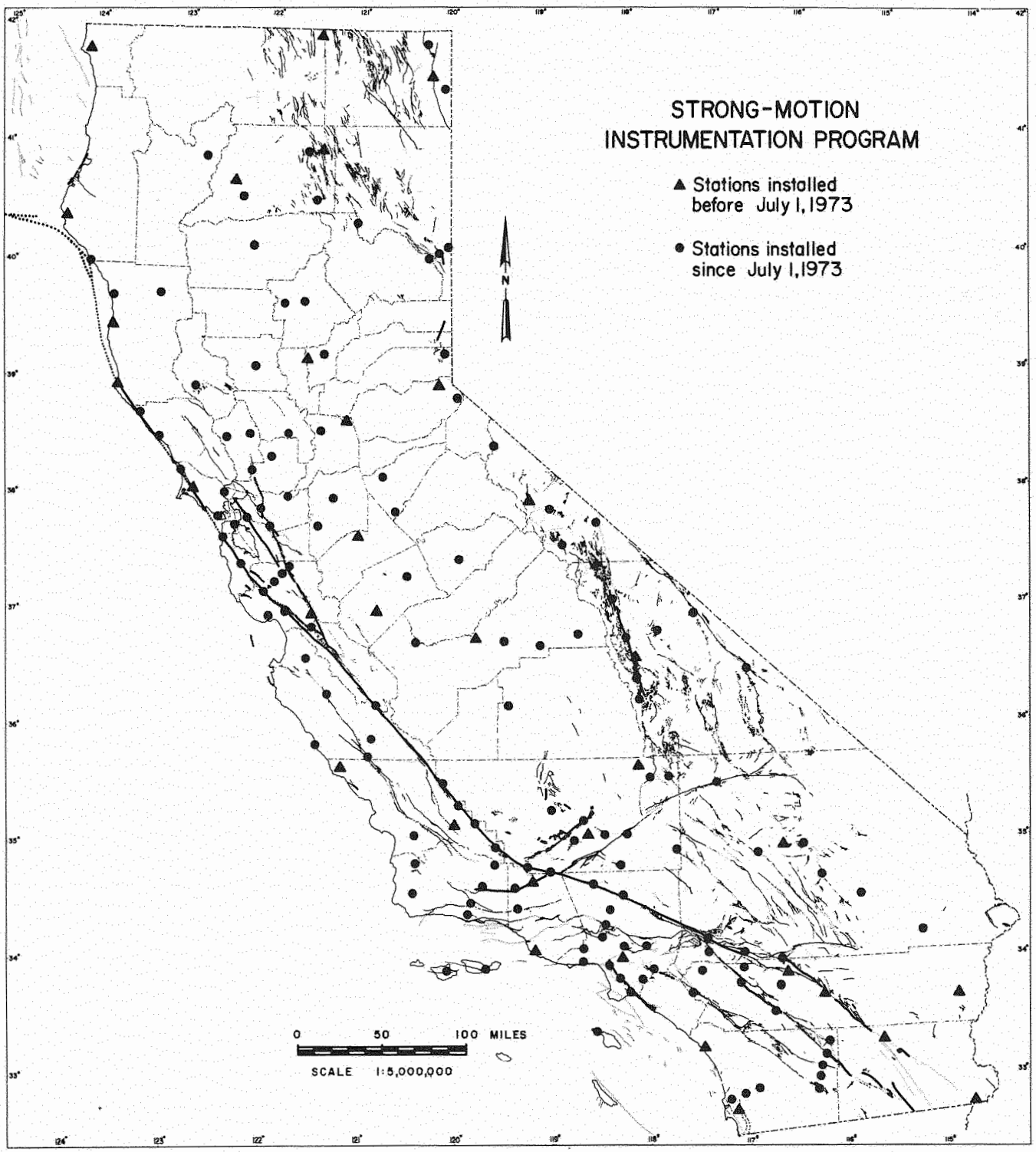
Future Action

Achievement of routine on-line computer analysis of the UCB telemetered seismograph network is expected within the next two years. Needed equipment, funded by the $180,000 NSF grant, is on order. Computer software is in the development stage. When the system is operational, epicentral location, magnitude, and other parameter data will be available very quickly for dissemination.

Activities of the UCB seismograph station are being expanded as a result of a $70,000 budget augmentation for FY 1974-75 that was recommended by the GEC.

The telemetered seismograph network, operated jointly by CIT and USGS, will be expanded in the San Bernardino area and in the Imperial Valley area. The enlarged network will be utilized to test the dilatency phenomenon as an earthquake prediction tool for Southern California.

On-line computer processing of the telemetered seismograph network data will be utilized to process the increased analysis workload.



LOCATIONS OF STRONG-MOTION ACCELEROGRAPH STATIONS INSTALLED BY CDMG UNDER THE CALIFORNIA STRONG-MOTION INSTRUMENTATION PROGRAM. (Recommendation No. 10)

RECOMMENDATION NO. 11
FROM THE 1972 REPORT

MECHANISM OF CRUSTAL FAILURE

Further fundamental research should be undertaken on the mechanism of crustal failure.

The solutions to a variety of earthquake problems are dependent on further fundamental research. Much of this research is being conducted by federal agencies and universities. An evaluation of the adequacy of ongoing research in fields related to the mechanics of crustal failure is desirable, specifically concerning:

1. Rock properties and behavior under realistic crustal conditions of stress, strain, and temperature,

2. Methods of in-situ crustal stress measurement,

3. Methods of estimating earthquake source properties,

4. Numerical modeling of the earthquake source and resulting ground motion on the surface of a realistic earth, incorporating soils and topography.

1973-74 Progress

A Penrose Conference on Fracture Mechanics and Earthquake Source Mechanisms was convened by the Geological Society of America in September 1971 at Aspen, Colorado. Some 84 experts in seismology and rock mechanics gathered to consider current research and research needs on essentially the four topics enumerated by GEC in this recommendation. The following summary of conclusions of that conference (see Geotimes, April 1972, pp 15-18 for a complete discussion) goes far in responding to the GEC recommendations.

"Current evidence supports a modified elastic-rebound theory for generation of earthquakes. Important new modifications include the need to account for a seismic slip and the roles of gouge and effective stress in the fault zone. Areas of greatest interest at the conference suggest manifold research needs. These include:

1) studies of mechanical properties of fault gouge,

2) explanations of the role that gouge plays during fault displacement,

3) interpretations for the order-of-magnitude difference between stress drops recorded in laboratory friction experiments compared with stress drops calculated for earthquakes,

4) improvements in theoretical and numerical models based on dislocation theory,

5) analyses of the high-frequency part of seismic spectra,

6) determinations on whether creep relieves significant strain energy or is premonitory to major earthquakes,

7) understanding of how fault behavior changes with depth, and

8) applications of experimental friction work to fault behavior in seismic zones of the world.

"Perhaps the greatest current need is for a greatly increased emphasis on the combined and simultaneous use of theory, laboratory data, and field observations in fracture mechanics and earthquake-source mechanism problems. Encouragingly, theoretical models that use laboratory rock-mechanics data yield source parameters and motions close to those calculated for earthquakes.

"Analyses of seismic spectra indicate a preference for the dislocation model for faults, but the models require refinement. Stimulation of strain-energy release seismically by high fluid pressures, underground explosions, and mining provide unique clues and extraordinary opportunities for studying physics and dynamics of earthquakes."

The above summary addresses all aspects of Recommendation 11 except the numerical modeling of strong motion with soil and topographic details included. Such research, utilizing finite element and finite difference techniques, is in progress at several laboratories. These studies, however, will depend heavily for completeness on a realistic model of the spatial and temporal characteristics of the earthquake source.

Future Action

Another Penrose Conference was convened in August 1974 and was widely attended. Active and advanced discussions of matters germane to earthquakes were pursued. The conclusions of this conference provide the latest professional evaluation of Research on Mechanisms of Crustal Failure.

RECOMMENDATION NO. 12
FROM THE 1972 REPORT

COST-BENEFIT STUDIES

Realistic cost-benefit studies should be made of earthquake countermeasures and earthquake losses.

Direct physical damage to private and public sector structures can be measured by relatively straightforward means. But the state-of-the-art for measuring indirect costs, commonly labeled "socioeconomic", is comparatively primitive. And the problems of measuring the effectiveness of mitigative measures and integrating and applying the full range of these evaluations in an effective framework of public policy--for instance in earthquake-prediction policy--remain to be studied in depth.

Systematic research is required to ascertain reliable values for all factors--social and economic--that should be used to quantify earthquake losses and loss-reduction measures. A first need is to arrive at a method for this type of analysis--identify the essential cost factors, the units that express them, and the means to obtain them. Once procedures are established for obtaining realistic estimates of total earthquake losses, determinations of more meaningful cost-benefit ratios will be possible.

1973-74 Progress

Since this recommendation was made in 1972, the principal advances have been research studies sponsored or funded by several agencies in the U. S. Department of Housing and Urban Development (HUD), by USGS offices formerly under NOAA, and by the insurance industry.

The Federal Disaster Assistance Administration (FDAA) sponsored studies of expectable losses in "scenario earthquakes" in the San Francisco and Los Angeles areas, released in 1973 and 1974. These were contract studies by technical investigators under the direction of the Environmental Research Laboratories (in NOAA). The FDAA also is sponsoring a recently organized (May 1974) Panel on Public Policy Implementation of Earthquake Predictions. The Office of the Assistant Secretary for Policy Development and Research (in HUD) supervised a research project in the performance of dwellings in the San Fernando earthquake and a follow-up study now underway to develop methodology for estimating losses to buildings. Cost considerations of improved earthquake-resistant construction practice will be another follow-up study.

The Office of the Federal Insurance Administrator (in HUD) is sponsoring research into insurance aspects of losses and indemnities.

Future Action

CDMG will review the results of applicable federal and state research projects pertinent to Recommendation No. 12 and report thereon with recommendations to the SSC by June 30, 1975.

RECOMMENDATION NO. 13
FROM THE 1972 REPORT

CONTINUING EDUCATION

Organizations involved in earthquake-related activities should actively support conferences, seminars, and short courses for the purpose of disseminating information on new developments; key personnel with such agencies should be encouraged to participate in such educational activities.

Earthquake engineering is a comparatively new and rapidly developing field. Ongoing research is continuously providing new technology or improving old procedures. It is important that new concepts and information be rapidly and effectively disseminated among those with the need to know.

1973-74 Progress

DWR sponsored a pilot conference on Earthquake Engineering for Water Projects (January 16 and 17, 1974) in compliance with this recommendation. It included technical sessions covering geologic, seismologic, and structural aspects of earthquake engineering as they relate to water projects. A panel of selected experts was called upon to examine the state-of-the-art and make recommendations on future action. On the suggestion of this panel the California Water and Power Earthquake Engineering Forum was established with the objective of reducing earthquake damage to water projects and public imperilment.

As another means of providing information the GIEC completed a catalog of material available in the files of its member agencies. Copies of the catalog were distributed to GIEC members.

Future Action

Education in this rapidly developing field must be a continuing process. An inventory of the State's needs for earthquake-related training has been compiled based on questionnaires submitted by the GIEC member agencies. Some of the needs now are being filled by the universities through on-campus classes, extension courses, and in some instances closed circuit television facilities. Other needs can best be met by agency-sponsored training such as the DWR conference. Continuation of such events should be encouraged.

RECOMMENDATION NO. 14
FROM THE 1972 REPORT

EARTHQUAKE WARNINGS

Criteria should be established for determining under what conditions earthquake warnings should be issued; who should be responsible for issuing such warnings; what officials, agencies or groups should be alerted; and what actions should be taken on receipt of such warnings by those so alerted.

Considerable progress has been achieved during the last two years in developing the capability to predict earthquakes. Most scientists agree that the technology will require several years of testing and development before reasonably reliable predictions can be expected. Nevertheless, prudence dictates the advisability of considering at this time how the predictions of the future should be handled and who should handle them.

1973-74 Progress

The GIEC Subcommittee for Earthquake Warning recommended the selection of an advisory group comprised of eminent scientists qualified to judge the reliability of earthquake predictions. The GIEC Advisory Group on Earthquake Prediction was formally initiated in March 1974 at UCB. The group was established to evaluate all earthquake predictions based on the authenticity, validity, and reliability of the technique(s) and the credibility of the author(s) and to present to the Governor, OES, the administration, and the Legislature scientifically unbiased evaluation of the predictions.

This scientific judgment will allow government to determine when official action will be necessary and, in turn, will provide the press a source of scientific data. The scientific panel is composed of the State Geologist, who serves as Executive Secretary, and representatives from:

California Division of Mines and Geology
California Institute of Technology
Stanford University
U. S. Geological Survey
University of California at Berkeley
University of Southern California

Future Action

Future work and funding will be an outgrowth of recommendations made by the Advisory Group on Earthquake Prediction and will be related to other recommendations such as:

1. Dissemination of earthquake-related earth science information,

2. Augmentation of research in earthquake engineering,

3. Research on faults, crustal strain, and faulting,

4. Seismograph networks and basic research in seismology, and

5. Fundamental research on the mechanism of crustal failure.

Advancements in these areas will stimulate increased reliability of earthquake predictions and warnings.

RECOMMENDATION NO. 15
FROM THE 1972 REPORT

EMERGENCY RESPONSE PLANS

(a) MANDATE LOCAL DISASTER PLANS

It should be mandated that local governments have prepared disaster plans which provide both intrinsic and mutual aid response following an earthquake or other natural disaster, in order to expedite the saving of lives and the reduction of property loss.

A regularly exercised emergency plan provides local jurisdictions with a readiness capability to accomplish the life-saving and property-protection goals stated above. Local capabilities can be increased by coordinating mutual aid provisions with adjacent jurisdictions. Most local disaster plans in existence today are very general or basic and do not contain contingency plans for specific emergencies.

1973-74 Progress

Senate Bill No. 1373 (Alquist) has been introduced requiring local jurisdictions to adopt ordinances establishing a disaster council and provide for an emergency plan and organization. The formation of a disaster council would be optional with a city which is represented on a countywide disaster council. It requires that OES establish a committee to develop criteria for the emergency plans and directs that such plans and each revision thereof be filed with OES. OES will be required to report to the Legislature and the Governor's Emergency Council, each year, on local jurisdictions not complying with the provisions of the California Emergency Services Act.

Future Action

OES will continue to provide local jurisdictions with planning guidance, training, and periodic evaluation of the plan adequacy through testing and exercising. In addition, OES will continue to negotiate with federal agencies for plan funding, and coordinate state and local planning efforts.

OES will report annually to the SSC.

(b) EVACUATION PLANS

Detailed plans and procedures to evacuate isolated or endangered people from areas made hazardous by earthquake or other disaster effects should be developed for each community.

After an earthquake, structural failure and resultant debris may completely block surface transportation and thereby isolate groups of people. It is necessary, therefore, to arrange for the movement of these people to undamaged and safe areas where they can receive medical treatment and emergency care.

1973-74 Progress

Section 8589.5 of the Government Code requires local jurisdictions to prepare evacuation plans as a follow-up to the inundation mapping program described under Recommendation No. 4. Interim evacuation planning guidance was distributed to directors of county emergency organizations in July 1973. Subsequently the guidance has been revised and expanded into final form based on comments from local jurisdictions and was redistributed in July 1974. Although developed for evacuation necessitated by dam failure, the principles are applicable to evacuation for any cause; and plans can be adapted to fit the actual hazards faced by the community.

OES also has published a draft "State Nuclear Power Plant Emergency Response Plan" which can be adapted to other emergencies. The plan describes the situation and hazards that could follow such an accident, specifies the organization and tasks to be accomplished by each level - operator, local, state, and federal - and provides a concept of operations for coping with the effects of the nuclear accident.

Future Action

OES will continue to update the emergency evacuation planning guidelines and provide local jurisdictions with planning guidance and training.

OES will report annually to the SSC.

(c) PLAN COORDINATION

The State and Federal Governments should be urged to intensify their joint emergency planning programs with local governments and the private sector, to insure availability of resources, mutual aid pacts, coordination of plans, and emergency response training.

When an earthquake or other disaster strikes, it knows no geographical boundaries; therefore, it is imperative that all levels of government be prepared to share their services, resources, and manpower with those in need of help.

1973-74 Progress

This is an ongoing assignment in California, involving the U. S. Defense Civil Preparedness Agency (DCPA), FDAA, and OES; and one which has taken notable steps forward in recent months. The focal point of this cooperative effort between federal, state, and local governments is in the nine Bay Area counties and the Los Angeles area.

Major emphasis has been placed on local planning, which included the issuance of planning guidance, the development of workshops emphasizing operational plans, and on-site assistance for local governments in updating their emergency plans. Emergency plans for schools, hospitals, and other public facilities are coordinated with local government plans at the municipal level.

Future Action

In cooperation with DCPA and FDAA, OES will continue to encourage local jurisdictions to develop and update their emergency response plans to assure uniform and adequate response in emergencies involving multiple jurisdictions.

OES will report annually to the SSC.

(d) STATE EMERGENCY RESOURCES MANAGEMENT PLAN

The State Emergency Resources Management Plan should be updated and modified to be applicable to earthquake or other emergencies. In addition, an inventory of critical resources should be included as an integral part of this plan.

A major earthquake will seriously reduce the ability of each affected jurisdiction to perform its emergency functions. Further, the extraordinary emergency requirements imposed by the loss of critical resources in a community make it imperative that a statewide inventory of critical resources be developed. To accomplish this it is necessary to identify, locate, determine availability, and make prearrangements for delivery of critical resources under the control of private as well as governmental sources.

1973-74 Progress

This "State Emergency Resources Management Plan" was considered in connection with the current work relative to the "State Emergency Plan". Part Two of the latter plan is undergoing a major revision which is scheduled for completion in December 1974. It was decided, for budgetary reasons, to postpone work on the Resources Management Plan, which will be a major undertaking, until the pending revision to Part Two of the State Emergency Plan is complete.

Future Action

OES will continue efforts to implement this recommendation and will report annually to the SSC.

RECOMMENDATION NO. 16
FROM THE 1972 REPORT

EMERGENCY OPERATIONS

(a) RECONNAISSANCE

Resources should be identified and procedures developed for providing aerial and ground reconnaissance of any area of the State which may be affected by an earthquake or other disaster.

As a basis for emergency operations after an earthquake, timely and accurate reconnaissance is necessary to assess the degree and extent of damage, perimeters of affected areas, and persons requiring assistance. Since there are a large number of private aircraft in the State in addition to those owned by government, a comprehensive plan to utilize this resource effectively must be prepared.

1973-74 Progress

A list of county sheriffs and CAP aerial squadrons has been compiled by OES and is updated periodically.

OES has standing agreements with NASA and the California Wing, CAP, providing for aerial photographic and reconnaissance flights (Recommendation No. 2(i)). In order to insure speedy and effective utilization of these resources during emergency and postemergency periods, OES has prepared standard operating procedures.

OES has prepared a concept for an "Aerial and Ground Reconnaissance Plan" in outline form. The California Division of Aeronautics (CDA) has formed an Aviation Action Committee to implement action under this recommendation.

Future Action

OES will develop the Ground Reconnaissance Plan and CDA will develop the Aerial Reconnaissance Plan. Both agencies will report annually to the SSC.

(b) HEAVY RESCUE

A heavy rescue capability should be expanded statewide, to insure that people entrapped in structures severely damaged during an earthquake or other disaster can be rescued in time to save their lives.

Considerable structural damage and destruction to highways, waterways, transportation, and other public and private facilities will result from the effects of a major earthquake.

Knowledgeable techniques and rapid employment of heavy rescue will save lives of many people entrapped in such damaged structures. The combined effort and resources of government and industry must be brought to bear to develop an emergency capability to perform heavy rescue operations.

1973-74 Progress

The Heavy Rescue Subcommittee, organized in response to this recommendation, submitted its final report to the GEC on January 14, 1974. The Subcommittee makes many observations and recommendations relative to heavy rescue operations under the categories of responsibility and authority, heavy rescue requirements, organization, resources inventory, agreements, and training and funding.

Future Action

OES will actively pursue the recommendation of the Heavy Rescue Subcommittee and will report annually to the SSC.

(c) FIRE SERVICE CAPABILITY

A task force should be created to investigate the capabilities of local, state, and federal fire service to discharge their responsibilities when burdened by the disruption of supporting water and communications systems in the aftermath of an earthquake or other disaster.

Earthquakes in developed areas, particularly urban and industrial developments, are invariably followed by disastrous fires. The suppression of fires started as a secondary effect of earthquakes is made more difficult because of the destruction of water lines and fire reporting systems.

1973-74 Progress

The Subcommittee on Earthquake Resulting Fires, established pursuant to this recommendation, submitted its final report on February 5, 1974. The Subcommittee determined that California fire services possess the capability, basic manpower, and equipment to deal with most disaster situations. However, the subcommittee concluded that disruption of water and communication systems could present great problems and that many local jurisdictions are not fully aware of the impact a major earthquake could have on their services. The report lists several observations and recommendations of the Subcommittee.

Future Action

OES, in conjunction with responsibilities under other recommendations, will apprise local jurisdictions of probable impact of major earthquakes on needed services.

The SSC will evaluate the recommendations of the subcommittee and initiate necessary additional action not already implemented.

RECOMMENDATION NO. 17
FROM THE 1972 REPORT

EMERGENCY MEDICAL PROGRAM

(a) PLANS

Coordinated state and area emergency/disaster mutual aid medical plans should be established, and provisions made to update and test them annually.

The mass casualty potential of earthquakes and the susceptibility of medical facilities to earthquake damage are well recognized. Not all hospitals, medical groups, and volunteer organizations have developed emergency plans for their facilities and the area in which they serve. The vast resource of governmental and private medical facilities cannot be effectively utilized to care for large numbers of casualties after a major disaster without first developing and testing their emergency plans in coordination with other organizations within the same and adjacent areas. It is therefore necessary that operational mutural aid plans be well coordinated in advance so that all resources can be efficiently employed during an emergency.

1973-74 Progress

The State Department of Health (DOH) and OES formed an Emergency Medical Advisory Committee (EMAC) composed of representatives from DOH, OES, local civil preparedness organizations, California Medical Association, California Hospital Association, California Ambulance Association, public safety agencies, the communications and transportation industries, and the American National Red Cross (ANRC). EMAC published Emergency Medical Planning Standards on March 29, 1973. DOH prepared a draft of an Emergency Medical Mutual Aid Plan which was presented to EMAC on June 14, 1973. The committee suggested several modifications, which were implemented. The plan has since been approved by EMAC and the Emergency Council.

Future Action

The Emergency Medical Mutual Aid Plan will be printed and distributed as an extension of State Emergency Plan during 1974.

(b) COMMUNICATIONS

All hospitals with emergency medical facilities should be required to develop coordinated emergency medical communications systems.

An Emergency Medical Communications System between medical facilities and public safety agencies and other governmental

emergency organizations within a community could facilitate maximum coordination and insure effective utilization of facilities during an emergency. The System should be designed to provide control and minimize time required to move injured persons from the disaster scene to a medical facility in which they can receive prompt medical attention. Without such a system, facilities located nearest to a disaster scene could be drastically overloaded, creating long delays in treatment of patients.

1973-74 Progress

OES has convened a committee for the specific purpose of preparing guidelines and establishing goals for the development of a statewide Emergency Medical Communications Plan, which will establish criteria requiring compliance by local jurisdictions seeking state support while applying for federal funds.

Assembly Bill No. 515 establishes 1982 as the year when California must have the emergency telephone number "911" in service statewide. The State Department of General Services (DGS) has completed and distributed guidelines for "911" implementation, and many jurisdictions have established "911" committees to study problems associated with local implementation.

Future Action

The OES Emergency Telecommunications Advisory Committee, augmented by representatives from various medical related associations and state agencies, will develop an Emergency Medical Communications System for the State

OES will report annually to the SSC.

RECOMMENDATION NO. 18
FROM THE 1972 REPORT

DISASTER COMMUNICATIONS

(a) EMERGENCY OPERATIONS SYSTEM

There should be established additional radio communications systems which can be dedicated to exchanging emergency traffic between local governments and appropriate state agencies.

Experience has shown that commercial and private wire line communications facilities are prone to damage by earthquake, and their damage or destruction sharply reduces the effectiveness of emergency response. Communications in disaster situations are vital to the conduct of efficient operations. It is recognized that public safety agencies will require their respective tactical radio systems full time to support their own activities. Therefore, disaster-oriented information flow, necessary to support the coordination of disaster recovery operations and resource management during widespread emergencies, cannot depend on individual service networks.

1973-74 Progress

The Office of Criminal Justice Planning (OCJP) is funding the development of a statewide Law Enforcement Emergency Radio System. Initial equipment purchases are now in progress with a three-year total projected schedule.

Future Action

The project is scheduled to be in full operation by July 1976.

OES will report on the development of the Law Enforcement Emergency Radio System to the SSC by July 1, 1975.

(b) RADIO AMATEUR CIVIL EMERGENCY SERVICE

The Radio Amateur Civil Emergency Service (RACES) program should be given a high priority and expanded to support and augment existing state and local government communications systems.

Intragovernmental communications are generally adequate at each jurisdictional level. However, radio communication between local jurisdictions or from local government to the State is very limited. RACES is recognized and established for the purpose of augmenting existing communications systems during emergencies and can establish this missing interjurisdictional link.

1973-74 Progress

Federal Communications Commission (FCC) Docket 19723 solicits nationwide comments concerning RACES. Comments received so far have been more favorable than the FCC had contemplated and, in general, urge the FCC to lift restrictions on the emergency use of RACES.

Communications coordinators have been placed in OES regional offices with responsibility to assist local emergency service directors in recruitment and training of RACES operators for emergency functions.

Future Action

OES will continue its work in improving the capability of the RACES program by working with local officials and will report annually to the SSC.

(c) PUBLIC COMMUNICATIONS SERVICE

Official recognition and maximum use should be made of qualified amateur radio operation resources of existing amateur radio networks to provide supplemental communications for the health and well-being of the general public during emergencies.

1973-74 Progress

A plan providing the basis for the development of a coordinated program using non-RACES amateur radio groups to aid in the dissemination of health and welfare messages during disaster operations has been developed.

Before proceeding further with the plan, OES is evaluating the growth of RACES groups which may negate the need for additional groups other than RACES. An advantage of using RACES personnel is that they work closely with emergency organizations in their areas and are familiar with the emergency programs. Also, they train as a unit in moving messages and can be depended upon to respond immediately.

Future Action

The evaluation of the growth of RACES groups will set the stage for future coordination with other amateur radio networks. OES will determine the need for using additional amateur radio groups and report to the SSC.

AMATEUR RADIO STATION W6FRE EQUIPPED FOR EMERGENCY COMMUNICATION
(Recommendation No. 18)

Radio amateurs demonstrated their effectiveness during the 1971 San Fernando earthquake and during other past emergencies. Amateurs stand ready to operate fixed, mobile, and portable radio stations. OES will continue to improve coordination between the radio amateurs and governmental agencies. (Photo courtesy DWR)

RECOMMENDATION NO. 19
FROM THE 1972 REPORT

EDUCATION AND INFORMATION

Develop and implement a comprehensive emergency information and education program to provide the public with instructions that will enable them to prepare for and safely respond to the effects of an earthquake or other disaster.

Experience has shown that the public generally does not know what to do before, during, or after an earthquake. Government has a responsibility to provide, through the news media and other educational services, advice and information to the public on how to prepare themselves to meet this contingency and how to recover after the earthquake has occurred.

1973-74 Progress

OES convened a Task Force on Emergency Information and Education to guide that office in carrying out its responsibilities under this recommendation. The task force, which was composed of representatives from state, federal, and local emergency organizations, ANRC, radio and television stations, and state information officials, submitted its final report in June 1974.

OES has a continuing program whereby spot announcements on earthquake safety procedures are distributed to radio and television stations. Media, especially in the most earthquake-prone areas, have been generous in the time they have spent disseminating this type of information.

The State Department of Education currently has a fully federally-funded Disaster Preparedness Education Unit working in its Health and Safety Section. They prepare materials and conduct seminars for teachers to enable them to better teach disaster preparedness.

Future Action

Under the guidelines and recommendations made by the Task Force on Emergency Information, OES will further develop and implement a plan for dissemination of emergency public information in a major disaster. OES will report annually to the SSC.

RECOMMENDATION NO. 20
FROM THE 1972 REPORT

GOVERNMENT, BUSINESS AND INDUSTRY DISASTER SAFETY PROGRAM

A task force of government, business, and industrial interests should be created to develop a disaster safety program which will result in the preparation of internal emergency plans by pertinent organizations. Such plans should provide for the protection of employees, facilities, and equipment in an emergency. Particular emphasis should be placed on safety of individuals occupying high-rise structures.

During any kind of a disaster, facilities and personnel of government, business, and industry may be adversely affected--either economically or physically endangered. It is felt that in order for government, business, and industry to minimize the loss of property and insure the safety of their employees, they must have emergency plans and safety programs.

1973-74 Progress

The Government, Business, and Industry Task Force to the GIEC was formed in May 1973. The task force was divided into subcommittees representing Northern California and Southern California with direction to collect information and documents from public and private sources and to determine what material existed in the respective sectors of business and industry. The final report of the task force will cover pre-earthquake planning, immediate postearthquake actions and plans, and plans for dissemination of the program. It was determined that each level of government and industry should have a disaster control program to address potential earthquake damage and provide guidance for employees.

Future Action

OES will provide guidance to local governments so they can review and assist local business, industry, and their own agency organizations to prepare and test contingency plans.

The SSC will review the recommendations of the task force and take steps to initiate those not already implemented.

THE HAYWARD FAULT ZONE EAST OF SAN FRANCISCO BAY
(Recommendation No. 21)

Surface rupturing occurred along part of this fault during the temblor of October 21, 1968 which was prior to the land development shown in this photo. Housing projects and schools now lie within the zone where severe ground disruption may occur during future earthquakes. Plant nurseries, undeveloped open spaces, cemeteries, drive-in-theaters, golf courses, riding stables, and other recreational facilities are most compatible with the hazards posed by this and several other active earthquake faults in California. (Photo courtesy USGS)

RECOMMENDATION NO. 21
FROM THE 1972 REPORT

LAND USE PLANNING

(a) SEISMIC SAFETY ELEMENT

The State and Federal Governments should provide incentives and technical guidance to regional, county, and city governments for the preparation of seismic safety elements and action programs to implement the elements.

Government Code Section 65302(f) requires a seismic safety element of all city and county general plans. These code provisions are discussed under Recommendation No. 6(b), Earthquake Hazards Criteria.

Some local governments, particularly the smaller ones, lack the technical expertise required for preparation and comprehension of seismic safety elements. The needed guidance can be provided most effectively at the state and federal levels or by contract with private consulting firms.

1973-74 Progress

In September 1973, CIR issued General Plan Guidelines which provide assistance to local governments with preparation of plans including seismic safety elements.

An active role has been taken by CDMG in providing technical assistance to some local governments in the form of cooperative studies associated with the recognition, mapping and evaluation of geologic/seismic hazards. These various studies have developed basic geologic data and maps related to earthquakes, faults, and all other known geologic hazards.

CDMG, DWR, CALTRANS, and the State Office of Planning and Research (OPR) have been developing data for use by state agencies, local government, and the private sector. CDMG's contribution to these data include a state geologic map showing all known active and potentially active faults, a catalog of California earthquakes, guidelines for geologic/seismic studies, and the placement of strong-motion instruments and the collection of data from these instruments.

Legislation has been recommended, some introduced and some enacted into law, regarding seismic safety. Some of the legislation that has been enacted includes SB 519 (1972), which

requires the submission and technical review of geologic/seismic reports for proposed hospitals; and SB 520 (1972), which requires the delineation of active faults and potentially active faults and the administration of the provisions of the act by local government.

Future Action

Federal and state agencies and some universities will continue to provide guidance to local governments with the preparation of seismic safety elements. Legislation providing for effective and efficient guidelines and regulations for local government is required.

(b) FUNDING PUBLIC IMPROVEMENTS

Federal and state agencies should consider the seismic aspect of all local plans in making and funding significant public improvements.

All federal and state agencies involved in significant public works projects have been asked to work closely with appropriate local agencies and to conform as a minimum with seismic safety elements of local general plans.

1973-74 Progress

The CIR General Plan Guidelines were published in September 1973, and an annual review of local plans called for under legislation which required the CIR to develop the guidelines will begin as of October 1974. Since OPR now serves this staff function, the sufficiency of seismic safety considerations in general plans will be made when OPR reviews local plans. Local governments must indicate the degree to which their plans are consistent with the CIR guidelines. CDMG also may have a review role with respect to safety and seismic safety elements.

With respect to federal and state agency projects, the State Clearinghouse distributes information on pending projects to those state agencies concerned with the seismic aspects of state and federal projects. This is being done through the use of environmental impact reports.

Future Action

OPR must evaluate the effectiveness of the review process that becomes effective in October 1974 and submit such recommendations for improvements to SSC as it feels to be appropriate.

(c) GEOLOGIC REPORTS

Local government should require a geologic report on all private and public projects that have significant land use considerations.

Most improvement projects require reports that include geological data. Subdivision reports are required for privately-initiated projects. The geological contents of these reports are all too often inadequate to ascertain geologic hazards, and they are frequently not reviewed by technically competent authority. Public regulations and guidelines specifying the contents of geologic reports should require reports to cite known hazards in the project area and recommend how these conditions should be avoided or mitigated. These reports should be prepared and reviewed by licensed geologists.

1973-74 Progress

CDMG circulated proposed pertinent legislation to concerned private and public organizations in early 1973. Subsequently, Senator Albert Rodda introduced SB 158 which also applied to this subject. These attempts by way of legislation and administrative policies to implement this recommendation were unsuccessful.

Future Action

CDMG will arrange informal meetings between the various parties and attempt to arrive at a feasible resolution and an agreeable means of implementing this recommendation.

RECOMMENDATION NO. 22
FROM THE 1972 REPORT

TASK FORCE FOR RESEARCH ON EARTHQUAKE HAZARDS ABATEMENT IN STRUCTURES AND FACILITIES

The Governor should authorize the Chairman of the GEC to designate a select task force to conduct research upon which to base recommendations to the Governor relative to major changes and improvements in structural and facility construction, reduction of existing earthquake hazards in buildings and facilities, programs to assist local government in improving and implementing local code provisions, developing methodology to encourage private ownership to take voluntary corrective measures where earthquake hazards exist, identifying those areas of construction not presently covered by existing regulations, and recommending those areas of abatement of earthquake hazards in buildings and facilities requiring new legislation.

The Preparedness and Response Committee of the GEC had established, prior to publication of the First Report of the GEC, a subcommittee on Earthquake Hazard Reduction in Structures. The Chairman of GEC designated that subcommittee to serve as the task force proposed by this recommendation.

1973-74 Progress

The task force, consisting of representatives from a broad spectrum of earthquake-related interests, met on four occasions to consider an effective course of action. The following resolution and recommendations were submitted by the task force as the outcome of these deliberations:

1. WHEREAS, the Governor's Earthquake Council has determined that there exists real and serious risks to human life in the continuing use of existing earthquake hazardous buildings and other facilities, and

2. WHEREAS, the costs to abate such hazards in whole or in part have not been determined in a comprehensive manner, and

3. WHEREAS, without such information the public and its representatives cannot arrive at a rational conclusion to a program for the abatement of the earthquake hazards posed by existing buildings and other facilities, now,

   THEREFORE, BE IT RESOLVED that the Governor's Earthquake Council recommend a cost benefit study of hazardous buildings under the direction of the Task Force Subcommittee for Earthquake Hazard Reduction in Structures

and report back to said Task Force so that reasonable and rational recommendations may be made to the Governor's Earthquake Council;

BE IT FURTHER RESOLVED that the Governor's Earthquake Council obtain adequate funds to properly implement this study.

It was also moved and seconded that the following recommendation be adopted as a recommendation of this Task Force:

"The Governor should provide in the 1973-74 state budget and the Legislature should appropriate $60,000 for the Office of Architecture and Construction (OAC) to perform or to contract for the performance of research into the abilities of nonstructural elements of buildings to deflect without damage under the action of horizontal forces imposed by earthquake or high winds."

Future Action

Action on the recommendation for a cost-benefit study has been deferred awaiting the outcome of related investigations being conducted for HUD by the USGS. The USGS program was originally devoted to study of the effects of a large California earthquake on single-family dwellings over a 100-year period. The original work is relevant to Recommendation No. 12; however, the techniques developed are now being refined and extended to be applicable to other structures. Results are expected to become available in about one year, after which the task force recommendation should be reevaluated.

No source of funds has been identified for the research recommended to be performed by OAC.

RECOMMENDATION NO. 23
FROM THE 1972 REPORT

STATE REGULATION CONFORMANCE COMMITTEE

Establish a special committee within the state interagency coordinating body from all agencies concerned with earthquake hazards in structures and facilities.

Laws, rules, regulations, ordinances, and enforcement procedures have been adopted by various agencies at every level of government to provide earthquake safety. This fragmentation of action without coordination has resulted in some variations in building design standards and wide variations in enforcement standards. Inasmuch as the ultimate goal of all such standards should be the protection of life and property of the people of California, wide variations in standards should not be tolerated.

Most jurisdictions adopt building standards for earthquake design which have been published in the Uniform Building Code. SEAOC continues to be very active in developing such standards, and gradually its recommendations are being included in the Code. Similarly, the Office of the State Fire Marshal and the various fire services have been active in developing fire safety and egress standards which are also being included in the Code.

State agencies, pursuant to recently enacted legislation, are developing building standards applicable to hospitals. Legislation has been introduced to extend such action to fire stations, police stations, emergency communication centers, and other emergency facilities. However, there still is a serious lack of adequate enforcement standards in some jurisdictions due to the low priority given to enforcement budgets by the governing bodies. Only a recognition of the need for improved enforcement standards at local levels, or action by the State Legislature, will correct this situation.

1973-74 Progress

A State Regulation Conformance Committee (SRCC) has been established comprising representatives from the following agencies:

Department of Water Resources
Division of Mines and Geology
Department of Housing and Community Development
Department of Health
Office of State Fire Marshal
Office of Emergency Services
Department of Industrial Relations
Department of General Services
Department of Transportation
Department of Finance

The Committee was assigned responsibility for implementing Recommendation No. 23.

The SRCC feels that the variations between building standards can be eliminated or brought within acceptable requirements through legislation and the continued progress of groups involved.

Future Action

1. The SRCC has submitted several recommendations which should be reviewed by the SSC. Those adopted will be implemented.

2. The SRCC must continue to function as:

   (a) An advisory board to the SSC relative to reducing earthquake hazards in buildings and structures;

   (b) A forum for discussion of existing programs, policies and regulations by agencies with mutual interests; and

   (c) An advisory body to the SSC with respect to legislation affecting earthquake safety.

RECOMMENDATION NO. 24
FROM THE 1972 REPORT

EARTHQUAKE INSURANCE

(a) LONG-TERM REHABILITATION

Insurance to cover the cost of long-term property rehabilitation should be provided through private insurance companies as preferable to the present system of grants and loans.

Disaster insurance in the context of this recommendation covers, in addition to earthquakes, volcanic eruption, flood, wave wash, tsunami, and mudslides caused by heavy rain runoff--but not the consequences of slides in areas where ground is made unstable by cut or fill techniques.

Implementation procedures for this recommendation call for studies to insure the financial capacity of the private insurance industry to respond to a major earthquake and for assured availability of additional financial capacity from the Federal Government if such should prove necessary. After this has been accomplished, it was contemplated that legislation should mandate disaster coverage into the standard fire policy for one- to four-family residential properties.

1973-74 Progress

The Insurance Commissioner proposed to the Chairman of GEC, by report dated March 1, 1973, that legislative mandate be preceded by a requirement that each federal instrumentality responsible for the supervision, approval, regulation, or insuring of banks, savings and loan associations, or similar institutions shall by regulation direct such institutions not to make, increase, extend, or renew any loans secured by improved real estate (covering a one- to four-family dwelling) or a mobile home located, or to be located, in an area of high earthquake or flood hazard as respects earthquake or flood unless the building or mobile home securing such loan is covered by flood insurance or by earthquake insurance. It was further proposed that this lending requirement be in effect for five years preceding the effective time of legislation mandating disaster coverage into the fire policy. Additionally, the primary recommendation stated that the California FAIR* Plan Association should expand its eligibility to include disaster insurance on one- to four-family residences.

*Fair Access to Insurance Requirements

The National Flood Insurance Act of 1973 passed the Congress and was signed into law by the President. This Act essentially accomplished that portion of the recommendation which contemplated lending institutions requiring flood insurance as a precedent to the granting of a loan. Federally insured lending institutions are presently required by regulations promulgated under the authority of the 1973 Act to require flood insurance on new loans made or extensions of loans when the property securing the loan is located in an area of high flood hazard. Flood insurance is available through the National Flood Insurance Association. This is an association of private insurance companies and the Federal Government.

Federal lending institutions' regulatory authorities have been approached to determine whether or not they would impose a similar requirement for earthquake insurance as has been imposed for flood insurance. The response has been equivocal, but we believe that these authorities will not impose such a requirement without a legislative mandate from the Congress. Accordingly, the California Department of Insurance through the National Association of Insurance Commissioners is exploring this avenue with the administration in Washington. Coincident with this exploration is the conduct of detailed studies by the California Department of Insurance and a special task force working with the National Committee on Property Insurance (a private insurer organization) and the Availability of Essential Insurance Subcommittee of the National Association of Insurance Commissioners. This study is aimed at determining the full range of financial consequences on the public and on the insurance industry that might result from the widespread carrying of earthquake insurance in California. One of the essential objectives of the studies is to determine what, if any, federal financial participation might be necessary in a program of widespread carrying of earthquake insurance.

Future Action

That part of Recommendation No. 24 which relates to flood and mudslide insurance has been largely accomplished. One interim and one final step remain. Provision must be made so that this coverage can be added to the policyholder's normal fire or homeowner's policy rather than having to procure the policy through separate channels from the National Flood Insurance Association. This program is currently being pursued by the National Flood Insurance Association, and it is contemplated that it can be accomplished as soon as administrative problems are worked out.

Substantial progress in the studies presently being conducted with the Special Earthquake Task Force is envisioned.

A definitive position should be taken with regard to the feasibility and desirability of proceeding with legislation directing federal lending regulatory authority to adopt regulations calling for the carrying of earthquake insurance by October 1, 1974. Assuming an affirmative result, legislation will then be pursued directly with the administration.

(b) REQUIRED AVAILABILITY

Until Recommendation 24(a) can be implemented, the insurance industry should be encouraged to advise fire and homeowner policy holders of insurance provisions relating to disaster coverage.

There is a need for greater awareness among the general public and in some facets of the insurance industry on the terms and availability of disaster insurance in the present insurance market place. Because of the misunderstandings and lack of public knowledge about disaster insurance, and the fact that most segments of the insurance industry are unwilling to actively solicit disaster coverage, many property owners are either not aware of the availability of coverage or, from misinformation, are discouraged from carrying it.

1973-74 Progress

Earthquake insurance has been added to the lines of insurance available through the California FAIR Plan on one- to four-family residences for properties which are otherwise eligible for the FAIR Plan (located in an eligible urban or brush area). The California Department of Insurance has bulletined all insurers to request that they inform their policyholders and agents of the availability and desirability of carrying disaster insurance. In response to this request the Insurance Information Institute has distributed nearly 2,000,000 pamphlets containing this information to the insurance industry. Most of these pamphlets have been passed along to the public at the time of annual policy billings and renewals.

Future Action

The Department of Insurance will continue an information program to advise policyholders and agents of the availability, cost, and desirability of existing disaster coverage.

RECOMMENDATION NO. 25
FROM THE 1972 REPORT

TERM OF THE GOVERNOR'S EARTHQUAKE COUNCIL

The Governor's Earthquake Council, and its working committees as needed, should continue in existence through June 30, 1974.

In accordance with the term originally established, the GEC was to be discontinued June 30, 1974. However, the GEC continues to function and is preparing and publishing this second report. The GEC will continue to monitor progress on the 26 recommendations of the first report until the SSC is organized and functioning.

RECOMMENDATION NO. 26
FROM THE 1972 REPORT

CONSIDERATION OF A SUCCESSOR BODY

The Governor's Earthquake Council and the Legislature's Joint Committee on Seismic Safety should jointly explore the advisability of the establishment of a single successor body.

The mutual objectives of the GEC and the JCSS have not been fully achieved. In his letter of November 24, 1972, transmitting the First Report of the Governor's Earthquake Council to the Governor, the Chairman of the GEC suggested "that the Council be kept in existence until either the bulk of this work is completed or a successor body is established". The Council is consequently continuing its efforts in the interim.

1973-74 Progress

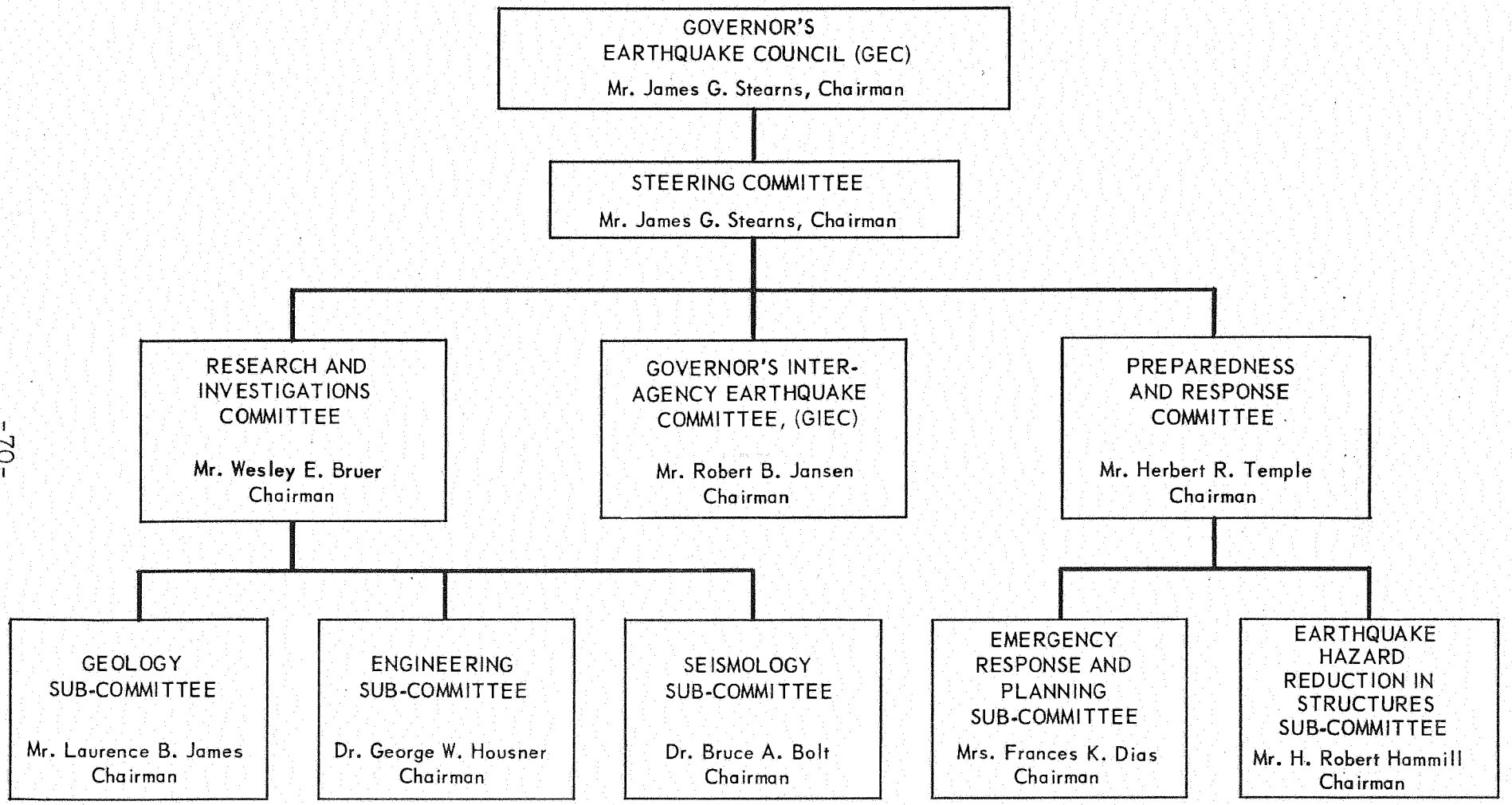
In accordance with the recommendation made in the First Report, a meeting of selected representatives from the GEC and JCSS was convened by the Chairman of GEC, at which time the establishment of a single successor body was considered. Following this discussion, legislation was drafted (Senate Bill No. 1729), and subsequently signed into law, creating a Seismic Safety Commission (SSC) with broad earthquake-related responsibilities. The legislation establishes the new Commission as the successor body to both the GEC and the JCSS.

Future Action

The GIEC will keep informed on the status of the activities initiated by the GEC and will maintain files available to the SSC.

APPENDIX

ORGANIZATION CHART



The Research and Investigations and Preparedness and Response Committees of the GEC functioned in the early stages of the Council's activities. The Governor's Interagency Earthquake Committee (GIEC) was created in response to Recommendation No. 1 of the First Report of the GEC and has since undertaken coordination of the efforts to implement the remaining 25 recommendations set forth in that report.

GOVERNOR'S EARTHQUAKE COUNCIL
MEMBERSHIP

CHAIRMAN	Mr. James G. Stearns Secretary of Agriculture and Services
VICE-CHAIRMAN	Mr. Herbert R. Temple, Jr. Director, OES (Resigned 6/30/74)
SECRETARY	Mr. Robert B. Jansen Deputy Director, DWR Replaced Mr. Wesley G. Bruer State Geologist, CDMG (Resigned 10/73)

Representative	Alternate
STATE AGENCIES	
Mr. John C. Worsley State Architect, OAC Replaced Mr. Fred Hummel, 3/1/73	Mr. William R. Vick Deputy State Architect, OAC
Mr. Art Dreyer, HCD	Mr. Cal Jepsen, HCD
Mr. Gleeson L. Payne Insurance Commissioner Replaced Mr. Richards D. Barger, 11/1/72	Mr. Lawrence C. Baker, Jr. Chief Deputy Insurance Commissioner
Mr. Fred Silva, CIR Replaced Mrs. Carol Walker, CIR, 6/73	(No alternate)
Dr. Clarence R. Allen, JCSS	Mr. Rodney J. Diridon, JCSS
Mr. Karl V. Steinbrugge State Mining and Geology Board	Dr. Clarence R. Allen State Mining and Geology Board
Mr. John B. Passerello, OPR	Mr. John S. Tooker, Director OPR
Mr. Robert J. Datel, CALTRANS	Mr. Robert Cassano, CALTRANS Replaced Mr. Arthur L. Elliott, CALTRANS, 10/73
Mr. Raymond M. Dabler Assistant Commissioner, DRE Replaced Mr. Thomas J. Nolan (Resigned 1/73)	Mr. Richard D. Carlson Chief Deputy Commissioner, DRE

GEC MEMBERSHIP (Continued)

Representative	Alternate
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Dr. Roy E. Hanson Earth Science Section, NSF	Dr. Charles C. Thiel RANN Program, NSF
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Mrs. Frances K. Dias Regional Director, DCPA	Mr. Allen E. Wilmore, DCPA
Mr. G. Richard Schermerhorn Region IX, HUD	Mr. Dale James, HUD
Dr. Gerald P. Eaton, Chief Office of Earthquake Research, USGS	Dr. Robert E. Wallace Assistant Chief Geologist, USGS

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Dr. Willard F. Libby, UCLA	Dr. Leon Knopoff, UCLA
Dr. James N. Brune, UCSD	Dr. J. Freeman Gilbert, UCSD Dr. Richard A. Haubrich, UCSD
Dr. George W. Housner, CIT	Dr. Clarence R. Allen, CIT
Dr. Frank R. Bowerman, USC	Dr. Orville L. Bandy, USC (deceased 8/2/73)
Dr. Richard H. Jahns Stanford University	Dr. Robert L. Kovach Stanford University

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Mr. Daniel D. Mikesell, San Bernardino County Supervisors Association of California	Mr. Edward E. Bernard, St. Helena County Supervisors Association of California

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Mr. Art Arthur, Rubidoux, California

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Melville Owen	Public

Recorders: Tom M. Wootton, California Division of Mines and Geology

Thomas E. Gay, Jr., California Division of Mines and Geology

*Wesley G. Bruer was Secretary until his resignation from State service in October 1973.

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Bill Holliman, League of California Cities
Robert James, City Administrator, City of San Fernando
Drew Lawrence, Industrial Indemnity Company
Evelyn Maley, American National Red Cross
Jene McKnight, Los Angeles County Regional Planning Commission
Walt Meagher, Division Chief, Los Angeles County Fire Department
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*Participation by invitation of the Committee

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California Department of Water Resources

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Cities and Counties League of California Cities	Mr. Gene Block Mrs. Mary Henderson
County Supervisors Association	Mr. Jack Merelman

* Mr. Arthur Elliott represented Department of Transportation until his retirement from State Service in October 1973.

** Mr. Wesley G. Bruer represented the Department of Conservation until his resignation from State Service October 31, 1973.

*** Resigned from State Service June 15, 1974.

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2(e)	Funds for Schoolhouse Studies	
	Mr. Ralph Hilton	OES
2(f)	Coordination of Engineering Studies	
	Dr. D. F. Moran	EERI

*Resigned from state service, October 1973

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	Mr. Tom Gay	CDMG
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10b(1) Seismograph Networks Support UCB Network		
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10b(2) Seismograph Networks Support CIT Network		
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	Dr. Clarence R. Allen	CIT
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	Dr. J. B. Berger	UCSD
	Mr. Donald Steinwert	DWR
	Mr. William Cloud	UCB
	Dr. Alan Ryal	Univ. Nevada
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	Mr. J. Van Valkenberg resigned and replaced by	LA City School Rescue
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18	Communications	
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