FIRST REPORT OF THE

GOVERNOR'S

EARTHQUAKE COUNCIL

NOVEMBER 21, 1972

RONALD REAGAN, *GOVERNOR*
STATE OF CALIFORNIA

GOVERNOR'S EARTHQUAKE COUNCIL

ROOM 1341 RESOURCES BUILDING • 1416 NINTH STREET • SACRAMENTO 95814

November 24, 1972

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

Dear Governor Reagan:

It is my pleasure to transmit herewith the "First Report of the Governor's Earthquake Council" for your approval in whole or in part. The report contains 26 major recommendations which, if pursued to full implementation, can prevent the loss of thousands of lives and significantly reduce property damage in future California earthquakes.

Time is the essence of this report. The Council has conducted its work during these past nine months with the knowledge that damaging earthquakes will continue to occur in the State and that a great earthquake, such as the 1906 San Francisco event, may strike at any time. Those recommended earthquake hazard reduction measures which you approve should be implemented by your request and direction with all possible speed. The situation is analogous to preparing for the explosion of one or more gigantic hidden time-bombs; we're not sure when or where they will go off but we know that they're ticking.

Many of the recommendations in this report are for initial action that will lead to further recommendations for more specific measures. The Council is particularly suited to oversee, guide and coordinate these subsequent steps. I therefore respectfully suggest that the Council be kept in existence until either the bulk of this work is completed or a successor body is established.

A copy of the "California Universities Earthquake Hazards Proposal" is also being transmitted to you under separate cover. This is a joint proposal for additional earthquake engineering, seismological and geophysical research projects by seven public and private universities in California. The proposal was coordinated by Dr. Willard Libby.

Members of the Council and other individuals who assisted in the work of the Council have done an outstanding job in a short period of time; many have done so on their own time and at their own expense. All have worked with dedication and a sense of urgency befitting the task you have set for us.

Respectfully submitted,

James G. Stearns
Chairman

RONALD REAGAN, GOVERNOR
STATE OF CALIFORNIA

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INTRODUCTION

Recognizing the need for a coordinated approach to reduce future earthquake losses in California, Governor Ronald Reagan appointed the Governor's Earthquake Council in January, 1972. The following categories are represented on the Council: State agencies, Federal agencies, local government, universities, private organizations, and the public. A representative and, in most instances, an alternate were appointed from each entity represented on the Council (see Council Membership). James G. Stearns, the Director of the State Department of Conservation (now Secretary of Agriculture and Services) was appointed chairman; Herbert R. Temple, Jr., Director of the State Office of Emergency Services, was appointed vice-chairman; and State Geologist Wesley G. Bruer was appointed secretary.

An organizational meeting was held in the State Capitol on February 28, 1972. Governor Reagan charged the Council with the task of preparing recommendations of whatever kind for reducing losses in future earthquakes and pledged his full support to the efforts of the Council. Brief overviews of the earthquake-related programs and activities of organizations within each category were presented by representatives of each of those categories.

The Council was organized into 3 committees: the Steering Committee, composed of one member from each of the 6 categories represented on the Council plus the 3 officers, chaired by Mr. Stearns; the Preparedness and Response Committee, chaired by Mr. Temple; and the Research and Investigations Committee, chaired by Mr. Bruer. The Steering Committee met on March 13, 1972 to provide direction for the work of the other 2 committees. Those committees further divided into sub-committees (see Council Organization).

Recommendations contained in the President's Office of Science and Technology (OST) Report "Earthquake Hazard Reduction" (1970) were used as a basic starting point for the work of the committees. Other specific background sources included the "Report of the Los Angeles County Earthquake Commission" (1971), reports of the implementation task forces of that Commission (1972), "Earthquakes and Geologic Hazards in California; a Report to the Resources Agency, April 1967", and the several reports of the Joint Committee on Seismic Safety of the California Legislature. The tremendous volume of other earthquake-related literature provided a broad general source of information.

The most valuable contributions to the report came from the knowledge of the Council members themselves and from other dedicated individuals who contributed their special expertise to the work of the committees. The assistance of individuals other than Council members was provided by direct participation, by invitation, on the Research and Investigations Committee and its sub-committees; outside assistance was provided to the Preparedness and Response Committee by way of invited testimony at informal hearings. These invaluable contributions to the work of the Council are hereby gratefully acknowledged.

Most of the content of this report originated with the sub-commitees. Individual sub-committee reports were reviewed at meetings of their respective full committees and consolidated into the separate reports of the Preparedness and Response Committee and the Research and Investigations Committee. These reports were reviewed at several meetings of the Steering Committee and then further consolidated into a draft of this report of the full Council. The draft was then circulated for review and comment to all members of the Council and others who worked with the Council in its preparation. The resulting comments were evaluated and the report was modified to its present form.

Recommendations 1 through 14 are those developed primarily by the Research and Investigations Committee, 15 through 24 are primarily those of the Preparedness and Response Committee, and 25 and 26 originated in the Steering Committee. Staff assistance to the Council for such things as editing, rewriting, typing and reproducing reports, handling notices, minutes, travel claims, and other correspondence, and arranging meetings was provided by the California Division of Mines and Geology and the State Office of Emergency Services.

The Council is well aware of the outstanding work of the Legislature's Joint Committee on Seismic Safety (JCSS) and its Advisory Groups, which has been in progress for several years. Some overlap in membership between these organizations was consciously provided in the formation of the Council and its committees. Observers from one organization have also been invited to various meetings of the other to enhance coordination. The major thrust of the JCSS has been directed toward development of legislative proposals while that of the Council is toward administrative measures. Some duplication is inevitable and not entirely undesirable; however both organizations are endeavoring to keep such overlap to a minimum. An example of this is the absence of recommendations by the Council on tax incentives (or penalties) relative to earthquake hazard reduction measures undertaken (or not undertaken) by the private sector. The JCSS has devoted considerable effort to such considerations and the Council elected not to repeat that effort. It is also the desire of the Council that its recommendations for legislation of broad scope be worked out by, or in close cooperation with, the JCSS.

The principal weakness of past studies leading to recommendations for earthquake hazard reduction has been the lack of concerted follow-through for implementation of the recommendations. The greatest of recommendations is of little value if not carried out. The recommendations in this report each contain an implementation section in which, wherever feasible, the action required for at least the first step toward implementation is described, responsibility for the action is assigned, and a deadline for action is set. In many cases, follow-on recommendations will result from these actions. The main function of the Council during the remainder of its existence will be to work toward the implementation of those of its recommendations that are approved by the Governor. Because implementation in some categories promises to require appreciable time, the Council recommends that it be continued in existence for a period concurrent with the term of the JCSS which dissolves on June 30, 1974, and that the Council and JCSS jointly consider the need for and, if warranted, the nature of a single successor body to both organizations.

With respect to recommended research, the "California Universities Earthquake Hazards Proposal", in large degree, complements the report of the Council. The recommendations for State funding for the operation of seismographic networks is an outgrowth of the proposal. The State should strongly support funding of the remainder of the proposal by Federal agencies.

In addition to the preparation of this report, two other actions taken by the Council to date are worthy of note. In late April, the Council prepared and distributed a news release supporting Proposition 2, for earthquake-safe school bonds, which passed by a narrow margin in the June 6, 1972 election. Secondly, in response to a widely expressed need, the Council 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. The seismic safety element requirement was the result of legislation recommended by the JCSS and enacted and signed in 1971. The guidelines have been well received by local government.

Recent estimates of the effect of future great earthquakes in or near urban areas forecast many thousands of deaths. Most such deaths are preventable if appropriate measures are taken in time. Many of those measures are recommended in this report and others will be outlined in the forthcoming report of the JCSS. The Council strongly urges that the recommendations in this report be approved and that they then be implemented by all concerned as quickly as possible.

JAMES G. STEARNS
CHAIRMAN

Date: Nov 24, 1972

ABBREVIATIONS

AEC	U.S. Atomic Energy Commission
AEG	Association of Engineering Geologists
AIP	American Institute of Planners
AISI	American Iron and Steel Institute
ANRC	American National Red Cross
ARPA	Advanced Research Project Agency (U.S. Department of Defense)
ASCE	American Society of Civil Engineers
CCCJ	California Council on Criminal Justice
CDMG	California Division of Mines and Geology (in Department of Conservation)
CHP	California Highway Patrol
CIR	State Council on Intergovernmental Relations
CIT	California Institute of Technology
CSAC	County Supervisors Association of California
CSLL	California Savings and Loan League
DCPA	U.S. Defense Civil Preparedness Agency
DI	State Department of Insurance
DGS	State Department of General Services
DOT	U.S. Department of Transportation
DPH	State Department of Public Health
DPW	State Department of Public Works
DRE	State Department of Real Estate
DWR	State Department of Water Resources
EERI	Earthquake Engineering Research Institute
FAIR	Fair Access to Insurance Requirements
GEC	Governor's Earthquake Council
HCD	State Department of Housing and Community Development
HUD	U.S. Department of Housing and Urban Development
ICBO	International Council of Building Officials
JCSS	Joint Committee on Seismic Safety of the California Legislature
LCC	League of California Cities
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 (In DGS)
OEP	U.S. Office of Emergency Preparedness
OES	State Office of Emergency Services
OPR	State Office of Planning and Research
OST	President's Office of Science and Technology
PUC	State Public Utilities Commission
SEAOC	Structural Engineers Association of California
SLD	State Lands Division
UCB	University of California at Berkeley
UCEER	Universities Council for Earthquake Engineering Research
UCLA	University of California at Los Angeles
UCSD	University of California at San Diego
USBR	U.S. Bureau of Reclamation
USC	University of Southern California
USCE	U.S. Corps of Engineers
USGS	U.S. Geological Survey

S U M M A R Y

Rec. #	Pg.	Brief Description	Implementation Action	Organizations Involved	Lead (co-lead) Organizations	Action Deadlines
1	16	State Interagency Coordination	Administrative; form State coordinating body; report to GEC	State agencies, Universities, local government	GEC (Chairman)	01/31/73 02/15/73
2	16	Post-earthquake studies	(See below)	All	(See below)	(See below)
a	17	Select investigation team for out-of-State earthquakes; provide funds	(1) Select members	(1) All	(1) State Coord. body	(1) 02/28/73 04/30/73
			(2) Obtain authorization to expend emergency funds	(2) OES, Dept. of Finance, Governor's Office	(2) OES	(2) 03/01/73
b	17	Earthquake notification	Procedure development; report to GEC	UCB, CIT, NOAA, others	UCB (NOAA)	03/01/73
c	18	Clearinghouse for post-earthquake earth science investigations	Procedure development, notification and acknowledgement	CDMG, others	CDMG (USGS)	03/01/73
d	19	Clearinghouse for post-earthquake engineering investigations	Procedure development, notification and acknowledgement	EERI, others	EERI	03/01/73

Rec. #	Pg.	Brief Description	Implementation Action	Organizations Involved	Lead (co-lead) Organizations	Action Deadlines
e	20	Make funds available for OAC school studies	Obtain authorization in advance to expend emergency funds	OES, DGS, Dept. of Finance, Governor's Office	OES	03/01/73
f	20	Prior arrangements for coordination of post-earthquake engineering studies	Procedure development, funding arrangements; report to GEC	EERI, SEAOC, NOAA, ICBO, UCEER, NSF, OES, OEP, DPW, OAC, DWR, others	EERI	03/01/73
g	21	Socio-economic studies	Procedure development; report to GEC	OEP, OES, Universities, others	OEP (Federal-Regional Council) (OES)	03/01/73
h	22	Prepare to deploy instruments	Develop procedure, inventory instruments; report to GEC	NOAA, USGS, CDMG, UCB, CIT, OAC, SEAOC, DWR, USCE, USBR	(1) NOAA (CDMG) (2) EERI	03/01/73
i	23	Post-earthquake aerial photography	(1) Obtain authorization in advance to expend emergency funds (2) Maintain service agreements	(1) OES, Dept. of Finance, Governor's Office (2) OES, aerial photo organizations	OES	03/01/73
j	23	Access by investigators to damage areas	Procedure development; report to GEC	OES, local governments	OES	03/01/73
3	24	Earthquake resistance of public utility systems	Assess status and needs; report to GEC	PUC, EERI, LCC, CSAC, UCEER, DWR, DPW, OAC, Public Utilities, others	PUC	03/01/73

Rec. #	Pg.	Brief Description	Implementation Action	Organizations Involved	Lead (co-lead) Organizations	Action Deadlines
4	24	Safety of dams	(1) Assess status of safety of dams requirements under State and Federal jurisdictions; report to GEC	(1) DWR, others	(1) DWR	03/01/73
			(2) Report on status of contingency planning below dams	(2) OES, others	(2) OES	07/01/73
5	25	Accelerate preparation of earthquake geologic hazards maps	Augment State program with Federal funds	CDMG, USGS, NOAA NSF, others	CDMG	03/01/73
6	26	Dissemination of earthquake-related earth science information	(See below)	(See below)	(See below)	(See below)
a	26	State develop additional capacity	Broaden scope of current newsletter and publish quarterly; establish data storage and retrieval system; report to GEC	CDMG	CDMG	03/01/73
b	27	State develop hazard criteria for local government	Coordinated interagency development of criteria; report to GEC	CIR, OES, CDMG OAC, OPR, others	CIR	03/01/73

Rec. #	Pg.	Brief Description	Implementation Action	Organizations Involved	Lead (co-lead) Organizations	Action Deadlines
7	27	Augment research in earthquake engineering	(1) Coordination of State conducted or sponsored research; upgrade building codes	DGS, DPW, DWR	DGS	01/15/73 02/01/73
			(2) Determine ways and means to establish national testing laboratory; report to GEC	NFS, NOAA, NBS, HUD, UCB, CIT, EERI, SEAOC, UCEER, AISI, Universities, others	NSF	02/01/73
8	29	Prepare seismicity maps and catalogs	Coordinate efforts; report to GEC	CDMG, NOAA, USGS, Universities	CDMG (NOAA)	02/01/73
9	30	Research on faults, crustal strain and faulting	(see below)	(see below)	(see below)	(see below)
a	30	Increase research on faults and faulting	(1) Increase Federal funding for fault research	CDMG, NOAA, AEC, USGS, HUD, NSF, Universities, others	CDMG (USGS)	03/01/73
			(2) State agencies continue to support design-related geologic studies	DGS (OAC), DPW, DWR	DGS	03/01/73

Rec. #	Pg.	Brief Description	Implementation Action	Organizations Involved	Lead (co-lead) Organizations	Action Deadlines
9 a (cont)			(3) GEC support appropriate fault-zone legislation	GEC	GEC, Steering Committee	December, 1972
			(4) State encourage local governments to maintain files on engineering geology studies	CDMG, local governments	CDMG	03/01/73
b	31	Continue crustal strain measurements at a high level	(1) Maintain present cooperative effort on geodimeter net	USGS, CDMG	CDMG (USGS)	03/01/73
			(2) Increase frequency of measurements in selected areas	NOAA, CDMG, USGS	CDMG (USGS, NOAA)	03/01/73
			(3) Consider precise leveling	NOAA, CDMG	CDMG (NOAA)	03/01/73
			(4) Maintain funding of long base laser strain meter program	NOAA, USGA, UCSD	UCSD (NOAA, USGS)	03/01/73
10	32	Seismograph networks and basic research in seismology	(See below)	(See below)	(See below)	(See below)
a	32	Strengthen basic research programs in seismology	Recommend appropriate funding of non-duplicative parts of the joint California universities earthquake hazard proposal; identify overlapping proposals and report to GEC	Universities, USGS, NOAA, NSF, ARPA, CDMG	USGS (CDMG)	03/01/73

Rec. #	Pg.	Brief Description	Implementation Action	Organizations Involved	Lead (co-lead) Organizations	Action Deadlines
10 b	33	Support and selectively expand and modernize seismographic networks in California	(1) Specifically fund UCB seismographic network to adequately support the expanded network (as proposed), in UCB appropriation	UCB, Dept. of Finance, Legislature	UCB	03/01/73
			(2) State funding agency contracts, to support half of operating cost of CIT seismographic network; augment State agencies, budgets if necessary; adjust funding to cover added operating cost if network expanded	CIT, OES, CDMG, DWR, DPW, DGS, Dept. of Finance, Legislature	OES	03/01/73
			(3) Coordinate exchange, processing and integration of data from seismographic networks in California	UCB, CIT, DWR NOAA, USC, CDMG SLD, USGS, USC, others	UCB (NOAA)	03/01/73
11	35	Fundamental research on the mechanism of crustal failure	Evaluate adequacy of ongoing research; report to GEC	NSF, USGS, NOAA, ARPA, CDMG, Universities	NSF (UCB)	03/01/73
12	35	Make cost-benefit studies of earthquake countermeasures and earthquake losses	NOAA conduct or sponsor studies; report progress to GEC	NOAA	NOAA	03/01/73

Rec. #	Pg.	Brief Description	Implementation Action	Organizations Involved	Lead (co-lead) Organization	Action Deadlines
13	36	Organizations sponsor or support and personnel attend courses and seminars on new developments	Organizations budget funds for support of, and attendance at, continuing educational activities	ALL	----	----
14	37	Determine optimum procedure for issuing earthquake warnings	Determine status of studies; report to GEC	OEP, OES, DCPA, LCC, CSAC, USGS, NOAA, CDMG	OEP (OES)	02/01/73
15	38	Emergency Response Plans	(See Below)	(See Below)	(See Below)	(See Below)
a	38	Mandate local disaster plans	Draft legislation to amend Emergency Services Act; amend Act; OES provide local assistance, obtain funds, and coordinate planning effort	OES Legislature Legislative Counsel Local governments	OES	12/31/72 03/01/73
b	38	Develop evacuation plans and procedures	Require inclusion of evacuation element in disaster plans	OES CHP Local governments	OES	03/01/73 06/30/73
c	39	Coordination of all disaster plans	Ensure State and Federal plans are compatible with local plans	OES, DCPA, OEP, Public Health, Education, and private sector	OES	06/30/73

Rec. #	Pg.	Brief Description	Implementation Action	Organizations Involved	Lead (co-lead) Organizations	Action Deadlines
d	39	Update and modify State Emergency Resources Management Plan	Update and modify to make applicable to peacetime emergencies. Inventory critical resources	OES, OPR	OES	12/31/73
16	40	Emergency Operations	(See Below)	(See Below)	(See Below)	(See Below)
a	40	Provide aerial and ground reconnaissance of disaster areas	Develop State and local plans and procedures for procurement and conduct of aerial and ground reconnaissance in a disaster	OES, CAP, NASA, Aeronautics, Sheriffs, Military, News Media	OES	08/01/73 12/31/73
b	41	Expand heavy rescue capability statewide	Determine requirement; inventory resources; develop plans, provide training; arrange for immediate activation of rescue operations post-disaster	OES, DCPA, private industry, local government	OES	03/01/73 06/01/73 06/30/73 09/01/73
c	42	Appoint task force to assess fire service capability	Conduct a study to determine reduction of fire service capability due to disaster effects	Governor, OES, Task Force, others	Task Force	04/01/73 12/31/73

Rec. #	Pg.	Brief Description	Implementation Action	Organizations Involved	Lead (co-lead) Organization	Action Deadlines
17	42	Emergency medical program	(See Below)	(See Below)	(See Below)	(See Below)
a	42	Plans	Develop a State Medical Mutual Aid Plan with provisions to update and test	Public Health, OES, private medical groups	Public Health	06/30/73 10/01/73
b	43	Communications	Require emergency medical facilities to have a coordinated medical communications system	OES, Legislature, Legislative Counsel, Telecommunications Committee, Public Health	Public Health	04/01/73 06/31/73 09/01/73 12/31/73
18	44	Disaster communications	(See Below)	(See Below)	(See Below)	(See Below)
a	44	Establish emergency radio communications systems between local governments and State agencies	Plan and develop additional disaster radio communications systems to support emergency operations	OES, local governments, Legislature, CCCJ, Cabinet	OES	12/31/72 06/30/73
b	45	Radio Amateur Civil Emergency Service (RACES)	Give higher priority and funding to RACES program	OES, Legislature, local governments	OES	06/30/73
c	45	Public communications service	Make maximum use of amateur radio for traffic concerning health and well-being of disaster victims	OES, ANRC, local governments, Radio Amateur chapters	OES	06/30/73 12/31/73

Rec. #	Pg.	Brief Description	Implementation Action	Organizations Involved	Lead (co-lead) Organization	Action Deadlines
19	46	Public education and information	Develop statewide emergency public education information program; develop and initiate mandatory disaster training in schools; obtain public service time and space from media	OES, Education, broadcast, news, and entertainment media	OES (Supt. of Public Instruction)	08/01/73 09/01/73
20	47	Government, business and industry disaster safety program	Appoint task force to develop a disaster safety program. OES provide plan guidance. Organizations prepare and implement plans.	Governor, OES, task force, local government, private sector	OES	04/01/73 06/30/73 10/01/73 12/31/73
21	48	Land use planning	(See Below)	(See Below)	(See Below)	(See Below)
a	48	Provide incentives and technical guidance for preparation of seismic safety element	CIR propose legislation designating CIR as the certifying agency	CIR, Legislature, local government	CIR	03/01/73
b	49	Funding public improvements	Federal and State agencies to consider local seismic aspects in public improvement projects	CIR, Federal, State, and local agencies	CIR	06/30/73
c	49	Require geologic reports on private and public projects that have significant land use considerations	Dept. of Conservation to propose legislation in 1973 to make geologic reports mandatory on certain projects	Dept. of Conservation, Legislature, State Geologist, cities and counties, private sector	Conservation	12/31/72

Rec. #	Pg.	Brief Description	Implementation Action	Organizations Involved	Lead (co-lead) Organization	Action Deadlines
22	50	Task force for research on earthquake hazards abatement in structures and facilities	Chairman of GEC to appoint task force to study problems related to earthquake hazards abatement	Chairman, GEC; GEC Subcommittee; others	GEC	12/31/72 06/01/73
23	53	Establish state regulation conformance committee	Committee should be formed as a subgroup of Rec. 1. Exchange data pertaining to earthquake hazards to avoid duplication of effort	Selected State agencies	OAC	04/01/73
24	55	Earthquake insurance	(See Below)	(See Below)	(See Below)	(See Below)
a	55	Long-term rehabilitation	Pass legislation mandating disaster coverage into standard fire policy	Department of Insurance, Nat'l Assn. of Insurance Commissioners, Legislature, Legislative Counsel	Department of Insurance	03/01/73
b	56	Required availability of disaster insurance	Encourage insurance industry to advise policyholders of disaster coverage	Dept. of Insurance, Insurance industry	Department of Insurance	03/01/73
25	57	Term of the Governor's Earthquake Council	Extend to 6/30/74 by approval	Governor, GEC	Governor	------
26	57	Consideration of a successor body	Committees from GEC and JCSS confer and report	GEC, JCSS	GEC Chairman JCSS Chairman	Within 30 days of approval

RECOMMENDATIONS

1. 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.

Arrangements should be made for representatives of appropriate State agencies and universities dealing in a major way with earthquake problems and of local government, to meet from time to time to discuss their activities, concerns, and needs.

The purpose would be to create a general awareness in the State public service, of inter-agency responsibilities, available information and expertise, and procedures related to earthquakes. Several specialized coordination committees recommended in this report should function as sub-committees of this body.

Federal agencies should also consider forming a similar coordinating body.

Implementation

Prior to January 31, 1973, the chairman of the Governor's Earthquake Council should, with the Governor's authorization, call an organizational meeting for such interagency group and serve as temporary chairman thereof. The report of this meeting should be submitted to the Council by February 15, 1973.

2. POST-EARTHQUAKE STUDIES

Post-earthquake 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 re-paving, re-leveling or re-ploughing, 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. Post-earthquake studies must therefore commence immediately. In many cases, as much may be learned from a major earthquake outside of California as from one within the State's boundaries.

(a) 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.

Several alternate members should be selected in advance from each discipline required to investigate the geological, seismological, structural, socio-economic, and governmental operations effects of the earthquake and of the effectiveness of the emergency response. Team members should be selected from public and private organizations and universities.

Authority to make the decision as to whether to dispatch the investigation team and to determine the composition of the team should be vested by the Governor in the chairman of the State interagency coordination body. Decisions will be needed promptly on the significance of the out-of-state earthquake to California, on the disciplines needed on the team, and on the individuals from the designated group who will represent those disciplines. It must be clearly understood that timely reports, acceptable to the State interagency coordination body, will be submitted for all investigations so conducted.

Members of the designated group should maintain current passports, immunity from basic communicable diseases by way of inoculation, and have ready access to supplies, equipment, and, if needed, funds and travel authorizations necessary to conduct adequate short-term investigations.

Implementation

If and when this recommendation has been approved by the Governor, the State interagency coordinating body should designate potential members of an out-of-state earthquake investigations team and establish procedures for operation by April 30, 1973. Nominations for team members syould be made by the committees of the Governor's Earthquake Council by February 28, 1973.

Costs should range from $2000 to $12,000 per out-of-state investigation. An average of one and a maximum of two out-of-state earthquake of importance to California might be anticipated annually. OES should explore the availability of emergency funds for this purpose, request authorization for expenditure of same, and report to the Council by March 1, 1973.

(b) Procedures should be developed to ensure 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.

UCB, CIT, NOAA, and others now notify numerous organizations of the occurrence, location, and magnitude of earthquakes on a more-or-less bilateral basis. Notification procedures should be coordinated and systematized.

Implementation

A meeting for this purpose should be convened and chaired by UCB. A representative from NOAA should serve as co-chairman. A report on the results of the meeting should be submitted to the Council by March 1, 1973.

(c) For significant earthquakes within the state, the California Division of Mines and Geology (CDMG) should be established as the clearinghouse for the progress and results of post-earthquake seismological and geological investigations.

The nearest district office (Los Angeles, San Francisco, or Sacramento) of the Divison should serve as the data exchange center for all earth scientists engaged in post-earthquake studies, at least in the early stage of investigation. This will facilitate a better early evaluation of the extent and nature of the event and allow more efficient early deployment of instrumentation and personnel from the many organizations involved.

The designated Division office can serve as a temporary headquarters and/or message center for scientists from outside the area, within the physical limitations of the facility.

In addition to conducting its own investigations, the Division should promptly disseminate information to all concerned on the nature, progress and, when possible, on the results of investigations, or indicate the sources from which such results may be obtained. The Division office should particularly maintain close liaison with the OES operations center and promptly provide all pertinent earth science information to that operations center.

This procedure was followed successfully on an impromptu basis after the San Fernando earthquake.

When warranted, the Division office should be manned 24 hours a day.

Implementation

This procedure can be implemented by widely circulated written notice from the Division of its intention to serve this function and by acknowledgment from other concerned organizations. USGS should be consulted in the preparation of this notice. A copy of the agreed procedure should be submitted to the Council by March 1, 1973.

(d) For damaging earthquakes within the state, the Earthquake Engineering Research Institute (EERI) should be established as the clearinghouse for the progress and results of post-earthquake structural engineering and soils engineering investigations.

EERI should designate regional coordinators and alternates to provide a clearinghouse for information on post-earthquake structural and soils engineering investigations in much the same manner as CDMG is to provide earth-science information.

This will require that information centers and personnel to man the centers be designated in advance, at least for the early stage of post-earthquake investigations. Such centers could well be physically located in the district offices of CDMG, by prior arrangement, with distinct interdisciplinary advantages.

EERI should promptly disseminate information on the nature, progress and, when possible, on the results of investigations, or indicate the sources from which such results may be obtained. EERI should particularly maintain close liaison with the OES operations center and promptly provide all pertinent engineering and structural information to the operations center.

UCEER should coordinate post-earthquake investigations and studies relating to basic research and should inform EERI of the projects underway.

Implementation

This recommendation should be implemented by EERI through development of suitable procedures, designation of regional coordinators and alternates, and by making other necessary arrangements as soon as practicable. EERI should then widely circulate written notice of its intention to serve this function and of the procedure it proposes to follow. Acknowledgment of EERI's role by other concerned organizations would complete implementation. A copy of the agreed-upon procedures should be submitted to the Council by March 1, 1973.

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

Funds for augmenting the efforts of in-house personnel were not readily available immediately after the San Fernando earthquake. Consequently, inspections of school buildings and sites were of necessity less than comprehensive in many instances. Also, resources were not available to conduct in-depth studies of particularly significant school buildings and sites.

Implementation

Contingency funds should be available to OAC to allow professional structural and soils engineers and engineering geologists to be retained for assisting in the comprehensive post-earthquake inspection of school buildings and sites, the in-depth study of selected school buildings and sites, and the preparation of resulting reports.

A minimum of $25,000 should be immediately available for such an effort. Significantly damaging earthquakes requiring augmented investigations may be expected at two- to five-year intervals. OES should explore the availability of emergency funds for this purpose, request authorization for expenditure of same, and report to the Council by March 1, 1973.

(f) Prior arrangements should be made for coordinated early post-earthquake engineering inspections and studies.

Early post-earthquake engineering investigations and studies are conducted by engineers and building inspectors from local, state and federal agencies, universities, private organizations and by individual consulting engineers.

The work of universities, private organizations and consultants is especially valuable in augmenting the efforts of public agencies, yet much of this work is done at the expense of those organizations and individuals. Because of the expense, the efforts of the private sector and university research workers may be less concerted and effective than if prior arrangements had been made for directed and reimbursed work.

Implementation

Representatives of EERI, SEAOC, NOAA, ICBO, UCEER, NSF, OES, DPW, OAC, DWR, and other concerned organizations should convene to develop and adopt procedures for coordinated early post-earthquake engineering inspections and studies, including a mechanism whereby private organizations, university personnel and consultants may be utilized as fully and effectively as may be warranted. EERI should arrange and chair the meeting. A copy of the results of the meeting should be submitted to the Council by March 1, 1973.

(g) Post-earthquake socio-economic studies should be given more emphasis.

Socio-economic studies of earthquakes have been badly neglected as compared to engineering and geologic studies. Social behavior and economic dislocation occasioned by earthquakes should be investigated in depth.

Fragmentary investigations following the San Fernando earthquake suggest that dollar losses due to social and economic disruption, including litigation and medical costs, may significantly exceed the dollar loss of structures and facilities.

Social, economic, and political judgments as to the level of acceptable (or tolerable) earthquake risk also need further exploration and resolution.

Implementation

Representatives of OES, OEP, universities, and appropriate local, state, and federal agencies should convene to develop and adopt procedures which will assure that adequate early post-earthquake socio-economic studies are conducted. Consideration should also be given to needed, more general or long-range studies of the socio-economic effects of earthquakes and the funding of such studies.

OEP should arrange with the Federal-Regional Council* to convene and chair, and OES should co-chair, the meeting. A report on the results of the meeting should be submitted to the Council by March 1, 1973.

*(Agencies on the Federal-Regional Council: Environmental Protection Agency; and U.S. Departments of Housing and Urban Development; Health, Education and Welfare; Transportation; and Labor)

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

Post-earthquake deployment of instruments has mostly been conducted unilaterally by organizations owning or controlling such instruments, although some informal coordination normally takes place in practice.

Most instruments deployed after an earthquake have been placed on ground sites; few structures have been so instrumented, thus losing an opportunity to gain much valuable information on structural behavior during aftershocks.

Implementation

Representatives of USGS, NOAA, CDMG, UCB, CIT, OAC, and SEAOC should meet for the purpose of developing a coordinated procedure for deploying seismographs, accelerographs, creepmeters and other appropriate ground-movement measuring instruments. An inventory of such instruments available for rapid deployment in California should be compiled jointly and then up-dated periodically by CDMG. NOAA should convene and chair the meeting. CDMG should co-chair the meeting. A report on the results of the meeting should be submitted to the Council by March 1, 1973.

Representatives of EERI, SEAOC, NOAA, ICBO, OAC, DWR, DPW, USCE, USBR, and other organizations concerned with aseismic design and construction should meet for the purposes of (1) determining what types of instruments would be most useful in providing engineering information on the effects of ground shaking on structures, (2) determining the availability of such instruments and compiling an inventory of those which could be rapidly deployed, and (3) developing procedures for rapid and effective post-earthquake deployment of such instruments. EERI should convene and chair the meeting and periodically update the inventory of available instruments. A report on the results of the meeting should be submitted to the Council by March 1, 1973.

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

Aerial photography and low-level photogrammetry immediately following a damaging earthquake are potentially useful for a variety of purposes. Ground effects are often ephemeral; some of these occur in remote areas and otherwise go undiscovered for long periods. Access may also be difficult because of disrupted transportation systems.

Structural damage may also go unreported for long periods in remote locations. Quick aerial photography can provide an over-all view of the damage area useful in rescue and recovery work. Comparison of "before and after" aerial photography can be especially valuable.

Infra-red, aeromagnetic and other aerial surveys may also be useful in locating anomalies associated with earthquakes.

Guidance as to aerial survey areas should be obtained from the information clearinghouses established under recommendations 2(c) and 2(d).

Implementation

OES should explore the availability of emergency funds for this purpose and request authorization for expenditure of same. A minimum of $10,000 should be available. In addition, OES should maintain service agreements (or interagency agreement) which will permit employment of aerial survey equipment and aircraft in any part of the state on short notice (one hour or first-light). OES should report to the Council on the status of this recommendation by March 1, 1973.

(j) Provision should be made in advance for legitimate post-earthquake investigators to have ready access to areas affected by earthquakes.

Occasionally engineers, seismologists, and geologists have been prohibited from entering critical earthquake damage areas by public protection agency personnel. This has sometimes been because of lack of properly accredited identification of the investigators, but other times has been due to over-caution or lack of understanding of the role of such earthquake investigators on the part of public protection personnel. (It is recognized that public agencies cannot grant access to private property.)

Implementation

OES should explore with law enforcement agencies mechanisms for facilitating entry of earthquake investigators to earthquake damage areas. This might take the form of approved identification cards or badge, widely and readily recognizable by and acceptable to law enforcement agencies. Alternate methods should also be explored. OES should report to the Council on the status of this recommendation by March 1, 1973.

3. 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 public 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. Public utilities are, in general, such complicated systems that special studies should be made on how an adequate earthquake resistance can best be achieved at economical cost. The State of California should take the lead in initiating and sponsoring such research. This would probably best be done at universities in the State.

Implementation

PUC should convene and chair a meeting of representatives of EERI, LCC, CSAC, UCEER, DWR, DPW, OAC, public utilities organizations, and other appropriate organizations to assess the status of development in the earthquake-resistant design and construction of public utilities.

The need and scope of further research should be defined as specifically as possible and sources of research funding should be explored. PUC should make a status report to the Council by March 1, 1973.

4. SAFETY OF DAMS

The relative dam safety programs of the state and federal governments should be assessed; 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 State agencies working in this area must be made to ensure that such an event will not occur. The State has jurisdiction over all non-federally owned dams in California of greater than 6 feet in height that store 50 or more acre-feet of water, and of 25 or more feet in height that store more than 15 acre-feet of water.

The Division of Safety of Dams within DWR should assess the relative programs of the State and Federal governments in terms of dam safety requirements in California. If the Federal programs are inferior to those of the State, the Governor and the Legislature should urge that Federal programs be made at least equivalent to those of the State. Conversely, if State programs are found to be inferior to Federal programs they should be improved.

OES should be given responsibility for ensuring that operative contingency plans for areas below dams are available in the event of damage to any dam, regardless of ownership.

Implementation

The Division of Safety of Dams should make a status report of its assessment of State and Federal dam safety programs and requirements and submit it to the Council by March 1, 1973.

OES should report to the Council by July 1, 1973 on the status of contingency plans for areas below dams.

5. EARTHQUAKE GEOLOGIC HAZARDS MAPS

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

The available mapping of geologic hazards in California is inadequate, especially for rapidly urbanizing areas. Many of the available maps are too generalized for detailed use. A major effort should be made over the next several years to further expand the coverage and scope of geologic hazards mapping, as a guide to local and regional planning and building code development, as well as to provide better information for land-use decisions at all levels of government. For example, DGS needs this kind of information to better determine the location and scope of geological investigations needed for public school sites.

Earthquake geologic hazards mapping involves careful (and often difficult) interpretations of geologic data, and is absolutely essential to the evaluation of earthquake risk. The product commonly delineates areas of relative earthquake risk, expressed according to a qualitative scale, or in terms of probability.

Emphasis should be placed upon:

a. Distinctions among geologic faults in terms of nature and amount of displacement, recency and recurrence periods of movement, seismic activity, and probable future surface offset.

b. Measurement of physical properties, areal distribution and thickness of various rocks and surficial deposits, to determine their probable responses to strong shaking during an earthquake.

c. Evaluations of the natural stability of slopes, effects of ground water conditions upon stability, and relationship of stability to expectable ground shaking.

d. Correlation of earthquake intensity with duration and spectral characteristics of earthquake motion, based upon geologic conditions.

First priority should continue to be given to mapping in urban, urbanizing and other critical areas of California. Resulting maps should be periodically updated.

The compilation and frequent updating of an active and potentially active fault catalog for California should be considered. The catalog would contain all available data on such faults, including outcrop, ground rupture, trenching and bore-hole descriptions, and displacement and seismicity histories.

Implementation

CDMG is already heavily committed to urban geologic hazards mapping and interpretation; further internal reallocation to this activity within the Division is not feasible. A budget augmentation has been granted for 1972-73. Further acceleration of the geologic hazards program would require still more funds and personnel. If this recommendation is accepted, additional funds should be sought by CDMG from federal agencies. The alternative is another budget augmentation. Another possibility for short-term acceleration of geologic hazards mapping is by contract with consulting geologists; this is now done occasionally by local government and should be encouraged. CDMG should report to the Council on the status of this recommendation by March 1, 1973.

6. DISSEMINATION OF EARTHQUAKE-RELATED EARTH SCIENCE INFORMATION

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

The demand for earthquake-related earth science information is increasing rapidly. Information is being developed and collected by various organizations, including the USGS, NOAA, universities, CDMG, DWR, local agencies, private firms and professional societies. Many of these data are disseminated independently, sporadically and often with limited distribution.

USGS, NOAA, CDMG, DWR, and some universities and societies provide general earthquake-related earth science information through their publications and respond to specific requests. Since late 1970, CDMG has published and distributed "Crustal Movement Investigations in California" periodically, to summarize the salient developments in such programs. This publications does not, however, cover the entire earthquake-related earth science field.

CDMG functions as a state clearinghouse for all earth-science information but the Division does not now have a central storage and retrieval system for such data. A feasibility study of a data system for this and other earth science information is planned for 1972-73.

Implementation

CDMG should broaden the scope of its "Crustal Movement Investigations in California" to include the whole earthquake-related earth science field and publish the newsletter on a quarterly basis. More effort should be devoted to collecting and organizing information in this field. The Division should continue its study on the feasibility of establishing an electronic data storage and retrieval system. This study should include consultation with other concerned organizations. CDMG should make a status report to the Council by March 1, 1973.

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

The recently mandated "safety element" and "seismic safety element" of general plans 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 considerable expertise in delineating and evaluating geologic earthquake hazards; most do not. Private consultants are generally experienced in this work but statewide guidelines would be useful to them, as well as to local government which must make the final decision on site development.

The Governor's Earthquake Council developed suggested interim guidelines for the seismic safety element that were distributed by CIR in July 1972.

Implementation

CIR should take the lead in coordinating input from appropriate agencies to update seismic safety element guidelines and to prepare guidelines for the safety element. CIR should make a status report to the Council by March 1, 1973.

7. 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.

As a long-term program, it is vital to carry on analytical and experimental research on three levels:

a. Basic research directed to the development of new information and of methods of analysis that will form a basis for developing improved methods of earthquake-resistant design;

b. Intermediate research whereby the most promising results of the first stage are further developed, data are collected, and various implications and ramifications are studied;

c. Practical applied research and testing where the results can be used directly, or with little modification, in design practices and codes.

Earthquake engineering research is done by three types of organizations. Universities are the main source of basic research; and Government agencies and private organizations have the potential for intermediate and practical applied research. Since California has the greatest earthquake problem in the U.S., it would be expected that organizations in the State should assume leading positions in earthquake engineering research. This is, to a certain extent, the case, particularly in the university research. However, California universities, both public and private, have a potential for a much stronger research program than has been carried on in the past. The same is true for Government agencies, particularly the Seismological Field Survey, a NOAA agency based in San Francisco.

The State should sponsor research in earthquake engineering at public and private universities in California. Several years ago CIT and UCB took the lead in forming the Universities Council for Earthquake Engineering Research which has played a role in coordinating basic research nationally; this organization could also undertake to provide close coordination of basic research in California if an augmented program is sponsored by the State.

Government agencies and private organizations in California have also been leaders in sponsoring and doing intermediate and applied research, but even so, the research has been at such a low level that it should be augmented. SEAOC has recently formed an Applied Technology Council whose functions are to provide funding (obtained from State and Federal sources) and coordination of practical applied research aimed directly at improving the earthquake provisions in the building code. There has, as yet, been no corresponding group to provide coordination for research done and sponsored by State agencies. To date, earthquake engineering research has been sponsored mainly by Federal Government agencies and relatively little has been sponsored by State agencies.

There is a need for an expanded network of strong motion accelerographs. To meet this need in California the State recently initiated a program for installing such instruments. In addition, there is a need for more precise and more complete measurements of the motions and deformations of the ground and of structures under earthquake conditions. New and improved instruments should be developed.

There is a special need for a major laboratory facility that will perform static and dynamic tests of structures, structural components and assemblages, and structural elements. The objective of these tests should be to make clear the physical behavior of structures, and their parts, in an earthquake environment; particularly, under conditions of large strains that approach failure. The work done by this laboratory should be mainly practical applied research and testing that can be used directly, or with little modification, in design practices and codes. Such an earthquake structures laboratory should probably be a national laboratory and should be located in California.

There is also a need for a large capacity shaking table that can subject large-scale structures to earthquake-like shaking. This equipment would provide answers to many questions about earthquake behavior of structures without waiting for an actual earthquake. In addition to shaking table tests, full-scale static and dynamic testing of structures and structural members should be done.

The Uniform Building Code should be continually upgraded as new engineering criteria are developed and made available for adoption by local jurisdictions.

Implementation

A body for coordinating earthquake engineering research carried on or sponsored by the State should be established with members representing DGS, DPW, and DWR. The coordination body should also consider other earthquake engineering research needed by the State. This body should establish and maintain close liaison with EERI, the Applied Technology Council of SEAOC, UCEER, and federal agencies engaged in or supporting earthquake engineering research. DGS should convene and chair the organizational meeting of the State coordination body, and submit a status report to the Council by March 1, 1973. This can be done concurrently at the meeting requested in Recommendation 1 and the coordination body recommended herein should function as a subcommittee of the body specified in Recommendation 1.

Representatives of the State earthquake engineering research coordination body, NOAA, UCEER, NBS, HUD, NSF, UCB, CIT, EERI, SEAOC, AISI, and other concerned agencies, universities and private organizations should meet to discuss and recommend ways and means for establishing and supporting a national earthquake structural testing laboratory which will include a large capacity shaking table. NSF should convene and chair the first meeting, and make a status report to the Council by March 1, 1973.

8. SEISMICITY MAPS AND CATALOGS

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

The earthquake catalog should include historic seismicity data for all significant earthquakes, such as epicenters, magnitudes, intensity distributions, structural damage reports, peak accelerations, duration of shaking, ground displacement, and other crucial seismological parameters. CDMG and NOAA have negotiated an agreement for a cooperative effort to compile such a catalog during 1972-73.

Various maps should be prepared. These should include (1) seismicity maps, i.e., those which depict the various parameters of historic earthquakes, and (2) seismic probability maps, i.e., those which attempt to indicate probable recurrence interval, acceleration, duration, frequency or period of motion, or other seismicity parameters.

Implementation

CDMG, NOAA, USGS, and some universities are working on various of these aspects. CDMG should take the lead, in conjunction with NOAA, in coordinating those efforts,and report to the Council on the status of this recommendation by March 1, 1973.

9. RESEARCH ON FAULTS, CRUSTAL STRAIN AND FAULTING

(a) Coordinate research on the nature of faults and fault displacement, and on the histories of fault displacements through the recent geologic past should be increased.

In addition to accelerated geologic hazards mapping, more research is needed on the nature of faults and fault displacements in order to develop programs for the reduction of earthquake hazard to buildings, utilities, bridges and highways and other structures. A research program with both short- and long-term goals is needed.

Short-term research goals are:

(1) Detailed mapping of active and potentially active fault zones, differentiating the degrees of fault activity to the greatest extent possible.

(2) Determination of displacement histories of faults during the past few million years, and especially during the past 50 thousand years.

(3) Detailed investigation of offshore faults by seafloor studies, including continuous seismic profiling, and interpretation of drilling logs.

(4) Detailed investigation of microearthquake activity to complement the detailed mapping of faults.

(5) Coordinated studies of creep and strain phenomena along faults.

(6) Development of guidelines for acceptable definitions of "active fault", "potentially active fault", and related terms.

Long-term goals:

(1) Research into interrelationships of various California fault systems in time and space.

(2) Research on the behavior of major faults as they relate to seafloor spreading and disruption of the continental margin.

Implementation

USGS, CDMG and NOAA should increase their fault research activities. In addition, federal agencies such as USGS, NOAA, HUD, AEC and NSF should give serious consideration to funding more fault research projects to be conducted by universities, CDMG and private organizations. CDMG should monitor all such projects and assure coordination by publication of a newsletter (see Recommendation 6a) supplemented by the convening of coordination meetings if and when warranted. USGS should co-chair such meetings. CDMG should make a status report to the Council on the above by March 1, 1973.

Funds should be made available for State agencies such as OAC, the Division of Highways, and DWR to sponsor or continue to sponsor or conduct programs relating to geologic hazards as required adequately to design and safeguard the projects for which they are responsible. A report to the Council on the above should be incorporated in the report by DGS requested under Recommendation 7.

The Governor's Earthquake Council should support appropriate state legislation regarding zoning along faults, to restrict or control development until the nature of fault activity is better known and wise decisions taken. The Council should also support an appropriate tax relief measure to accompany restrictive zoning along fault zones. The Steering Committee should examine the status of such legislation or legislative proposals in December 1972.

The State should encourage counties or other appropriate jurisdictions to maintain on file copies of all engineering geology studies, including core logs, trench logs, and samples if possible, which have been prepared and submitted for both public and private projects. CDMG should make a status report on the above to the Council by March 1, 1973.

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

The crustal strain measurements carried out under the State program have been fundamental in importance to the understanding of faulting and earthquake generation along the San Andreas fault system in California. A particularly important feature of these measurements is their long-term indications. It is of critical importance that these crustal measurements be continued for at least the next decade and the long-term strain fluctuations calculated.

CDMG and USGS should also continue to investigate the usefulness of tiltmeters for detecting crustal strains associated with active faults. NOAA should consider the application of precise leveling surveys for this purpose. UCSD has an active program in perfecting long base laser strain meters which has been supported by USGS and NOAA. Measurements of the above kinds lead to a much clearer understanding of expected faulting, earthquake mechanism and perhaps to an earthquake warning system.

CDMG and USGS are presently cooperating in conducting measurements along the State network. CDMG measurements are carried out by private contractor at a current annual level of about $50,000; an approximately equivalent amount of work is conducted in-house by USGS. Work is divided generally on a geographic basis.

Implementation

CDMG and USGS should maintain the present level of measurement. NOAA should consider funding additional short frequency measurement of one or more critically located closed figures along the net. NOAA should also consider the feasibility of conducting precise level surveys in the vicinity of the State geodimeter network. NOAA and/or USGS should continue support to the UCSD long base laser strain meter program. CDMG should make a status report to the Council by March 1, 1973.

10. SEISMOGRAPHIC NETWORKS AND BASIC RESEARCH IN SEISMOLOGY

(a) Basic research programs in seismology should be strengthened.

A healthy research program in seismology is essential to the understanding of earthquakes and the reduction of earthquake hazards in California. Although basic research should continue to be supported by the Federal government, a modest program supported by the State should be carried out to emphasize the State's responsibility to its citizens in this field.

Particular emphasis should be placed on research of unique value to California that can best be carried out by California agencies and institutions. The geodimeter program along the San Andreas fault is an example of this effort, as is the long-term gathering of epicenter data and its analysis by the University of California and several private universities.

From time to time, certain new observatory instruments are developed which can be tested best under California conditions. The State should not hesitate to join Federal agencies in giving at least some initial support to these fresh research approaches.

The State should give favorable consideration to the Joint California Universities Earthquake Hazard Proposal. Economic support by the State, as well as by Federal agencies, for this coordinated program might be looked upon as a prudent minimal investment to ensure that first-class research by scientists in the State can go forward on the earthquake problem.

Implementation

The Council should recommend appropriate funding from all available sources for support of those parts of the Joint California Universities Earthquake Hazard Proposal that conform with the recommendations of its committees and which would not be duplicative of continuing or planned projects of such other agencies and organizations as the universities concerned, USGS, NOAA, NSF, ARPA, and CDMG. The USGS should convene and chair a meeting of representatives of these organizations for the purpose of identifying duplicative proposals and make a status report to the Council by March 1, 1973. CDMG should co-chair the meeting.

(b) Seismographic networks in the State should be expanded, adequately supported, and certain of their facilities modernized.

The State has a responsibility to ensure 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 off shore. UCB in the northern part of the state, and CIT in the southern part, have a long history in carrying out this responsibility. Both networks are underfunded in view of current needs and responsibilities; even though inadequate at current levels, the funding for the CIT network is also tenuous. Their efforts

should be supported by firm and adequate funding, including financial support by the State, and the effort should be expanded. (See discussion of these networks in the Joint California Universities Earthquake Hazard Proposal.)

Expansion is urgent in the light of the rapid increase of State population and industry. The data collected and analyzed include such important features as the earthquake magnitudes, precise locations of epicenters, the depth of foci and the general seismicity of California. They are regarded by engineers, planners and others as of fundamental importance in coping with the problems of earthquakes.

The expansion of seismograph networks in the state involves increased coverage of certain parts of the state and conversion of some of the present seismographic stations into more modern facilities. In some ways, the facilities in Japan and New Zealand are now superior to those in California.

It must be stressed that the networks operated by the Universities also provide the basic information for research on seismology by the seismologists at those institutions and by graduate students in seismology. This stream of highly trained and competent seismologists is an essential contribution of the State to understanding earthquakes, not only in California but throughout the world.

There is also a need in California for special purpose networks of seismographs of a modern type. The clearest examples of such networks are those operated by DWR in connection with certain of its major dams and water facilities, and by USC near large-scale oil-pumping in a metropolitan center. These special purpose networks should have adequate funding to enable continuous analysis and study of the seismograms obtained.

The State could make a considerable contribution in reducing the cost of maintaining the networks if it would make its microwave communication system throughout the State available essentially without charge to the University and State groups with need to telemeter seismic signals. This would enable the Universities to link the out-stations to the central observatories at Berkeley and Pasadena, for example, without the great costs of telephone-telemetry lines that duplicate the State microwave system. The State could contribute to the further reduction of unnecessary duplication and cost by encouraging all groups now operating seismographs in California, be it with Federal, State or other financial support, to increase the present real-time exchange of seismic data by expanded use of telemetry which permits one seismometer to transmit continuously to two or more recording centers.

Implementation

The University of California Seismograph Station budget for basic continuous support should be specifically identified in the annual appropriation for UCB; the amount so designated annually should be equivalent to the 1971-72 allotment ($98,000) increased by the $70,000 estimated to be needed to support its

recommended added capabilities at such time as these additions are realized, adjusted annually by an increment equal to annual changes in the cost of doing business. With this assurance of continuous basic support by the State, one or more Federal agencies, such as USGS, NOAA and NSF, should be requested by UCB and the Council to fund the recommended improvements for the network and its facilities. UCB should make a status report to the Council by March 1, 1973.

The CIT network and facilities perform essentially the same service to the State and others in southern California as is performed by UCB in northern and central California, but without significant State support. While the geographic area covered by the CIT network is smaller than that covered by UCB, it contains a larger population. The numbers of stations in each are nearly the same.

The State should therefore support at least one-half of the routine cost of operating the CIT seismographic network. The current annual budget for that operation is about $114,000. The half that the State should fund ($57,000) should be provided by contract or contracts between CIT and State agencies, such as OES, CDMG, DWR, DPW, and DGS, through the State interagency coordination body. The budgets of the State agencies involved should be augmented accordingly, if necessary. The amount of the contract or contracts should be adjusted annually to accommodate changes in the cost of doing business. If the recommended new stations are added to the CIT network, the contract or contracts with the State should be adjusted accordingly. OES should make a status report to the Council by March 1, 1973.

UCB should convene and chair an initial meeting, co-chaired by NOAA, of representatives of all organizations operating seismographic networks in California for the purpose of achieving better exchange, processing and integration of data collected by those networks. This group should also consider the advisability of establishing an informal council of representatives from agencies maintaining networks for the purpose of improving the overall system, including data exchange. UCB should make a status report to the Council by March 1, 1973.

11. MECHANISM OF CRUSTAL FAILURE

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

Further fundamental research on the mechanism of crustal failure is required for the solution of a variety of earthquake problems including the estimation of the maximum earthquake that could be generated by a particular geologic structure. Much of this relevant research is being carried out by USGS, NOAA and by university groups, including many in California. A partial list of the types of research that contribute to this goal are:

(1) Theoretical and laboratory studies of the properties and behavior of rocks under the conditions of stress, temperature and strain rates encountered within the crust and upper mantle.

(2) Development and evaluation of direct methods for determining in situ stress in the crust.

(3) Development and evaluation of seismic methods for deducing the characteristics of earthquake sources (dimension, time history, stress drop, and so on).

(4) Computer modeling of earthquake rupture of various types, propagation of seismic waves through the crust and soil layers and the effect of topography and soil conditions on strong ground motion at a pre-specified site.

Implementation

USGS, NOAA, NSF, ARPA and CDMG should jointly evaluate the overall adequacy of on-going research in this field being conducted or sponsored by these agencies. Other appropriate proposed studies, such as some of those contained in the Joint Universities Proposal, should also be funded by one or several of these agencies.

NSF should convene and chair an initial evaluation meeting, co-chaired by UCB, with representatives of USGS, NOAA, ARPA, CDMG and appropriate universities for consideration of the above, and make a status report to the Council by March 1, 1973.

12. COST-BENEFIT STUDIES

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

It is essential, from a broad point of view, to know what the overall cost of an earthquake can be, and what the overall cost of earthquake counter-measures can be. This knowledge is needed to arrive at the optimum expenditures for earthquake-protective measures, including research thereon. Recommendations for these kinds of studies have been made several times in the past but have not been implemented.

Socio-economic studies are needed also in order to evaluate the true cost of an earthquake. Harmful social effects or disruptive industrial effects may be as costly as the damage to structures.

Attention should be given to the acceptable (or tolerable) loss of life during an earthquake. For example, in the event of the repetition of the 1906 San Francisco earthquake, what number of deaths can be acceptable, 0-10, 10-100, or more? This number has an important bearing on the cost of providing earthquake protection.

Pealistic cost-benefit studies and socio-economic studies must be made as an interdisciplinary effort that includes engineers, economists, and social scientists. This research can probably best be done at universities and private research institutes, or organizations. There is no precedant for such comprehensive research on costs of a natural disaster, but the potential payoff is sufficiently large to warrant a major effort.

Implementation

NOAA, which has responsibilities in both engineering and earth-science aspects of earthquakes, should conduct or sponsor comprehensive earthquake damage and counter-measures cost-benefit studies. This is a logical follow-on to its 1967 report, "A Preliminary Study of Engineering Seismology Benefits" (J. D. Crumlish and G. F. Wirth). NOAA should make a status report to the Council by March 1, 1973.

13. 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 organizations should be encouraged to participate in such educational activities.

Much new information on seismology and earthquake engineering available to researchers is continuously being developed. Organizations involved in earthquake-related activities should provide partial support to assist in disseminating of such information to professionals in California. Specific reference is made to recent developments in site evaluation for seismic risk which can be performed by only a few professionals. Such techniques and skills must be acquired and understood by many more.

Implementation

Concerned organizations, especially public agencies, should budget funds for the continuing education of key personnel in earthquake-related developments.

14. 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.

A considerable amount of effort is now being expended on a program aimed at eventual earthquake prediction. Local, State and Federal agencies particularly concerned with public safety should be aware of these programs and stay abreast of their progress. Some thought should be given to the ways in which warnings might best be promulgated if an effective earthquake prediction capability is to be achieved.

Implementation

Representatives of OEP, OES, DCPA, LCC, CSAC, USGS, NOAA, DWR and CDMG should meet to discuss earthquake warning procedures. OEP should convene and chair the meeting, co-chaired by OES, and make a status report to the Council by March 1, 1973.

15. 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 a local jurisdiction with a readiness capability to accomplish the life-saving and property protection goals stated above. To increase local capabilities, plans should include mutual aid provisions with adjacent jurisdictions and should dovetail with the State and Federal plans. Periodic review and updating is imperative.

Implementation

The California Emergency Services Act should be amended to mandate local emergency planning and make it compatible with the public safety and seismic safety elements in general plan legislation. By December 31, 1972, OES will provide the initial draft material for submittal to the Legislative Counsel for final bill preparation. Legislation should require local governments to submit plans to OES for review and approval. OES should continue to provide local jurisdictions with planning guidance, training, and periodic evaluation of the plan adequacy through testing and exercising. OES will submit a report of the status of local emergency planning to the GEC by March 1, 1973. In addition, OES will continue to negotiate with Federal agencies for plan funding and coordinate State and local planning efforts.

(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 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.

Implementation

Individual communities should include in their emergency plans and procedures an element to provide for evacuation of potentially hazardous areas. This should be coordinated by OES and compatible with CHP traffic control plans.

After Recommendation 15.a. is implemented, OES will advise all jurisdictions that emergency plans must include an evacuation element before OES can approve them. By March 1, 1973, OES will review all available local emergency plans and determine which lack the evacuation element. Jurisdictions not having this element in their plans will be notified and instructed to amend their plans and submit to OES by June 30, 1973. OES will make progress reports to GEC and the Legislature no later than 30 days after the above deadline dates.

(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 ensure 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, the coordination of all levels of government for services, resources, and manpower is imperative. This joint effort further provides for financial burdens of equipment, personnel, and training to be shared.

Implementation

This is an ongoing assignment in California to OES, DCPA, and OEP.

The emergency plans for schools, hospitals, and other public facilities must be coordinated with the plans of local governments. The State Public Health, Education, and other responsible State departments must work with OES to ensure that such plans are coordinated.

OES will report to GEC, by June 30, 1973, the status of emergency plans and progress made during the fiscal year 1972-73.

(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.

The ability of each affected jurisdiction to perform emergency functions following a major earthquake will be seriously reduced. The extraordinary emergency requirements imposed by the loss of critical resources in a community make it imperative that a state-wide inventory 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.

Implementation

The OES should take full responsibility and work in close cooperation with OPR.

OES should prepare and submit a suggested modified draft of the State Emergency Resources Management Plan to the GEC by December 31, 1973.

16. 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 ther 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.

Implementation

The Department of Aeronautics should have the primary responsibility for developing an aerial reconnaissance plan. OES should ensure that the aerial reconnaissance plan provides for the use of resources of the Civil Air Patrol, sheriffs' aerial squadrons, military, NASA, and the news media.

OES should develop procedures on how local jurisdictions can procure and utilize aerial reconnaissance and, at the same time, develop ground reconnaissance plan guidance for local governments. Such guidance should be distributed to local governments by December 31, 1973.

The aerial reconnaissance plan, after being approved by the GEC, should be published as part of the State Peacetime Plan and be ready for distribution by August 1, 1973.

(b) Heavy Rescue

A heavy rescue capability should be expanded statewide, to ensure 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.

Special emphasis in consideration of heavy rescue capability should be given to the areas of planning, equipment, and heavy rescue training. The Federal Government presently provides only partial financial support for a heavy rescue training center in Los Angeles.

Implementation

OES should:

1. Determine the statewide heavy rescue requirements;

2. Identify and catalog the equipment and manpower of governmental agencies and private industries which is suitable to conduct heavy rescue operations;

3. Negotiate agreements with industry for providing heavy rescue assistance;

4. Develop a system for mobilizing and dispatching heavy rescue teams into earthquake-devastated areas;

5. Work with DCPA and other governmental agencies to obtain additional training facilities and funding to satisfy the skilled manpower requirements; and

6. Include plan for provision of heavy rescue in local disaster plans.

7. Report progress on above activities to the GEC as follows:

   a. Heavy rescue requirements - March 1, 1973
   b. Heavy rescue resources - June 30, 1973
   c. Agreements with industry - June 30, 1973
   d. Mobilization and dispatch system - September 1, 1973
   e. Training facilities and funds - June 1, 1973
   f. Local disaster plans - June 30, 1973

(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.

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. Impairment of surface routes, and rescue and extrication of victims are added burdens during this crisis. It is conceivable that under these conditions the fire service as it exists today, despite mutual aid agreements, may not be capable of accomplishing all the tasks it would be called upon to perform.

Implementation

Prior to April 1, 1973, the Governor should direct the Director of OES to appoint a task force to study the present fire capability, with the objective to determine whether this service has the capability to perform adequately under the stated conditions. The task force should consist of members selected from:

Department of Conservation
Large metropolitan fire service
Rural fire representative
Local government, large city or county
Fire Marshal
Insurance industry (private)
Large metropolitan civil defense
Utilities
Public Works
Office of Emergency Services

The task force should make progress reports after each quarterly meeting, and submit a final report to the GEC prior to December 31, 1973.

17. 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. Even though some hospitals, medical groups, and volunteer organizations have developed emergency plans for their facilities and the area in which they serve, others have done little or nothing. 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 area and regional mutual aid plans be well coordinated in advance so that all resources can be efficiently employed during an emergency.

Implementation

DPH should develop a basic emergency medical mutual aid plan for the State and provide corresponding guidance to private medical groups to enable them to prepare and test local plans. Consideration should be given to the methods of reimbursement between these facilities and to providing for the use of the State and Federally owned Packaged Disaster Hospitals and First Aid Stations.

The State medical mutual aid plan should be completed by June 30, 1973. Guidance for local planning should be distributed to appropriate medical groups no later than October 1, 1973. DPH should report progress to the GEC by June 30, 1973.

(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 would facilitate maximum coordination and ensure effective utilization of facilities during an emergency.

The emergency medical communications 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.

Implementation

The OES Emergency Telecommunications Committee should recommend minimum communications criteria for emergency medical facilities to DPH for consideration in future legislation to make this a certification requirement. Criteria should be submitted to Public Health no later than June 31, 1973.

DPH should prepare draft legislation and submit it to the Legislative Counsel for final bill preparation by December 31, 1973. A progress report should be submitted to the GEC by OES no later than April 1, 1973, and by DPH by September 1, 1973.

18. 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 (fire, law enforcement, etc.) will require the full time of their respective tactical radio systems 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.

Implementation

OES should be responsible for planning and developing additional disaster communications systems in conjunction with local governments. Such systems shall be dedicated, during disaster periods, to supporting emergency operations. The systems shall interconnect the various State and Federal disaster agencies and the supporting public safety agencies, as well as local governments.

OES has prepared a proposal for a radio system which will satisfy this recommendation. This proposal, if given Cabinet approval and funds are allocated by CCCJ, will be submitted to the Legislature during the fiscal 1973-74 session.

OES will report progress to the GEC by December 31, 1972 and June 30, 1973.

(b) Radio Amateur Civil Emergency Service (RACES)

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. Radio communications between local jurisdictions and from local government to the State, however, is very limited. The Radio Amateur Civil Emergency Service (RACES) is recognized and established for the purpose of augmenting existing communications systems during emergencies, and can establish this missing interjurisdictional link.

Implementation

OES should provide leadership and a concentrated effort to revitalize the RACES program statewide. The effort should emphasize planning, training, organization, and updating of obsolete equipment. OES should request that additional communications personnel be approved by the Legislature for employment during fiscal 1973-74. OES will report progress to GEC by June 30, 1973. If personnel are approved, OES will submit to GEC a work plan and schedule for implementation of this recommendation.

(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.

An extremely heavy message traffic burden vital to public morale during disasters is health and welfare information. Most frequently this aspect of public support is neglected by officials in disaster areas. However, there exists the vast resource of amateur operators organized into volunteer networks that are proficient in traffic handling. These networks should be accorded official recognition and support by State and local governments.

Implementation

Local governments and ANRC should be encouraged by OES to execute formal agreements which reflect the way that existing amateur radio operator/network resources will be used to provide communications for the public during emergencies when commercial service is dedicated to operational traffic. OES should coordinate plans with ANRC and provide guidance to local governments to establish such a service no later than June 30, 1973, and submit a progress report to GEC by December 31, 1973. Local American Red Cross chapters should work with their respective governments and be a party to local agreements.

19. 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. Because of the unpredictability of an earthquake and the violence and destruction in its wake, some individuals, having failed to prepare properly, would probably react irrationally. 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.

Implementation

1. OES should develop a statewide public information program designed to provide the citizens of California with information, advice, and training on how to protect themselves, their families, and their homes during earthquakes. A progress report should be submitted to the GEC by August 1, 1973.

2. The Superintendent of Public Instruction should develop a comprehensive, mandatory program of disaster training for children in all California schools. A pilot program should be implemented in a representative number of schools during the spring semester of 1973, and a report submitted to the GEC by August 1, 1973. The final program should be available by September 1, 1973, for use by all school districts.

3. Radio, TV, and press news and entertainment media should be expected to provide public service time and space to disseminate the State public information program materials. Some material has already been provided by OES.

4. Procedure for disseminating post-earthquake information and instructions to the public should be prepared and distributed to all local jurisdictions by OES. The State and each local jurisdiction should predesignate the agency through which the news media will receive such material for public announcement.

20. 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 strctures.

During any kind of a disaster, facilities and personnel of government, business, and industry are 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 ensure the safety of their employees, they must have emergency plans and safety programs. Some work has been done at the Federal level to formulate guidance for war-caused disasters, but no coordinated activity has been established for peacetime emergencies. It is necessary that this program be described by a group of knowledgeable people from government and industry.

An effective disaster safety program must include requirements for organizational emergency contingency plans, procedures, instructions, and training,

so that each individual and group of employees understands the emergency chain of command and can take independent action before, during, and after a disaster. It is also important that the organization's ability to respond not be impaired by unnecessary injury or damage to its facilities.

Each organization should inspect and secure its facilities, so far as practicable, from damage caused by various types of disasters. In the case of earthquake plans, specific provisions should be made to anchor or otherwise secure and arrange housekeeping items, equipment, bookcases, cabinets, etc., so as to prevent damage and injury and minimize the disruption of the organization's post-earthquake operations.

Implementation

The Governor should direct the Director of the OES to appoint such a task force prior to April 1, 1973. Coordination should be with OES and pertinent Federal agencies. The task force should consist of at least one member from each of the following:

Department of Industrial Relations	Insurance industry (private)
Fire Marshal	Organized labor (private)
Business and Transportation Agency	Construction industry (private)
Department of Agriculture	State Chamber of Commerce
Department of Public Health	Public information media (private)
Department of General Services	

The task force should make monthly progress reports and submit to OES a final report no later than June 30, 1973.

When sufficient direction has been received from the task force, the requirements for the planning effort should be disseminated by OES to appropriate organizations along with planning guidance. OES should provide specific guidance to local government so they can review and assist local business, industry, and their own agency organizations to prepare and test contingency plans.

State and Federal agencies should forward drafts of their proposed plans to OES and OEP, respectively, by October 1, 1973. OEP and OES should respond and plans should be adopted by December 31, 1973. OES should also review those response plans of critical industries (utilities, communications, etc.) on request.

OES should report to the GEC on the status of all above by December 31, 1973.

21. 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.

Recognition of hazards as a threat must be considered as part of State and local planning criteria and included in enabling legislation in the areas of zoning, subdivision controls, specific plan ordinances, mandatory referrals, and redevelopment. The legislation can be improved, insofar as it pertains to general plans, with respect to the consideration of hazardous situations in establishing and enforcing controls over land development.

Comprehensive revisions of planning legislation which will be more responsive to hazards reduction are now being drafted by a committee of CIR. Additionally, State guidance to local government relating to the seismic safety element and the public safety element for the general plan are being drafted by CIR.

State and Federal agencies administering financial grants for redevelopment and new development of land should require that hazard reduction be considered and included as part of a local jurisdiction's proposal in order for a project to qualify for a grant.

The State now requires that open space and conservation elements and open space action programs be provided in order to qualify for Open Space Subvention Funds. Similar incentives contained in legislation and regulations can be provided for the seismic safety element.

Implementation

Legislation should be proposed by the CIR which would require action programs for implementation, and designate the CIR (with advice from other appropriate State agencies) as the agency responsible for certification once the elements and action programs are completed. State and Federal funds for related programs (such as the implementation of the Field Act) should be contingent upon the preparation of a seismic safety element and action program. The CIR should report to the GEC by March 1, 1973 on needed changes in regulations or statutes to accomplish the above.

(b) Funding Public Improvements

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

Federal and State agency consideration of plans can be accomplished through administrative direction and project reviews. Executive, commission, and departmental orders can be issued to require agencies to consider existing plans in developing improvement projects and prior to funding or approval of public and private projects. Also,

Federal and State agencies should submit their projects to local planning agencies for review similar to that of local projects by local planning agencies as required by State law.

Conformance to general plans and their seismic safety contents can be insured by the review process performed by the responsible regional or State agency. Instruments to accomplish this include administrative regulations and clearance reports.

Implementation

All Federal and State agencies involved in significant public works projects should work closely with appropriate local agencies and should as a minimum conform with seismic safety elements of local general plans.

The CIR should submit a progress report to the GEC by June 30, 1973 on how this is being accomplished.

(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, etc., are required for privately-initiated projects. The geological contents of these are all too often inadequate to ascertain geologic hazards and they are frequently not reviewed by competent authority. The 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.

Implementation

The Department of Conservation should propose legislation for the 1973 session that would make the following procedure mandatory for all cities and counties, including charter cities and counties: A preliminary geologic report should be prepared, in the same manner that preliminary soil reports are now required, for all subdivisions and for critical structures and facilities, and other private and public projects that have significant land use considerations, except in those areas that are mutually agreed to be of low risk by the State Geologist and local government.

22. 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.

Specific measure which should be studied for possible implementation include the following:

a. Regardless of ownership, buildings, utilities, and facilities should be designed and constructed to resist earthquakes;

b. Buildings, utility systems, and other facilities for which there is a public need that they survive an earthquake in operable condition shall be designed to a higher standard of performance than may be required of other buildings and facilities;

c. Buildings shall be designed for varying requirements for earthquake resistance, based on type of occupancy and number of occupants, in a manner similar to that now generally required for fire resistance;

d. The design and installation of ancillary equipment, facilities, machinery, furniture, etc., of every kind shall be performed in a manner to resist earthquake effects;

e. All construction permits shall be issued on the basis of definitive construction documents prepared by responsible, state-licensed design professionals which have been reviewed by equally qualified officials;

f. Required level of competence of persons allowed to design the construction and installation of buildings and of certain contents of buildings and of other structures, utilities, and facilities, shall be re-examined by their peers;

g. Require city and county authorities to enact and enforce correction of existing hazards, with special attention to pre-Riley Act structures; and

h. Explore incentive methods of inducing owners of existing buildings and facilities to take voluntary corrective measures where earthquake hazards exist.

Exposure to earthquake hazards involves several elements:

a. Seismicity of the site of a structure;

b. Use or occupancy of a structure, both as to number of occupants and percentage of time occupied;

c. Ability of a structure to resist earthquakes; and

d. Life of a structure.

The exposure clearly includes a time element if the probability of any given structure being damaged by earthquake forces during its useful life is to be assessed.

There appears to be an inverse relationship between earthquake magnitude and frequency of recurrence. The greater the earthquake, the longer is the mean recurrence interval. Accordingly, the terms "maximum credible earthquake" and "maximum probable earthquake" are in use.

The degree of resistance to earthquakes to be provided in engineered structures of all types should be a decision by the body politic, not by the engineers. Some structures undoubtedly should be designed to resist the maximum credible earthquake. Most, no doubt, should be designed to resist the maximum probable earthquake. And some few, of short life and no particular hazard to life or property, may not need to be designed for earthquake. The decision as to what resistance should be provided involves considerations of loss of life, cost to repair or replace, and need to survive an earthquake in operating condition.

Human injury, loss of life, and property damage resulting from earthquakes are not caused by structural deficiencies only, but also by ancillary equipment, facilities, machinery, furniture, etc., of every kind.

It must be recognized that construction in earthquake country involves an element of risk and therefore construction must be in accordance with that risk. To simply not build because of the risk would potentially eliminate many areas in California from any construction whatsoever. Any approach to land use in conjunction with building construction must be in recognition of the element of risk.

It is recognized that the accurate assessment of the degree of seismic risk is not at this time (1972) everywhere possible or economically feasible for most buildings and many facilities, but as implementation of other recommendations of the GEC makes required information available, it should then be employed.

Current restrictions on the design of structures, including some residences, by persons insufficiently trained in structural design, appear inadequate to secure acceptable limits of damage during earthquakes. Moreover, many governmental agencies having jurisdiction over the building of structures lack personnel who are competent to evaluate structural designs.

Throughout California there are many buildings built before 1933 prior to enactment of the Earthquake Protection Law (Riley Act), California Health and Safety Code, Division 13, Part 3. It is necessary to consider the physical condition of such buildings and develop guidelines if we are to come to grips with the problem.

We must be aware that many communities in California recognize the need to make their older buildings earthquake safe; however, many have not moved effectively to accomplish this end for reasons such as lack of adequate State mandate, lack of finances, lack of capable personnel, potential loss of tax base, lack of definition of what is a hazardous building, and even because of the local political situation.

It must be recognized that there are many other communities in California which do not recognize the problem. These communities also have within their boundaries older buildings with questionable resistance to seismic forces.

Although the Federal report speaks of "encouragement" of communities to effectively deal with the problem, something more than "encouragement" would be necessary if meaningful corrective work is to be undertaken.

The use of force of law, although often necessary, should not be the sole or total answer, nor may it in fact be the best approach to reduction of earthquake hazards in pre-1933 structures. Thought must therefore be given to stimulate building owners to correct their buildings through other means, such as fiscal incentives.

Implementation

The task force should be appointed by the Chairman of the GEC by December 31, 1972. It should be organized around a nucleus consisting of the current members of the Earthquake Hazard Reduction in Structures Subcommittee; however, this task force must be augmented by representatives from the following areas of expertise:

Banking	Seismology
Insurance	Housing and Community Development
Real Estate	Architecture
Community Planning	Intergovernmental Relations
Geology	Legal (Legislative Law)
Local Government	Public

Because of the complexity and statewide impact of this task force's recommendations, it will be necessary to utilize the services of a broad spectrum of the government and private sector as consultants. In addition, full time staff personnel to support the work of this task force may be necessary. This task force should submit a status report to the Chairman of the GEC no later than June 1, 1973.

23. 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.

The purpose of this committee would be to gather information, exchange data of mutual interest pertaining to their area of responsibility and to insure that regulations and policies of their respective agencies are clearly understood and are non-conflicting with other State agencies with similar responsibilities.

This committee would endeavor to eliminate duplication, conflict, and overlap between regulations administered by each of the participants and to serve as a State advisory body to the State interagency coordinating body relative to reduction of earthquake hazards in buildings and structures.

The committee should also recommend to DGS the development of guidelines and design codes for earthquake safety as the need for them becomes apparent.

There are many agencies within State government with regulatory or administrative responsibility which have impact upon a broad segment of the public and private sector concerned with reduction of earthquake hazards. In addition, some agencies have responsibilities but have not developed appropriate regulations or plans. As the result of California's historic interest in earthquake safety, many regulations and policy procedures have been established for State government to administer and implement which should be more closely coordinated with other interested agencies. It is imperative that State government create some forum within which affected agencies might consider their existing programs, policies and regulations in coordination with agencies of a mutual interest.

Implementation

A State coordinating committee to conform regulations relating to earthquake hazards in structures and facilities should be formed as a subgroup within the State interagency coordinating body organized pursuant to Recommendation 1. Responsibility for the program and conduct of this committee's efforts within the State interagency coordinating body should be given to OAC, and the committee should be comprised of representatives from each of the following agencies:

Department of Finance
Department of General Services
(Office of Architecture and Construction)
Office of Emergency Services
Fire Marshal
Public Utilities Commission
Department of Water Resources
Reclamation Board
Department of Housing and Community Development

Department of Public Works
(Division of Highways - Bridge Department)
(Division of Highways - Highway Department)
Department of Public Health
Building Standards Commission.
Department of Industrial Relations
(Division of Industrial Safety)
Department of Conservation
(Division of Mines and Geology)

This committee should be formed at the organization meeting called for in Recommendation 1 and asked to report to the State interagency coordinating body by April 1, 1973 their progress and achievements, an indication of specific issues addressed and resolved, and a projection of their future work.

24. 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" as used in the context of insurance shall include earthquake, volcanic eruption, flood, wave wash, tsunami, and mud slides that are caused by heavy rain runoff. "Disaster" does not include the consequences of landslides in areas where the ground is made unstable by cut or fill techniques.

Disaster insurance is carried by only a small percentage of individual homeowners and businessmen. Consequently, the financial burden of long-term rehabilitation following a disaster is largely borne by the Federal government through its disaster relief grants and loans. The economy at large and individual property owners and businessmen bear the loss directly to the extent that limitations on the forgiveness portion of the federal loan programs apply. The agencies employed to administer the federal programs are ill-equipped to handle the large number of loan applications with prompt, equitable damage assessment and adjustment of loss estimates. Conversely, it is felt that the private insurance industry is better equipped to cope with the adjustment of disaster claims.

Such a system of private insurance would need to be universally, or nearly so, carried by all owners of private residences in order to constitute a viable alternative to the grants and loans program. At the same time, it is likely that the financial backing of the Federal government may be required in the early stages of a program of universal disaster insurance in order to be assured that widespread insolvency among insurance companies would not result from a major disaster.

However, a compulsory carrying of disaster insurance should not result in windfall profits to the insurance industry or a dissipation of the premiums collected in loss-free years through dividends, taxing, or subsidization of non-disaster losses. Rather, the premiums should be collected in a tax-free mechanism and retained (while earning interest) to be available to pay losses when a disaster occurs.

Additionally, the California FAIR Plan Association should expand its eligibility to include disaster insurance on one- to four-family residences on a statewide basis.

Implementation

After sufficient studies have been made and the availability of federal backup is assured, legislation should be passed mandating other disaster coverages into the standard fire policy for one- to four-family residential properties.

The Department of Insurance should pursue the establishment of such insurance, in conjunction with a national program, through the National Association of Insurance Commissioners, in cooperation with the insurance industry and the Federal government.

The Department of Insurance should submit a draft proposal to the GEC no later than March 1, 1973. This proposal should include a recommended course of action and draft legislation for consideration.

(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 widespread ignorance 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.

Implementation

The Department of Insurance should develop a plan to enlist the support of the insurance industry to implement an information program to advise policyholders of the availability and relative cost of existing disaster coverage.

In addition, the Department will develop a public information program, to be distributed through public service media, to recommend the private

citizens their personal action to secure this information from their insurance carrier.

The Department should report progress to GEC no later than March 1, 1973 and whenever significant action is taken.

25. 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.

The principal remaining work of the Council should be to oversee, encourage, guide and coordinate efforts to implement such of its recommendations as are approved by the Governor. Some of these will require a relatively short time for implementation; others will require years. Many of the recommendations are only for a first step toward significant earthquake hazard reduction; recommendations for subsequent steps will need to be developed and carried through. The Council, by its nature, is well suited for these tasks.

The Legislature's Joint Committee on Seismic Safety expires June 30, 1974. It is probable that the mutual objectives of the Council and the JCSS will not have been fully achieved by that time, in which case the creation of a single successor body for both organizations may be desirable at that time.

26. 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.

As noted under Recommendation 25, it is probable that the mutual objectives of the Council and the JCSS will not have been fully achieved by June 30, 1974. This probability should be further explored and, if a single successor body appears desirable, its nature should be considered.

Implementation

The Chairman of the Council should select a small committee of Council members to meet with a like committee selected by the Chairman of the JCSS to discuss the subjects of this recommendation and to jointly prepare recommendations related thereto for consideration by their respective organizations. If this recommendation is approved by the Governor, the Chairman of the Council should contact the Chairman of the JCSS as soon as possible and arrange for said meeting to take place within one month of the approval date.

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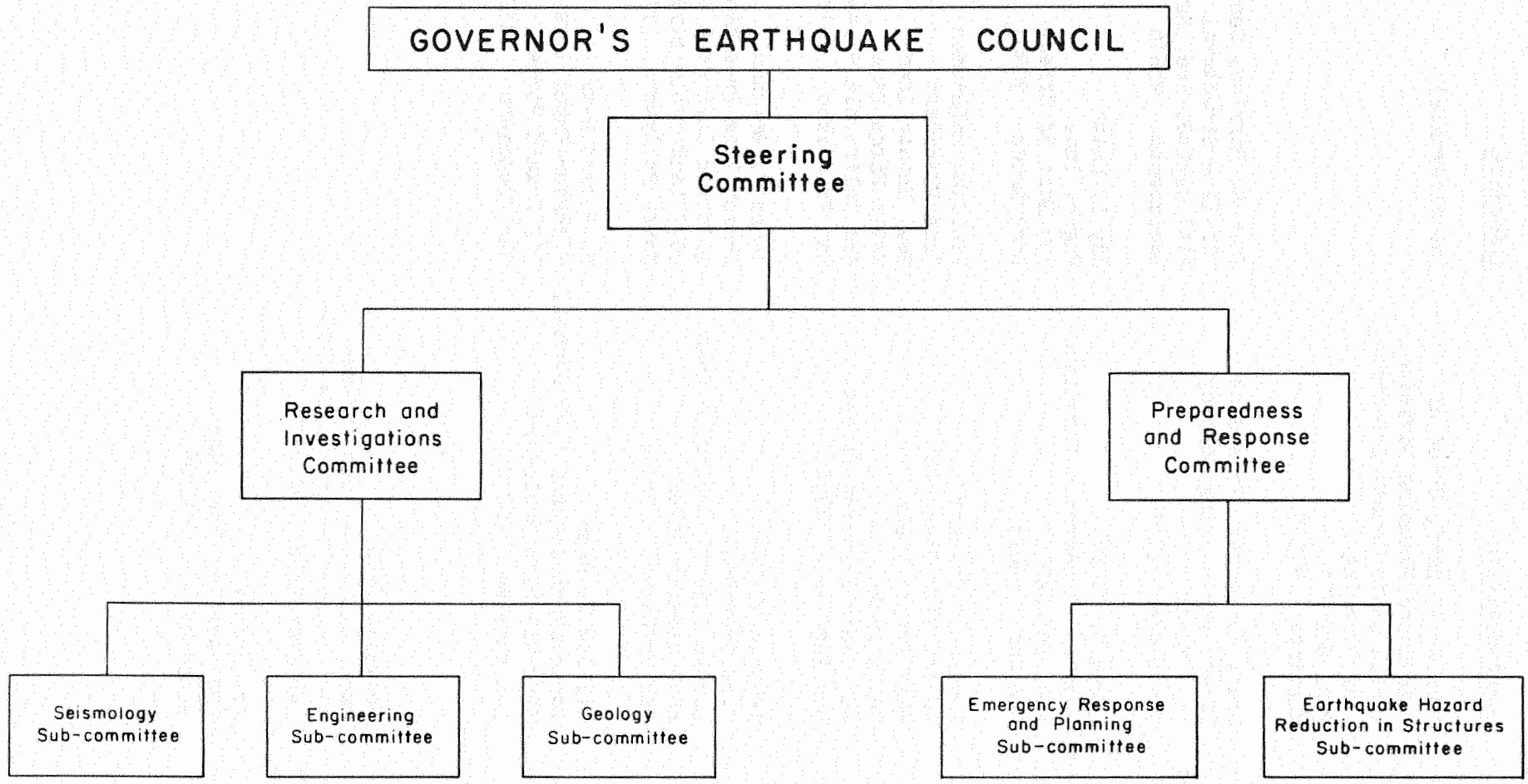

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