EARTHQUAKE ENGINEERING RESEARCH INSTITUTE

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David J. Leeds
Editor

STRONG MOTION PROGRAM

The last issue of the NEWSLETTER focused attention on NOAA's withdrawal from seismological activities. We also indicated that most of the functions would be continued by the U.S. Geological Survey. At the time of writing, the disposition of the Seismological Field Survey had not been determined and may not be finally announced by the Office of Management and Budget (OMB) before April 30, 1973.

The future of SFS is assured, however, by OMB. The National Science Foundation has been directed to determine proper management for the presently designated "Strong Motion Program" and to provide funding for Fiscal Year 1974 since the program is vital to NSF activities. However, it is not possible for NSF to continue the program in-house. At present, there appears to be administrative activity at the highest levels of OMB, NSF, NOAA, and USGS to adjust the seismological activities to meet the various agency objectives.

The Strong Motion Program is not in jeopardy although parent management of the program is undecided for now. Attached letters from NOAA and USGS indicate increased support for seismological activities. A letter from State Senator Alquist (attached) thanks EERI for its concern.

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NSF PROGRAM

Acceptance of a proposal by NSF for a grant to EERI for earthquake investigation planning is "almost a reality". Its objective is to maximize the learning from destructive earthquakes (see attachment). Award of the grant for implementation of the study would require a fixed operating base for EERI, much like that established for the San Fernando Earthquake Study.

The EERI Committee on Planning Earthquake Investigations continued its consideration of the effort in its meeting on February 9 preceding the Annual Meeting.

The objectives of the proposal and the committee report should be of interest. An item of importance is the need for permanent staff. If anyone has any suggestion on the availability of an Executive Director/Manager type with experience in earthquake investigation and reporting, pass the word on quietly to the President or one of the Board.

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PROPOSAL TO

NATIONAL SCIENCE FOUNDATION

Research Applied to National Needs (RANN)

By

EARTHQUAKE ENGINEERING RESEARCH INSTITUTE (EERI)

(A Non-Profit California Corporation)

366 - 40th Street

Oakland, California 94609

For

DEVELOPMENT OF A PLAN TO MAXIMIZE THE LEARNING FROM DESTRUCTIVE EARTHQUAKES

Amount Requested: $199,000.00. Proposed Duration: One Year

Requested Starting Date: April 1, 1973

Principal Investigator: C. Martin Duke, Professor, EERI President

Office Phone: (213) 825-2536

Co-Principal Investigator: D. F. Moran, Structural Engineer

December, 1972

EERI Endorsements

	President and Principal Investigator	Vice President and Co-Principal Investigator
Name:	C. Martin Duke	D. F. Moran
Signature:	_____	_____
Title:	_____	_____
Date:	_____	_____

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I

ABSTRACT

Progress in earthquake engineering is more strongly influenced through experiences in destructive earthquakes than in any other way. The recent San Fernando earthquake provided a one million dollar uncontrolled experiment. It is therefore of the highest importance to maximize the learning from future quakes.

The Earthquake Engineering Research Institute (EERI) proposes to develop a plan to maximize the collection and dissemination of critically needed information emanating from destructive earthquakes. A three part development procedure will be used which includes (1) the identification of subjects requiring investigation, (2) the preparation of material to facilitate the gathering of information on these subjects and (3) the development of a methodology to expedite the dissemination of the information.

Under the overall control and guidance of the EERI President and Board of Directors the operational organization will function with a staff consisting of a project manager and three assistant project managers, responsible in the engineering, scientific and socioeconomic fields. A parallel advisory organization will consist of a main panel and several subpanels roughly representing the same fields. The staff will perform the work of administration, coordination and report preparation in consultation with the respective advisory panels. The advisory panels will develop overall guidelines for the plan and review and approve the staff work.

An operational flow chart (Fig. 1), organization chart (Fig. 2) and schedule (Fig. 3) are included.

II

INTRODUCTION AND APPROACH

Progress in earthquake engineering is more strongly influenced through experiences in destructive earthquakes than in any other way. The recent San Fernando earthquake provided a one billion dollar uncontrolled experiment. Such earthquakes provide the only true test of the ability of engineered works to withstand seismic forces, and the ability of people to react and survive.

It is therefore of the highest importance to maximize the learning from future quakes within the total of the resources that can be brought to bear.

The San Fernando experience showed that the available resources are vast. Numerous local, state, and federal government agencies, universities, trade associations, professional societies and individuals conducted investigations on a variety of topics and made reports. The 1964 Alaska experience was similar.

However, investigative efforts have received little coordination. As a result, excessive attention given to general surveys with substantial duplication, and several important aspects have been insufficiently studied. A national coordination of investigative efforts in future earthquakes is important.

The objective of this proposal is to develop a plan to maximize the collection and dissemination of critically needed information emanating from future destructive earthquakes. This first phase will be mainly concerned with the preparation of a technical plan of action. The essential ingredients of this plan are to (1) identify specific subjects and areas of interest in the scientific, engineering and socioeconomic fields which

urgently require additional investigation; (2) develop a methodology for gathering the required information including guidebooks, banks of base-line information and investigation scenarios of several hypothetical earthquakes and (3) develop a methodology for the rapid dissemination of the results of the investigations to the professions, agencies and organizations concerned.

The Earthquake Engineering Research Institute (EERI) is well qualified to develop this first phase. Experiences of many EERI members in the investigation of destructive earthquakes, including the San Fernando shock of February 9, 1971, have developed a special expertise. Therefore, EERI, through its broad range of disciplines supporting earthquake Engineering, can provide experienced and effective individuals and panels for the administration, planning and guidance of this phase. In addition, EERI proposes to make use of the best available people in all of the fields whether or not they happen to be members of EERI.

It is recognized that additional phases beyond that proposed herein must be completed to reach the overall objective of maximizing our learning from future destructive earthquakes. These additional phases should include the establishment of the plan, developed under this proposal, by identifying people, organizations and agencies who will make the plan viable. A final phase could be the actual implementation of the plan during an investigation of a future destructive earthquake.

It is proposed that EERI not assume any role or perform any activity in the final two phases at this time. However, it should be noted that EERI has accepted an assignment from the California Governers Earthquake Council to assume a role of overall coordination of engineering investigations for California earthquakes.

III

PROCEDURE

The objective of this proposal is to develop a plan to maximize the collection and dissemination of critically needed information emanating from future destructive earthquakes.

In order to achieve this objective, the following three step procedure will be adopted:

Step 1. Identify the specific subjects and areas of interest in the scientific engineering and socioeconomic fields which urgently require additional investigation. This identification process will involve the participation of as many of the leading individuals and organizations in each field as possible. Table I is a summary of subjects and areas of interest, which will be considered in the identification process.

Table I is tentative and additional subjects and areas of interest will undoubtably be recognized in the process of development of the plan. However, the main thrust would be directed toward identifying those subjects which are critical and deserving of a high priority. A priority list will be established in each field.

The identification process will be by personal contacts of EERI staff members with the cognizant professions and agencies plus workshops with members of various advisory panels to be established.

Step 2. Develop a methodology for gathering the information identified in (1) above. This portion of the plan involves the preparation of various software items which can be used as an "off-the-shelf" supply in a future earthquake investigation.

Experience in the San Fernando investigation indicated that, even with a considerable staff of trained inspectors and engineers, the local building departments were unable to compile building damage information

TABLE I

SUBJECTS AND AREAS OF INTEREST

SCIENTIFIC (Basic and Applied)	ENGINEERING	SOCIOECONOMIC
Seismology Geology Geodesy Instrumentation	Soils-Structure interaction Design earthquakes for various locations and levels of safety Buildings, foundations Buildings, structural Distribution of damage vs ground motion, geology and soils. Variations in damage vs lateral force design. Variations in damage vs building type and size. Buildings, non structural Architectural Mechanical Electrical Utilities Electrical Gas Oil Water Waste disposal Tanks Underground facilities Transportation Systems Highways, Bridges and Tunnels Railways, Bridges and Tunnels Airlines Harbors and Shipping Communication Systems Radio, Commercial and Amateur Television Telegraph Telephone	Loss of life and injury Structural hazard Panic hazard Public health hazard Rescue operations Medical facilities, emergency treatment and hospitalization. Psychological Aspects Economic Impact Physical Damage Employment Losses Insurance Government Assistance Land Use Planning Emergency Activities (Evaluation of effectivene Fire Police Building Department Utilities Transportation Communication

of sufficient quality detail so that it could be effectively used by investigators. Similarly, individual professional investigators were hampered by the lack of training and availability of guidelines and forms. For use in these aspects, guidebooks will be prepared covering recommended techniques and procedures for gathering data. One general manual is planned plus several others covering the main fields of interest developed under (1) above.

It is intended that these guidebooks will contain information which will assist all investigators, especially those persons who are relatively inexperienced in earthquake investigations. Information retrieval forms designed for computer input will be developed as a part of each manual. These forms can serve as checklists and guides for investigators and subsequently can be used for rapid correlation of information. Development of appropriate computer programs will be necessary. Printing and publication costs for the guidebooks are not included in this proposal.

The Damage Survey Guide (Appendix B) is a guidebook which was prepared by EERI several years ago. This booklet was helpful in the investigations of buildings following the San Fernando shock. However, the guidebooks prepared under this proposal will be more complete and cover a much wider range of subjects. Furthermore, the forms will be more detailed.

Elementary efforts along this line have been made in some foreign countries by UNESCO.

A training film is another device which could be used in rapid post earthquake training of local professionals who are not experienced in earthquake engineering. The production cost of such a film is not included in this proposal, but the talent for the film would be available from among the people who participate in the preparation of this plan.

Experiences following San Fernando in 1971 and other recent destructive earthquakes have shown that investigators have been hampered by the lack of availability of local information such as maps, building data and drawings, applicable codes, etc. To deal with this, a methodology will be developed which can be used by various local professional organizations and agencies throughout the country to compile data banks of baseline information which will be readily available to investigators in future earthquakes.

Data banks should contain the following baseline information:

Maps showing:

- Major building locations
- Transportation systems
- Utility systems
- Communication systems
- Geology
- Soil conditions
- Recording instruments
- Instrumented structures

Data on buildings, utilities, communication and transportation systems, including:

- Applicable codes and regulations used in the design.
- Brief description of all major structures.
- Design data (or locations thereof).
- Drawings (or locations thereof).

The compilations of these data banks are important for at least two reasons. First, they will be extremely valuable in expediting the investigation and, second, they will automatically help assure interest and involvement of the local professions and government agencies.

Another part of the software program will be to develop detailed investigation plans for various hypothetical earthquakes. The size and depth of each investigation will depend to a large extent upon the size and location of the earthquake and whether or not earthquake resistant construction is involved. An action matrix will be prepared which will serve as a guide. The matrix will consider two sizes of earthquakes, moderate (magnitude 6. 5 to 7. 5) and severe (magnitude 7, 5 to 8. 5). For each of these sizes the following locations will be included:

A. United States, urban area on West Coast (Earthquake resistant construction).

B. United States, urban area outside of West Coast (Little earthquake resistant construction).

C. United States, rural (few structures).

For each size and location of earthquake (total of 6 combinations) a tentative investigation plan and organization will be developed. These plans must be flexible. The exact details of specific investigations must depend on the actual earthquake and local conditions. Each past major earthquake has been unique and has given us new answers and posed unexpected questions. It would not be feasible to develop an exact plan of action to meet all of the possibilities.

Periodic updating of the plans, perhaps annually, must be carried out. This will require conferences or workshops of the involved organizations.

The matrix will contain, for each hypothetical earthquake, a series of decisions and events which should occur in order that the investigation can proceed as rapidly as possible and the information gathering be maximized. The guidebooks, data banks and films mentioned previously will be integral parts of each investigation plan. Estimated funding and manpower requirements for reconnaissance teams and complete investigation

teams and reports will be included.

A critical problem which always follows a destructive earthquake in urban areas is the rapid determination of which buildings are safe for occupancy. Generally, local building departments are not staffed for this emergency. Professional talent, local and perhaps out-of-town, must be used to supplement the building department staff. The training films and guidebooks will be used to train local professionals on the spot to assist the building department as well as to collect needed data.

Dry runs, perhaps in conjunction with civil defense exercises, may be held to test the investigation plans.

Step 3. Develop a methodology for the rapid dissemination of results of the investigations to the professions and agencies.

The professions will be anxious to evaluate their design procedures and to make the necessary changes. The regulatory agencies will be anxious to modify their rules and codes. Research organizations will want to plan their early contributions. All require rapid and accurate access to the new data.

Several methods of achieving this goal will be investigated. Recommended procedures will be incorporated into the various earthquake investigation plans discussed in Step 2 above. Possible methods of achieving this goal include the publication of early preliminary reports, the prompt holding of conferences and workshops, and the computer coding of the data.

An information center or centers may be helpful. Available information could be furnished to these centers as it is gathered and then be disseminated to those who have a need for it. These centers could be staffed by representatives of the concerned professions and agencies.

IV

OPERATIONAL ORGANIZATION

The project will be under the overall direction of the EERI President and Board of Directors (Fig. 1).

A project manager will be in direct charge of the staff operation and be responsible to the EERI President and Board.

Three assistant project managers will perform the detailed work such as coordination with advisory panels, data gathering, contacts and report preparation. It is proposed that these assistant project managers have responsibilities in three main areas: scientific, engineering and socioeconomic. The engineering assignment will require a full time effort. The other two will probably only be required about one half time.

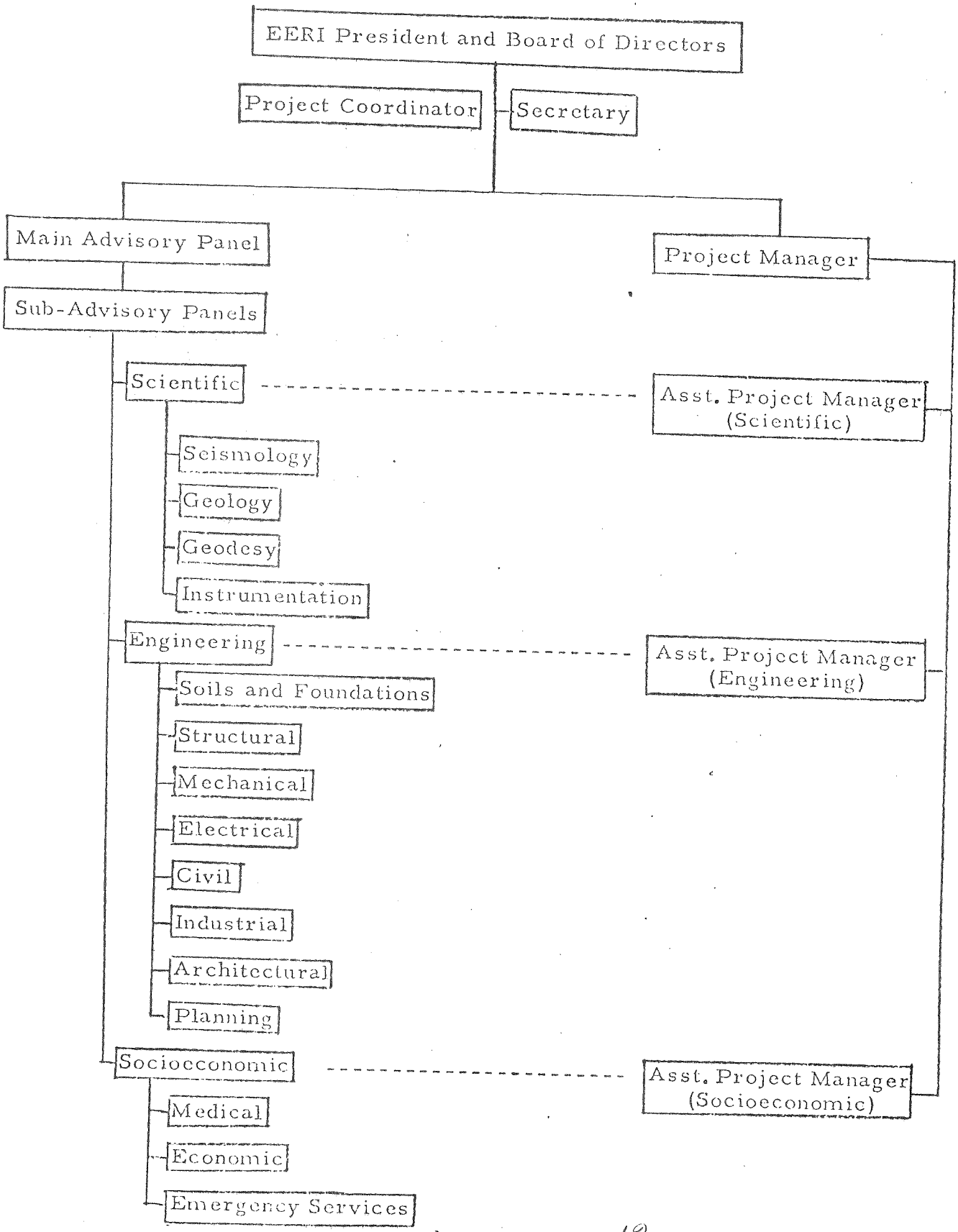
A parallel advisory organization will consist of a main advisory panel and three sub-panels which will guide, monitor and review the entire operation. The main panel will be appointed by and responsible to the EERI President and Board. This main panel will also work directly with the project manager. Several sub-advisory panels will be appointed with direct responsibilities in the scientific, engineering and socioeconomic fields. Members of these panels will be representatives of the professions and agencies involved. The sub-panels will work directly with the assistant project managers but will be responsible to the main advisory panel.

A project coordinator will be responsible for coordinating the activities of the advisory panels and staff. A full time secretary will handle typing, filing, bookeeping and arrangements for travel and meetings of the staff and advisory panels.

This somewhat large organization is essential if the task is to be completed in a reasonable time while taking advantage of the wide range of expertise available, both within and outside of EERI.

ORGANIZATION CHART

Fig. 1



An operational flow chart (Fig. 2) is included to show the sequence of operations and how the staff and advisory panels will function.

V

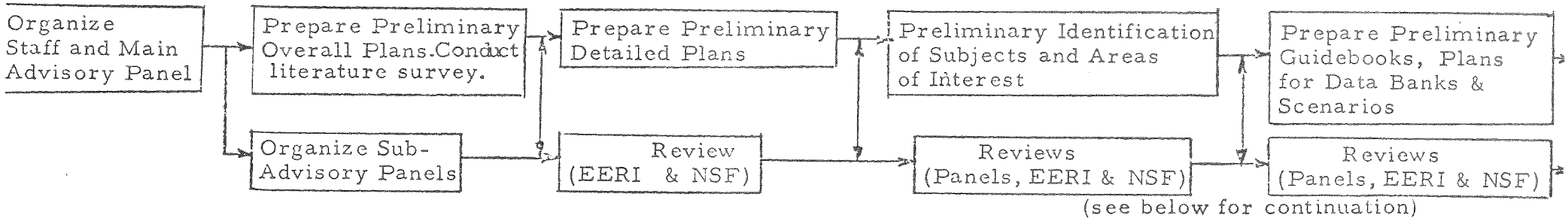
SCHEDULE

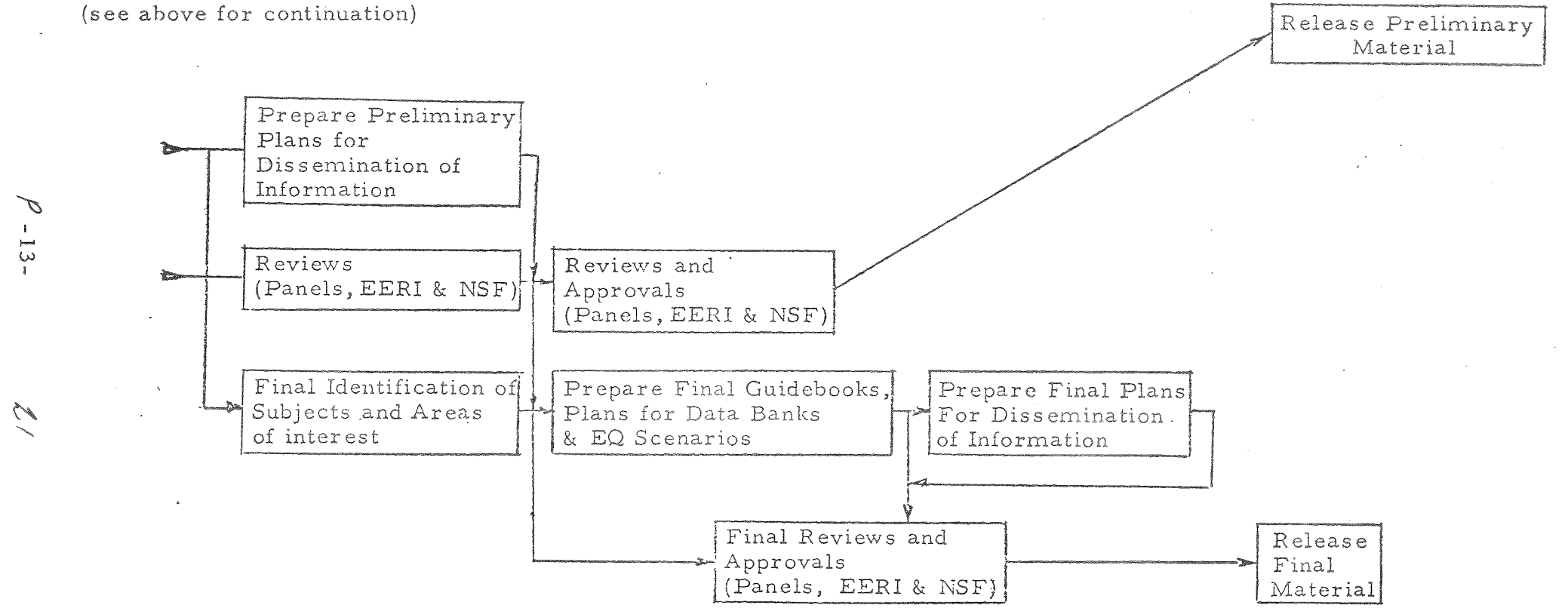
Experience in past earthquake investigations has shown that plans of action, forms, etc. have not been followed or used by investigators unless they were readily available to all concerned and the investigators were aware of their existence and trained in their use.

Therefore, it is essential that this first phase be completed as early as possible, preferably before the next destructive earthquake. It is also important that significant portions of the plan be made available as soon as they are developed in preliminary form.

The following schedule (Fig. 3) reflects a maximum early effort leading to an interim plan, and an overall period of one year to completion of the comprehensive plan.

A literature survey will be included in the first two months effort.



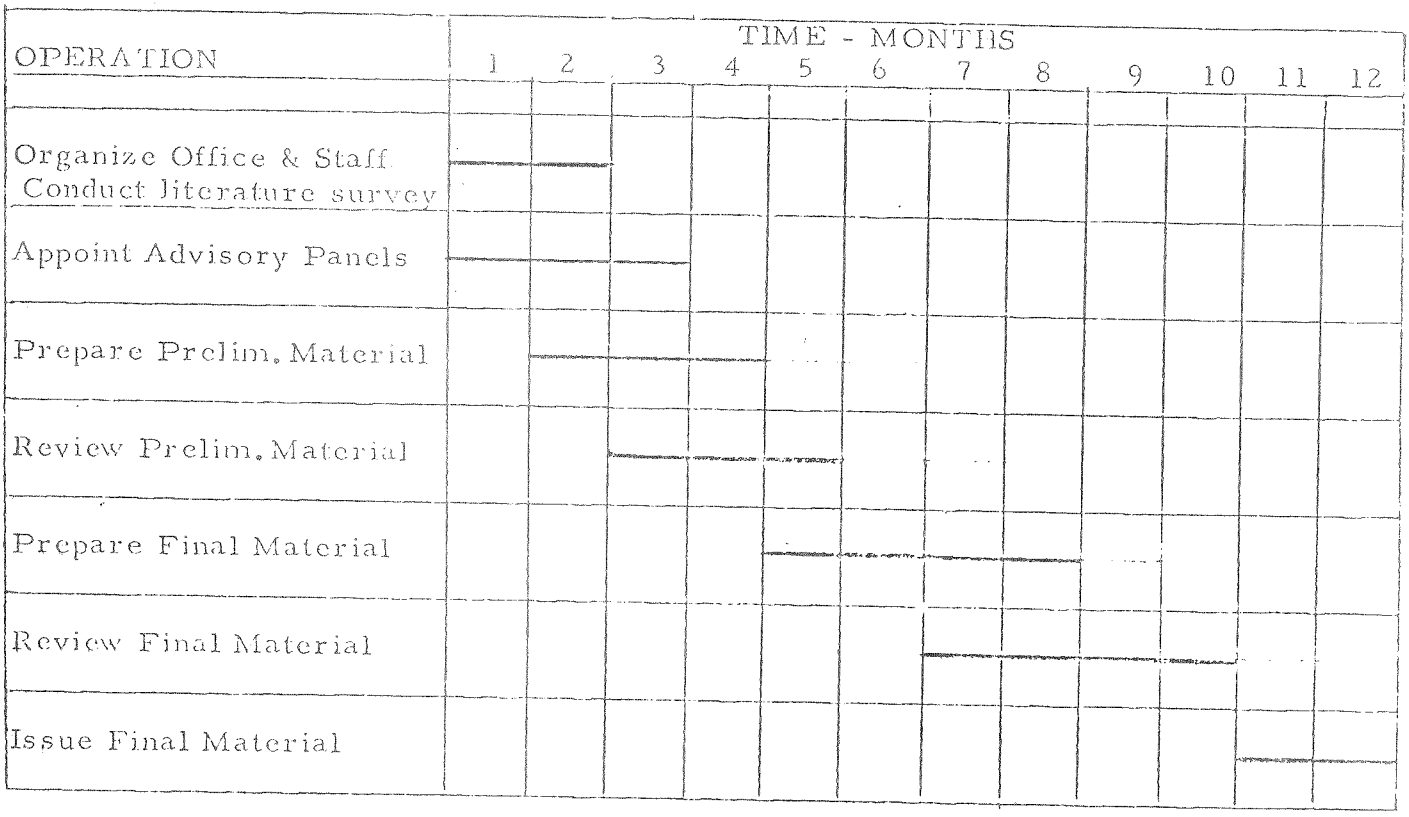


OPERATIONAL FLOW CHART

Fig. 2

SCHEDULE

Fig. 3



VI

BUDGET

A. Salaries and Wages (Staff)

Project Coordinator (Principal Investigator)	15% Time
Project Manager (Co-Principal Investigator)	75% Time
Assistant Project Manager (Engineering)	100% Time
Assistant Project Manager (Science)	50% Time
Assistant Project Manager (Socioeconomic)	50% Time
Secretary	100% Time

B. Total Salaries and Wages

C. Travel (Staff and Advisory Panels)

Domestic

D. Computer Costs

E. Other Costs

Advisory Panels (30 persons for average of 5 days each at $200.00 per man day)

F. Total Direct Costs (B through E)

G. Indirect Costs (50% of $98,000.00)

H. Total Costs (F plus G)

QUARTERLY EXPENDITURE ESTIMATE

First Quarter	$ 60,000.00
Second Quarter	$ 60,000.00
Third Quarter	$ 60,000.00
Fourth Quarter	$ 19,000.00
TOTAL	$199,000.00

This budget is an estimate and is not considered binding in the individual categories.