(d) "Governor" means the chief executive of any State;

(e) "Local government" means any county, city, village, town, district, or other political subdivision of any State, or the District of Columbia, and include any rural community or unincorporated town or village for which an application for assistance is made by a State or local government or governmental agency.

(f) "Federal agency" means any department, independent establishment, Government corporation, or other agency of the executive branch of the Federal Government, excepting, however, the American National Red Cross.

Sec. 3. In any major disaster, Federal agencies are hereby authorized when directed by the President to provide assistance (a) by utilizing or lending, with or without compensation therefor, to States and local governments their equipment, supplies, facilities, personnel, and other resources, other than the extension of credit under the authority of any Act; (b) by distributing through the American National Red Cross or otherwise, medicine, food, and other consumable supplies; (c) by donating or lending equipment and supplies, determined under then existing law to be surplus to the needs and responsibilities of the Federal Government, to States for use or distribution by them for the purposes of the Act including the restoration of public facilities damaged or destroyed in such major disaster and essential rehabilitation of individuals in need as the result of such major disaster; and (d) by performing on public or private lands protective and other work essential for the preservation of life and property, clearing debris and wreckage, making emergency repairs to and temporary replacements of public facilities of States and local governments damaged or destroyed in such major disaster, providing temporary housing or other emergency shelter for families who, as a result of such major disaster, require temporary housing or other emergency shelter, and making contributions to States and local governments for purposes stated in subsection (d). The authority conferred by this Act, and any funds provided hereunder shall be supplementary to, and not in substitution for, nor in limitation of, any other authority conferred or funds provided under any other law. Any funds received by Federal agencies as reimbursement for services or supplies furnished under the authority of this section shall be deposited to the credit of the appropriation or appropriations currently available for such services or supplies. The Federal Government shall not be liable for any claim based upon the exercise or performance or the failure

to exercise or perform a discretionary function or duty on the part of a Federal agency or an employee of the Government in carrying out the provisions of this section.

Sec. 4. In providing such assistance hereunder, Federal agencies shall cooperate to the fullest extent possible with each other and with States and local governments, relief agencies, and the American National Red Cross, but nothing contained in this Act shall be construed to limit or in any way affect the responsibilities of the American National Red Cross under the Act approved January 5, 1905 (33 Stat. 599), as amended.

Sec. 5. (a) In the interest of providing maximum mobilization of Federal assistance under this Act, the President is authorized to coordinate in such manner as he may determine the activities of Federal agencies in providing disaster assistance. The President may direct any Federal agency to utilize its available personnel, equipment, supplies, facilities, and other resources, in accordance with the authority herein contained.

(b) The President may, from time to time, prescribe such rules and regulations as may be necessary and proper to carry out any of the provisions of this Act, and he may exercise any power or authority conferred on him by any section of this Act either directly or through such Federal agency as he may designate.

Sec. 6. If facilities owned by the United States are damaged or destroyed in any major disaster and the Federal agency having jurisdiction thereof lacks the authority or an appropriation to repair, reconstruct, or restore such facilities, such Federal agency is hereby authorized to repair, reconstruct, or restore such facilities to the extent necessary to place them in a reasonably usable condition and to use therefor any available funds not otherwise immediately required: Provided, however, That the President shall first determine that the repair, reconstruction, or restoration is of such importance and urgency that it cannot reasonably be deferred pending the enactment of specific authorizing legislation or the making of an appropriation therefor. If sufficient funds are not available to such Federal agency for use in repairing, reconstructing, or restoring such facilities as above provided, the President is authorized to transfer to such Federal agency funds made available under this Act in such amount as he may determine to be warranted in the circumstances. If said funds are insufficient for this purpose, there is hereby authorized to be appropriated to any

Federal agency repairing, reconstructing, or restoring facilities under authority of this section such sum or sums as may be necessary to reimburse appropriated funds to the amount expended therefrom.

Sec. 7. In carrying out the purposes of this Act, any Federal agency is authorized to accept and utilize with the consent of any State or local government, the services and facilities of such State or local government, or of any agencies, officers, or employees thereof. Any Federal agency, in performing any activities under section 3 of this Act, is authorized to employ temporarily additional personnel without regard to the civil-service laws and the Classification Act of 1949, as amended, and to incur obligations on behalf of the United States by contract or otherwise for the acquisition, rental, or hire of equipment, services, materials, and supplies for shipping, drayage, travel and communication, and for the supervision and administration of such activities. Such obligations, including obligations arising out of the temporary employment of additional personnel, may be incurred by any agency in such amount as may be made available to it by the President out of the funds specified in section 8. The President may, also, out of such funds, reimburse any Federal agency for any of its expenditures under section 3 in connection with a major disaster, such reimbursement to be in such amounts as the President may deem appropriate.

Sec. 8. There is hereby authorized to be appropriated to the President a sum or sums, not exceeding $5,000,000 in the aggregate, to carry out the purposes of this Act. The President shall transmit to the Congress at the beginning of each regular session a full report covering the expenditure of the amounts so appropriated with the amounts of the allocations to each State under this Act. The President may from time to time transmit to the Congress supplemental reports in his discretion, all of which reports shall be referred to the Committees on Appropriations and the Committees on Public Works of the Senate and the House of Representatives.

Sec. 9. The Act of July 25, 1947 (Public Law 233, Eightieth Congress), entitled "An Act to make surplus property available for the alleviation of damage caused by flood or other catastrophe", is hereby repealed.

Approved September 30, 1950."

c. Army

Repair and restoration work of earthquake damage for U. S. Army, Alaska was accomplished through normally established chains of command and through normal construction activities. The Alaska District continued the normal operations of the regular construction program while in addition making damage surveys and designing emergency works for U. S. Army, Alaska.

d. Air Force

Restoration work for the Alaskan Air Command was accomplished in the same method as projects for the normal Air Force construction program. The Alaska District designed emergency work and continued normal operations of the regular construction program while developing more deliberate design for some reconstruction programs.

e. Alaska Railroad

The Alaska District Corps of Engineers accomplished reconstruction work for the Alaska Railroad on a reimbursable basis. The same reimbursable work order procedure was used as was used for the work being done for Office of Emergency Planning. Official authorization for advance planning and design work was given on Seward dock and other related facilities of the Alaska Railroad in letter dated 9 June 1964 from the Assistant Secretary of the Interior to the Secretary of the Army.

f. Alaska State Housing Authority

The Alaska State Housing Authority, acting as agent for the Urban Renewal Administration of the Housing and Home Finance Agency, requested the Alaska District to be the design and construction agency for specific urban renewal projects. The Corps of Engineers, Alaska District, proceeded with urban renewal work immediately upon receipt of individual directives from ASHA.

3-02 MISSION ASSIGNMENTS

Corps of Engineers

Flood fighting repair and restoration are normal operations of the Corps of Engineers. This type of work is carried out utilizing funds provided by Public Law 99 and Operations and Maintenance, General Appropriations.

The Corps of Engineers was formally requested to assume the responsibility for repair and restorative work in the disaster area within the purview of Public Law 875 by letter dated 31 March 1964 from the Director, Office of Emergency Planning, Executive Office of the President. Washington, D. C. The Alaska District, Corps of Engineers, was requested to proceed with the repair and restorative work through its personnel, upon receipt of individual directives from OEP. The directives from OEP Region 8 at Everett, Washington were initiated as a result of requests from public entities, and sent to the Alaska District for action through North Pacific Division Corps of Engineers. Similar requests utilizing other funds were received from the Department of Interior, Alaska Railroad, the Alaskan Air Command, the U. S. Army Alaska, and Alaska State Housing Authority acting for the Urban Renewal Administration.

Mission assignments to the Corps of Engineers by the Region 8, Office of Emergency Planning, in general consisted of the following:

(1) Providing technical assistance, execution of surveys, and submission of reports to the OEP Regional Director.

(2) Emergency repair to and temporary replacement of public facilities, except as reserved to other Federal agencies.

(3) Debris and wreckage clearance.

(4) Performing protective and other work essential for the preservation of life and property.

The District's operations in connection with Public Law 875 are conducted primarily as civil works activities. Professional and administrative judgments are required to determine the eligibility of projects under this law. Public Law 875 relates to emergency repairs and temporary replacement and to provide Federal assistance to alleviate damage, hardship, and suffering brought about by a disaster; but this law is not intended to provide for improvement or betterment.

3-03 ADMINISTRATIVE ASSIGNMENTS

a. Organization and Mobilization

The Alaska District requested engineers from North Pacific Division for damage survey teams. Some 65 engineers for emergency disaster teams were sent to Alaska from the

Walla Walla, Seattle, and Portland Districts to survey damages, and to help in the development of cost estimates and scope of specific projects to be repaired.

The Alaska District also negotiated with architect-engineer firms to execute the design projects defined by the survey teams. A cost-plus-fixed-fee contract was negotiated with a master architect-engineer firm to augment the staff of the Engineering Division so as to insure that designs conformed to both Federal and State standards and met the needs of the communities. The Alaska District organized three new Resident Engineer Offices, one at Anchorage, one at Valdez, and one at Seward, and a number of project offices at the smaller towns to maintain close contact with the communities in developing projects.

Construction contracts were put out in successive increments as much as possible to allow the maximum participation by local bidders. This approach permitted the Corps and architect-engineers to produce bidding documents earlier than if large segments of work were included in one contract. This was an effective way of increasing needed employment and channeling as much of the restoration work as possible to the hard-hit local residents. One of the major problems in every community, and particularly in the smaller ones, was the serious disruption of the local economy. By reducing work to small contracts, the local economy was assisted and some savings of time in accomplishing the assigned mission was achieved.

b. Coordination with other Agencies

Close coordination was involved between the Alaska District and the Office of Emergency Planning during the Corps' task of furnishing the engineering support requested by the Office of Emergency Planning. This support included supervision and administration of construction contracts and support for all types of Public Law 875 work. The Office of Emergency Planning submitted 20 separate work orders to the Corps for various disaster assistance projects.

As was previously mentioned, restoration of projects for the Alaskan Air Command and for the U. S. Army, Alaska was accomplished through normal established chains of command as are done for projects in the regular construction program for each agency.

Work and coordination between the Alaska Railroad and the Corps was accomplished by separate work order procedures, in much the same way as was done for OEP.

Extensive coordination with the Alaska State Housing Authority was necessary to complete urban renewal restoration. Most urban renewal projects required extremely close coordination due to the complex scheduling of demolition of structures to be removed. Also, close coordination was necessary to incorporate the cities' or other political identities' desires, if the desires were within URA regulations.

The Corps of Engineers provided extensive technical and administrative help for the task forces committees and for the Federal Reconstruction and Development Planning Commission. The Federal Commission was set up by President Johnson to develop coordinated plans and recommendations for the reconstruction and economic development of Alaska. The composition of the Commission was conceived so it facilitated design making with a Member of Congress, agency heads and Cabinet Officers working closely together. Both legislative recommendations and major policy decisions by departments and agencies could be agreed to at Commission meetings. After agreements were reached at Commission meetings the members of the Commission had authority to act with broad areas of responsibility without further approvals. Thus, the time involved in the normal process of interagency and Bureau of the Budget clearance of proposed legislation was drastically reduced. On 7 April, the Federal Commission established the Alaska Field Committee. This committee provided coordination at the field level for those problems which cut across agency lines of responsibility. The membership was composed of representatives of agencies serving on the Federal Commission which had staffs in Alaska. Of the task teams, the Corps of Engineers participated in the following: National Resources Development, Ports and Fishing, Scientific and Engineering, and Scientific and Engineering Field Team.

PART IV

EMERGENCY RECOVERY

4-01 DAMAGE SURVEYS

The immediate problem posed by the earthquake was to determine the extent of damages to civilian communities, military installations and transportation facilities. Engineer disaster teams were organized to survey the damage and furnish guidance for emergency restoration to insure public safety, maintain health and to restore communications. Survey teams were sent in light aircraft and wheeled vehicles to check on all communities affected by the earthquake. It became apparent immediately after the earthquake that the Alaska District did not have sufficient engineering personnel to survey the damage, perform the design for earthquake restoration and to carry on the normal workload of military and civil works projects.

Damage survey personnel were requested from Corps of Engineers' offices to help with the earthquake. A disaster survey team of engineers headed by William E. Schaem from the Office Chief of Engineers made a survey of damage to military construction in Alaska. The list of the team members is given in Appendix VII.

It was decided that all earthquake restoration design would be done by architect engineers (A-E). Preparation of criteria packages for negotiation with A-E also presented a major task beyond Alaska District engineering resources. The well qualified engineering firm of Metcalf and Eddy (M&E) of Boston, Mass. was engaged on a cost-plus-a-fixed-fee A-E contract to supplement the Engineering Division's capability. Metcalf and Eddy assembled a particularly well qualified group of engineers, peaking at about 50, under the supervision of Brigadier General B. B. Talley (USA retired) a senior associate in the firm. This organization performed very well, making a significant contribution to the total earthquake restoration effort.

Of the public and private structures, particular emphasis was placed on damage assessment of the many schools in the affected communities. Several schools suffered severe structural damage and were declared to be unsafe. Lightly damaged or undamaged schools were occupied only on verification of the structural adequacy by the staff of the Alaska District.

4-02 INVESTIGATIONS

A vital part of the program was the assembly of adequate technical information to serve as a basis for engineering decision making. Because of the extensive earthquake-induced slides, it was felt that a major soils, geology, and foundation study of these landslides would be needed. An investigation of the landslides and other earthquake damage was initiated on 29 March 1964 by the Anchorage Engineering Geology Evaluation Group under authorization of the Alaska State Housing Authority and the city of Anchorage. In Anchorage, an operational organization was selected which consisted of an architect-engineer group to function under the supervision of the Alaska District's engineering staff. This group was to investigate and report to the Alaska District, along with a board of consultants.

A consultant on soils mechanics and foundations (Shannon and Wilson, Inc., of Seattle) was hired to augment the staff in supervising the programing of soils studies. The studies required the drilling of holes, and testing samples taken from various localities including the slide areas of Anchorage, Seward, and Valdez.

The board of consultants consisted of eminent soils and geology experts which was constituted to monitor and review the progress and direction of the soils and geology studies of the Alaska District and the district's foundations contractor, and to advise the District on the course of action to be undertaken. The Board was composed of Dr. Ralph B. Peck of the University of Illinois, Dr. Laurits Bjerrum, director of the Norwegian Geological Institute, and Thomas F. Thompson of Burlingame, California. Dr. H. B. Seed of the University of California under contract with the firm of Shannon and Wilson, attended the board meetings and gave considerable assistance. Mr. Stanley D. Wilson of the firm Shannon and Wilson was present at many of the meetings and aided in the decisions. Dr. Leo Casagrande, of the Harvard University, gave assistance in electro-osmosis investigations on stabilization efforts for Turnagain Slide.

The work of the investigation was voluminous and of a great variety, and it resulted in comprehensive engineering data on each slide and surrounding area. Subsurface profiles were developed from some 150 borings and other explorations and tests. Comprehensive laboratory investigations were conducted.

The information received from the Alaska District and others enabled the Scientific and Engineering Field Team

(Task Force Nine) to determine and revise risk area classifications on land in or near landslide areas. Risk classifications were changed as additional information was received, and were published in the newspapers along with a semitechnical explanation of the Alaska District's findings concerning stability and restoration of the landslide areas. The Office of Emergency Planning along with the Alaska District also utilized the findings as background for important engineering decisions as to restoration of public facilities and for stabilization in each landslide area.

Shannon and Wilson's report of 28 August 1964 presents the results of the investigation in detail, gives explanations as to reasons for what occurred: and makes final recommendations as to design criteria for remedial measures and land uses. A summary of the conclusions are as follows:

(1) The strong ground motion waves from the earthquake-generated shear stresses in the upper critical soils of the Bootlegger Cove Clay, which underlies parts of Anchorage, caused failure in these soils and permitted horizontal sliding toward the bluffs in locations where height, declivity, and other physical parameters were most unfavorable to stability.

(2) Though all slide areas are stable under present static conditions, all may be expected to experience additional movements of varying magnitudes in another great earthquake.

(3) All areas which failed can be stabilized against another earthquake of similar magnitude and duration by means of slope flattening, buttressing, improvement of subsurface drainage, and other well established procedures.

(4) Settlement of the ground surfaces, in and adjacent to the slide areas, will occur over a period of years due to consolidation of the slide distributed clay and sand strata, especially within the graben and pressure ridge parts.

(5) Many of the bluff slopes in the vicinity of Anchorage underlain by the Bootlegger Cove Clay are of marginal static and dynamic stability, and oversteepening or overloading of existing slopes by excavations at the base or by construction of fills or heavy structures near the crest or on the slope may result in localized landslides.

(6) Ground motions during earthquakes will likely be greater near the crest of such slopes than elsewhere.

Engineering firms were employed by contract for inspection of water and sewer systems in order to obtain data on which to base the design for restoration and reconstruction.

It was necessary to depend upon visual inspection for accomplishment of the more urgent repairs on an emergency basis. Later a more sophisticated inspection was accomplished.

4-03 RECOVERY

a. Demolition and Cleanup

Demolition of damaged, unrepairable structures and the clearance of debris and wreckage from disaster affected areas were begun immediately. Due to short construction season and severity of Alaskan winters, rapid demolition and cleanup was essential so as to clear areas for reconstruction. Since ground surface freezing in the Anchorage area occurs around 15 October to 20 October, speed in demolition and cleanup was essential before freezeup.

b. Utilities

Procedures for testing of certain water lines were included in the provisions of the contracts for inspection, and test requirements were established on the same basis as would be used for new construction. Acceptance of lines, tested on this basis, gave the communities assurance that the repaired system would be as trouble free as possible.

The determination of the location of damage and the delineation of repair methods for sewer restoration was more complex than was the case with the water distribution system. Damage to sewers was not confined to slide areas nor was damage obvious at the ground surface as is often the case with breaks in water lines. Photographic and direct visual inspection of the sewers were employed to determine the location and nature of individual line breaks. Manholes were inspected at the same time that camera crews were using them for access to the sewer. Photographs were made at 30-inch intervals along the pipe in all storm and sanitary sewers smaller than 24 inches where damage was suspected to exist, and direct visual inspection was undertaken in all such sewers 24 inches and larger.

Flushing and cleaning of sewers prior to inspection was required, and some cleaning with "porcupines" and buckets was found to be necessary. It was also found necessary to employ pumping to lower the hydraulic gradient and to bypass some of the sewage flow in heavily loaded sewers. Approximately 700,000 linear feet of storm and sanitary sewers were inspected by contract in the Anchorage area alone, during the summer of 1964. Photography was of two types, one being the "inspectoline" process, in which a 16 mm single-frame automatic camera with stroboscopic flash equipment was used. This equipment is suitable for pipelines 8 inches and larger. It was found that color film gave better results than black and white film. The other method utilized a 35 mm double-frame stereoscopic automatic camera, equipped with stroboscopic flash equipment and a heating device to prevent lens fogging, producing black and white stereo-paired photographs of excellent quality.

PART V

RESTORATION

5-01 RESTORATION

Immediately after the emergency restoration projects were completed, the Alaska District along with other agencies who participated in the restoration effort followed a plan for reconstruction initiated by the Federal Reconstruction and Development Planning Commission for Alaska. Due to the short construction season and the severity of the Alaskan winters, the Commission carefully coordinated critical reconstruction project planning. The representatives of the commission worked closely with the Office of Emergency Planning and with the Department of Defense personnel in expediting work schedules, but also attempted to avoid placing all work in a crash basis in order to lessen inflation, discourage the importation of non-Alaskan labor and pace the reconstruction period for noncritical work. The pattern plan was followed by the district in order to strengthen the Alaskan economy. The plan was first, to make emergency repairs to the utilities and highways; second, to make geologic and soils studies; third, to design projects; and last, to award contracts. In order to expedite the reconstruction, design of the projects many times paralleled the soils studies.

During this period, almost every step was reduced in time under that normally required.

Top priority was given to the restoration of water and sewer systems. Irrigation pipes were laid above ground and garden hoses connected to houses as a temporary water system in many areas. All major breaks in sewer and water lines were repaired before the Alaskan winter arrived.

Reconstruction of port facilities was given a priority second only to that of water and sewers. Almost all of the goods going to and from central Alaska pass through the port facilities.

Repair of the schools was another major and critical area of work that was needed before winter set in. Almost all of the schools were repaired in time for the 1964 fall term. However, where new permanent buildings were required, completion was scheduled for the fall of 1965.

A comprehensive report on earthquake damage, restoration activities and technical information about the 1964 Alaska Earthquake is currently being prepared by the Alaska District for the National Academy of Sciences (NAS). The Alaska District will finalize and bind the report and submit the same to the Chief of Engineers. Chapter titles of subjects included in NAS report and report submitted to Chief of Engineers are included in Appendix II.

The Alaska District had a special interest in the restoration of the small-boat basins. The boat basins had been designed and constructed by the Corps of Engineers, so when restoration was required the Alaska District gave immediate attention to rebuilding the installations. Before the earthquake occurred several basins required additional moorage space. Therefore, at the time of restoration of the small-boat basins, which required extensive construction, additional Corps of Engineers funds were allocated to enlarge the basins. About two million dollars was spent for this expansion work. Restoration of all the small-boat basins was performed by the Alaska District under the Office of Emergency Planning authorization.

General description of the restoration of the major damaged areas is as follows. Immediately following the restoration description of each major damaged area are photographs depicting pre-earthquake, earthquake and/or wave damage, and restoration conditions.

ANCHORAGE AND VICINITY:

Restoration of underground utilities, as well as all of the schools that had light to moderate damage were repaired by construction contracts in time for the beginning of the fall sememster in 1964. Denali Elementary School, which had heavy damage, was available for use at the beginning of the second sememster. West Anchorage High School, which was very heavily damaged, required extensive repair. The moderatly damaged auditorium wing was first restored, in time for use by the school for the first sememster of 1964. Next came the restoration of the severely damaged classroom wing, which was ready for used for the second semester. A new one-story classroom wing was then constructed to replace the destroyed second story of the school. The Government Hill Elementary School, which was destroyed by an earthslide, could not be rebuilt in the same location because of unstable soil conditions. A new school was built and ready for occupancy by August 1965.

Repair of underground utilities also had priority. Surface waterlines were laid immediately after the earthquake so as to provide service in the major slide areas. Essential permanent restoration of water service in all areas was completed well before freezeup, and the temporary surface lines were then dismantled. New wells to replace those destroyed were drilled so as to assure a continued dependable water supply.

Upon completion of soils investigation and review by the Board of Consultants, it became apparent that stabilization of the major slide areas would have to be accomplished, not only to restore the areas to use, but also to protect adjacent property. Due to this the Fourth Avenue slide area was to be stabilized by use of a buttress system. The project was expanded to include the construction of a new utility and street system. The Turnagain slide area posed a problem. Blasting and mechanical stabilization methods became unattractive when drawbacks developed while attempting to consolidate the sensitive clay. Electro-osmosis was then attempted. A test model consisting of 22 railroad rails as probes introducing direct current at varying voltage and amperages to the clay has been to some degree successful in increasing soil strength.

Although some of the experiments were to some extent promising, it was found that the slide material was gaining strength without outside help. Most of the slide material has now gained a greater part of its original strength. Due to the findings, the Alaska District decided that stabilization measures, other than protection of the shoreline, were unnecessary.

Street repairs were deferred until utility repair which required the removal of pavement was complete. All pavement restoration was completed by August 1965.