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EMERGENCY ACTIONS AND DISASTER REACTIONS:

AN ANALYSIS OF THE ANCHORAGE PUBLIC WORKS DEPARTMENT

IN THE 1964 ALASKAN EARTHQUAKE

by

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for

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FOREWORD

This document is one of a series of publications prepared by the staff of the Disaster Research Center, The Ohio State University. This aspect of the work of the Center has been sponsored by the Office of Civil Defense under Contract OCD-PS-64-46 Work Unit 2651-A. Below is a listing of the materials which have been included in the monograph and the report series.

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PREFACE

Everett Hughes once observed that it might appear to outsiders that sociologists chose some of their subject matter on the basis of the status of the object they studied. At least it seemed to explain why many low-status jobs and work organizations were largely ignored compared with the relatively greater scholarly attention given to high-status activities. Whatever the reason, it is true that there are major lacunae in sociological descriptions and analyses of many of the most common but less prestigious community organizations. This monograph starts to fill in one of these gaps, focusing as it does on a municipal public works department.

Besides presenting a sociologically informed view of such an organization during normal times -- very probably the first such study of its kind -- the author also depicts the operation of this kind of complex organization under stress conditions. To be sure, what he presents is but a case study of a single organization, yet his presentation goes beyond mere description. While his notion of viewing complex organization as confederations of rather different groups certainly does not apply to all large organizations, it is a provocative idea and merits examination in other contexts. In this particular instance, the multinature of the public works department clearly resulted in differential responses to the stress condition in which it had to operate.

This monograph is one of a series of continuing publications, initiated by the Disaster Research Center. Some monographs in the series will deal with different aspects of the Alaskan earthquake, and others on different issues and disaster events. These monographs are written with several audiences in mind. One of these audiences is composed of social science professionals. Another is composed of persons responsible for the functioning of organizations. Hopefully, others with no professional or occupational motives will also be interested. With such a diverse audience, it is possible that the final product will satisfy no one. For some, the monograph may be too abstract and theoretical; for others, they may be too detailed and practical. It is hoped, however, that they will have some value for all. This monograph, as well as several others in the series, was written on a project supported by the Office of Civil Defense, OCD-PS-64-46, Work Unit 2651-A. We are appreciative of this support.

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CHAPTER I

INTRODUCTION AND OVERVIEW

Introduction

This monograph has two purposes. The first, and more obvious of these, is to describe the response of one organization to a disaster. The Anchorage Public Works Department was one of several public agencies involved in the emergency operations which followed the March 27, 1964, earthquake in Alaska. Responsible for the maintenance of public streets and for the sewer and water systems of Anchorage, as well as for the engineering tasks associated with these municipal systems, the public works was as important as any other organization in facilitating the recovery of the community from the effects of the disaster. Indeed, given the range of the public works' emergency activities, it was perhaps the most important single municipal organization in this recovery.

In addition to providing case study material, this monograph incorporates two theoretical approaches or formulations relevant to the understanding of organizations in disasters. Both of these were developed at the Disaster Research Center (DRC) and were the result of extensive analysis of existing literature, as well as of organizational data collected by the Center's field teams and from its laboratory experiments and simulations. What follows in succeeding chapters cannot be construed as a test of the propositions in either approach; one of the necessary limits of the case study is, in fact, that it normally cannot test hypotheses. Rather, this monograph employs these theoretical approaches to organizational behavior in an attempt to suggest their uses and limitations. This is the second purpose of the monograph.

This first chapter introduces and defines a number of terms which derive from these two formulations. The descriptive and analytical content of the chapters after this one have been structured by these terms. However, a more complete discussion of the two formulations is reserved for the final chapter of this monograph. In that chapter the expectations which the theoretical approaches generate are illustrated, more or less successfully, by what appears to be the major characteristics of a public works department in a disaster situation. The overall organization of this monograph was dictated by the assumption that it was, first of all, description. Theoretical considerations were defined as secondary in this context.

In several papers written by Haas, Drabek, Quarantelli, and other DRC staff members, a conceptual and theoretical scheme for the analysis of organizational behavior in both "normal" and extreme environments has been elaborated.[1] Several of the concepts which are a part of this scheme have been employed in a somewhat simplified form in this monograph. The most basic of these is the distinction between Time One and Time Two. These terms refer, respectively, to "normal" times and to "emergency" or "disaster" periods. (A distinction between emergency and disaster is suggested later in this

monograph.) The crucial variable in making this distinction is stress, a condition which itself is an index of an imbalance between the demands made on an organization and the capability of that organization in satisfying those demands. Stress and the ratio between demands and capability are discussed more completely in the final chapter. For purposes of the descriptive analysis which follows, the normal-emergency distinction is sufficient.

A number of additional concepts have been employed in the description of organizational behavior, during both Time One and Two. These concepts also derive from the papers indicated above. Somewhat more broadly than in their initial usage, the distinction between performance structure (or tasks) and normative structure (or authority) are incorporated in the following chapters. Tasks, in the context of these chapters, refers simply to the activities of members of the organization -- to the things which they do as members of the organization. To the extent that these activities are recurrent, the notion of performance structure as formulated by Haas is implied.

Similarly, the term normative structure is incorporated in the idea authority, especially when reference is made to patterned deference relationships among members of the organization. These patterns may be said to be the result of social norms, which ". . . operating through the participants, tend to produce the patterning which has been observed."[12] Further, the idea of authority, in the general sense of the capacity to determine the activities of others, is illustrated by certain terms which are less abstract and refer specifically to overt behavior. "Decision making" and "chain of command" (lines of authority) are two such terms. Decision making has been employed to designate responses to the question, "Who decided that such-and-such should be done?" and chain of command has reference to the communication of these decisions, i.e., "Who told you that such-and-such should be done?"

The adjectives official and unofficial are also employed in the decription and analysis that follows. These terms have been attached most frequently to the notions of tasks and authority. In any complex organization, there are certain positions whose occupants, because they hold these positions, are responsible for initiating procedural norms and/or making changes in existing norms. This responsibility may be called official insofar as it adheres in the position itself rather than in the individual who occupies the position. Unofficial norms -- which likewise pertain to organizational tasks or authority relationships -- are those which originate with individuals who do not occupy organizational positions possessing this authority. This does not, of course, eliminate the possibility that norms which were unofficial may become official when recognized as useful or legitimate by the occupants of authority positions.

Several DRC papers by Quarantelli, Dynes, Brouillette, and others present a typology of involvement among organizations in disaster situations.[3] This typology has been extended to serve as the basis for certain

functional distinctions within one organization, in this case, the Anchorage Public Works Department. Four organizational types are developed in Quarantelli's original paper by contrasting established with emergent organizations, and regular with nonregular tasks in a disaster environment. Basically the same comparisons have been employed in the description and analysis of the divisions and sections within the department. Maintenance groups, for example, are contrasted with engineering sections, the distinction being that during the emergency, existing maintenance units performed their "regular" tasks while existing engineering groups performed largely "nonregular" tasks. In addition, one section within the engineering division of the public works expanded its personnel and altered its tasks to the extent that it became a new organization altogether. This illustrates what Quarantelli in his statement called Type IV organizations, emergent groups which perform nonregular tasks.[4]

The various theoretical formulations provide concepts which have been useful in structuring the bulk of this monograph. Again, however, the monograph should not be read as an attempt to test any hypotheses. It remains a case study and, as such, primarily descriptive although an attempt is made to assess the advantages and limitations of both formulations.

Overview of the Monograph

Chapter two characterizes the community setting of the Anchorage Public Works Department. The structure of the city government and the location of the department within that framework, as well as some remarks on the "spirit of Anchorage," are included. The second part of the chapter describes the earthquake itself, and briefly notes the extent and nature of the damages which followed the disaster, with emphasis on those which had particular pertinence for the operation of the public works organization.

A description of the normal, Time One operations and structure of the department are given in chapter three. In this discussion the official distinction among the various divisions and sections of the organization are followed, although wherever unofficial relationships overlap these boundaries they are noted. The data included in this chapter provide the basis for isolating the changes which occured during the emergency (Time Two).

Chapters four and five consider Time Two. Chapter four describes the tasks which the engineering, the maintenance, and the service and administrative personnel undertook. Chapter five continues this discussion with a presentation of the changes (or the continuities) in authority patterns in these groups after the earthquake. Thus, chapters three, four and five constitute the discussion of official and unofficial tasks and authority in Time One and Time Two. Chapter two introduces certain interesting variables which affected, either positively or negatively, the capability of the public works to satisfy the emergency demands. In addition, chapter two suggests something of the nature of the community demands which the public works was required to meet during both Time One and Time Two.

Descriptive material in these chapters is also organized, somewhat roughly, around the aforementioned typology. Thus, in chapters three and five, personnel of the public works are generally categorized as maintenance (existing groups with regular tasks) and engineering (existing groups with nonregular tasks). In addition, consideration is given to organizational personnel, primarily in service and administration, who do not appear to fall within the typology as neatly as do the other two. Descriptive data concerning the emergent group with nonregular tasks that appeared in public works are provided in chapters four and five, but again under the "engineering" rubric.

The final chapter of this monograph is devoted to a reconsideration of the data, to certain major themes which appear again and again in the descriptions, and to a discussion of these themes in terms of the two theoretical formulations introduced in this first chapter.

Methodological Note

The interviews on which this monograph is largely based were conducted in Anchorage, Alaska, by members of the DRC staff. The process of interviewing began within twenty-seven hours following the earthquake in 1964, and was continued through a total of six trips, the last of which took place in September, 1965. Approximately sixty separate interviews were conducted with members of the Anchorage Public Works Department, although some employees were interviewed as many as three or four times. These in-depth interviews typically lasted two hours; some, however, extended for upwards of five hours. All were tape recorded and subsequently transcribed.

An attempt was made to interview all personnel in positions of foreman or higher. With only two exceptions, this attempt was successful. Thus, approximately one-half of the interview data was provided by supervisory personnel. Additional interviews were conducted with other public works employees, the general approach being to sample every fifth member of each division and section in the total organization. Twenty-four members of the department were interviewed in this way. Twenty-five supervisors were interviewed in the 100 percent sample of those personnel. Only supervisory personnel were reinterviewed.

In the writing of this monograph, the data contained in these interviews were supplemented by additional information from a variety of written sources. The annual budgets of the city of Anchorage, minutes of meetings held during the emergency, field notes of DRC personnel, and similar documents provided substantial support for parts of this monograph. Published documents are, of course, footnoted; information derived from unpublished material or from sources other than the recorded interviews is documented in the text.

FOOTNOTES: Chapter I

1. Some of this particular theoretical formulation originates in J. Eugene Haas, Role Conception and Group Consensus (Columbus: Bureau of Business Research, The Ohio State University, 1964). It is developed with reference to complex organizations and disaster situations in two papers: J. Eugene Haas and E. L. Quarantelli, "Organizations Under Stress: Towards a Theoretical Explanation of Variation in Response" (Columbus: Disaster Research Center, The Ohio State University, 1964); and Thomas E. Drabek, J. Eugene Haas, E. L. Quarantelli and Russell R. Dynes, "Research in Organizational Stress Theory," to be published in the National Institute of Social and Behavioral Science Symposia Studies Series. Findings from an experimental testing of some propositions in the formulation are analyzed in Thomas E. Drabek, Laboratory Simulation of a Police Communication System Under Stress, Disaster Research Center Monograph Series (Columbus: College of Administrative Science, The Ohio State University, 1969).

2. Haas, Role Conception, p. 26.

3. E. L. Quarantelli, "Organization Under Stress," Symposium on Emergency Operations, ed. by Robert C. Brictson (Santa Monica: System Development Corporation, 1966), pp. 3-19; Russell R. Dynes, Organized Behavior in Disaster: Analysis and Conceptualization, Disaster Research Center Monograph Series (Columbus: Disaster Research Center, The Ohio State University, 1969); and John R. Brouillette, "The Bureaucratic Model of Organizational Analysis: Its Limits and an Alternative Position," a paper delivered at The Ohio Valley Sociological Society meetings, Notre Dame University, South Bend, Indiana, April 26, 1967. (Typewritten.)

4. Quarantelli, "Organization Under Stress," p. 5.

CHAPTER II

THE COMMUNITY ENVIRONMENT AND THE DISASTER

Any attempt to understand the activities of either individuals or groups must draw certain boundaries, arbitrarily perhaps, but necessary nonetheless if the explanation is not to be as unwieldy and diffuse as the thing itself. Thus, this study of the Anchorage public works has excluded much that is tangential to the organization and its personnel but which would be required were a total understanding possible. There are, however, a number of situational factors which must at least be hinted at if the organization's reactions to the disaster are to be appreciated. To these factors this chapter is devoted.

Two separate sets of situational factors are included in this chapter. The first set, those of the community, includes the relevant climatic, geographical, and social characteristics of Anchorage which appear to have affected the capacity of the public works organization to respond to the earthquake.[1] The second set of factors discussed includes the earthquake itself, the timing of the disaster, the extent of the damage which it caused, and the nature of the destruction, especially as it involved buildings, streets, and utilities for which the public works department is responsible.

Community Environment

Climate and Seasonality

Anchorage is located on the south-central coast of Alaska, almost at the head of Cook Inlet, a large natural bay which empties into the Gulf of Alaska. The city is situated on a broad, undulating glacial plain, roughly triangular in shape, bounded on the northwest by the Knik Arm of the inlet and on the southwest by the Turnagain Arm. On the eastern side of the triangle, Anchorage is bounded by the Chugach Mountains. Between the mountains and Anchorage itself, which is presently concentrated close to the Knik Arm of Cook Inlet, the growth of the city is checked by two military installations: Fort Richardson and Elmendorf Air Force Base. Thus, the suburban perimeter of the city is moving south, toward and along the Turnagain Arm of the inlet.

Compared with other areas of Alaska, Anchorage enjoys a moderate climate, with neither extremes in rainfall or temperature. Its average annual precipitation of fourteen inches is the result of its location behind the Kenai Mountains, a range which lies along the south-central coast of Alaska. The warm and moist winds which prevail from the Pacific are "wrung out" by these mountains before they reach Anchorage, leaving behind more than one hundred inches of rain annually in some areas. Unlike interior regions of Alaska which are subject to extremes of temperature -- from as low as 78° below zero to summer temperatures in the nineties -- Anchorage temperatures are moderated by the Pacific winds. Summers are comparatively cool with average temperatures ranging in the middle fifties and winters are mild,

average temperatures falling in the thirties. The spring thaw, one of the "normal emergencies" which affect members of the public works, occurs during April; winter freezing normally begins again in October. The result is a relatively short warm season of some five or six months, a climatic feature which limits the operations of certain business enterprises, especially the construction and fishing industries.

Indeed, this seasonality is one of the principal characteristics of the Alaskan economic system. Since it is a direct result of the climate of the region, this seasonality is immune to political action. Programs for change can be focused only on the social consequences of these climatic limitations as, for example, the disrupting variations in employment between summer and winter.[2] This variation requires either an in-migration of workers during the summer months or an extended period of unemployment for permanent residents of the area during the winter months. In a Department of Commerce report, Graham makes the following analysis of the effects of seasonal variations on the labor force of the entire state.

> Rough approximations, for which statistical measures are lacking, indicate that in recent years /the 1950's/ the employed labor force at its seasonal high is from two-fifths to one-half larger than at its seasonal low. This means that some 30,000 to 40,000 persons are idle during a part of the year or that a considerable number of workmen must be brought into the State on a temporary basis in order to meet seasonal labor requirements. It appears that a combination of the two alternatives is used. About one-third of the requisite pool of seasonal employees is made up of temporary, non-resident workers. As much as an additional one-fourth of this "surplus" labor pool appears to consist of fulltime residents of the state who are, except for seasonal work, unemployed.[3]

Like private businesses in construction work, the public works department of Anchorage periodically expands its labor pool to accommodate the increased building of the summer months. Particularly true of the general maintenance section of the maintenance division, this expansion creates certain problems which continue to resist solution. To the extent that the temporary employees are new to the system, there is a necessary period of education during which the new men must rely on their permanent co-workers' knowledge and experience. This reduction in efficiency is complicated if friction develops between the permanent and the temporary employees. No evidence is available which suggests whether the same temporary workers return to the same positions each year, but an informal estimate of the yearly employee turnover in the organization places it at something like 20 percent. Such a variation in employees clearly creates expensive problems in training and continuity. Under these conditions, permanent help becomes valuable: the "old-timer" becomes an essential source of information and a highly useful, although often unofficial, supervisor.

Population

The transient nature of the population is not limited to the civilian employees of Alaskan industry and community departments. Anchorage in particular is largely dependent on the presence of federal military installations for employment and general economic stability. Indeed, Anchorage -- in terms of its economic and "cultural" expansion during the 1940's and 1950's -- is something of a creation of the federal military departments. The presence of Fort Richardson and Elmendorf Air Force Base is to this extent a blessing; it is, however, a mixed blessing since the bases add significantly to the transiency of the city's population. The majority of those military personnel who are assigned to Anchorage (and to Alaska), despite present encouragements to bring their families with them, apparently see their residence there only as temporary. A certain reluctance exists on their part to be as active in the political and social affairs of the community as more permanent residents might be. Children of military personnel may be enrolled in the city's schools and military wives may work as secretaries, teachers, and nurses in the Anchorage community, and these families may patronize retail and service enterprises, but they do so with the understanding that this will last only for the duration of the husband's military assignment.

The simple presence or absence of this segment of the population -- in 1960, 25,000 of the 226,000 who lived in the Anchorage area were military -- also has an important effect on the community. When large movements take place which involve these persons (in 1958, for example, 13,000 military personnel left the state), the economic and social life of Anchorage is likely to be directly affected. Again in 1958, and probably associated with the out-migration of the military personnel, 8,500 civilians also left the state.[4]

"Spirit of Anchorage"

Given this fluid population, both military and civilian, there is a cultural premium attached by more permanent residents of the state to their own permanency. According to Rogers, Alaskans are fond of the idea that their state is the "last frontier" open to Americans and that their lives in Alaska -- the clean air, the unspoiled wilderness, and the simplicity of their style -- are the embodiment of the "American dream."[5] These ideas may be associated with two important features of the Alaskan situation: first, the relative youth of the state and its communities (Anchorage, for example, was founded in 1914, and incorporated in 1920), and, second, the great dependence of the economy of the state on the federal government. More than half the personal income of residents of Alaska derives from positions in federal, military, or civil agencies, a fact which requires, perhaps, some explanation or compensation in the light of the American tradition of individualism.[6]

Paradoxically, however, the people of Anchorage, as residents of the state's largest and most progressive city, are proud of the cosmopolitan character the city has taken on. All of the amenities of city

living in the "lower forty-eight" have been consciously sought: utilities, schools, and cultural events which are equal to, if not better than, a city of comparable size elsewhere in the nation. Probably this campaign does not exclude the "last frontier" mythology completely; some sort of combination of the two -- a cosmopolitan pioneer spirit, perhaps -- may be the goal. Even so, the urbanization of Anchorage has not been completely endorsed by the community; some residents have suggested that in following this course of action the city has been misled. A wiser investment of public funds, these critics have argued, largely to themselves, would be the more productive solution, for example building roads to open up potentially lucrative mining areas. But progress, in its more obvious manifestations, remains the goal of the city. Rogers, in a description of the spirit of Anchorage, suggests how the youthfulness of the city, the presence of the military, and the nature of the city's population contribute to this notion of "progress" in the city's life.

> The spectacular expansion of the last two decades resulted from decisions by government planners to locate the major military installations in its vicinity and the Alaskan Command Headquarters just outside its corporate limits. Aside from its strategic location, the forces and elements of Anchorage's growth came from outside the area. As if to illustrate this underlying character, the community does not flow naturally from its physical setting, but appears to be forced upon it. . . . Having little history of its own, drawing the bulk of its residents from non-Alaska sources, the essential spirit of Anchorage does not look back for inspiration. It reaches aggressively and greedily to grasp the future, impatient with any suggestion that such things take time.[7]

This emphasis on wider streets and public utilities -- the construction of a "Fifth Avenue on the tundra" -- has had an important effect on the city department most frequently involved in these improvements, the public works. Thus, that it is, with 169 employees, the largest single city department, may be a reflection of the "spirit of Anchorage." Clearly it is also a reflection of the enormous expansion of the city's population; in the decade from 1950 to 1960, the population of the city increased fourfold, from 11,000 to upwards of 45,000. Just prior to the earthquake, for example, a new hospital had opened, another hospital had greatly increased its operations, a natural gas utility had been formed, a new port facility had been constructed, and the public school system was in the process of change and enlargement. These additions to the city's public facilities were required to serve the growing population adequately, but they were also consistent with the ethos of the community. Not only does this emphasis on progress affect public agencies like the public works, but it also defines to a great extent the type of private enterprise most appropriate to the community. Construction industries and other service-oriented businesses predominate in Anchorage, providing the specialized and professional assistance which a growing population demands.

Structure of the City Government

The city government of Anchorage follows the council-mayor-city manager pattern. The legislative functions of the system are performed by the eight-member city council and by the mayor. City councilmen and the mayor are elected by direct ballot, three members of the city council being elected each year. Elections for both councilmen and mayor are nonpartisan. All matters concerning city policy and major decisions concerning city planning and construction must be considered by the council and the mayor.

The city manager is the chief administrative officer in the city government. Appointed by the city council and the mayor, he has administrative authority over all city departments and agencies, and is the direct supervisor of all the heads of these departments. Thus, the director of the public works, like his counterparts in the other city departments, is responsible to the city manager. The latter, of course, is directly responsible to the city council and to the mayor. The principal function of the city manager is the coordination of all municipal departments, including the annual submission of the budget and other similar administrative tasks. He also has the authority to hire and fire (with discretion) the heads of the various city departments, just as they, within each of their departments, exercise similar authority.

A number of citizens' commissions and review boards have been established to assist the mayor and the city council in matters of policy and enforcement. These are associated with the various city departments as, for example, the parking and traffic commission is with the traffic engineering division of the public works. In addition to these groups, a civil defense disaster committee exists in Anchorage, made up of representatives from many of the city departments -- like the police and fire departments -- and from several civilian groups. Significantly, prior to the earthquake, no one from the public works department was included on this committee.

Communications among the various departments of the Anchorage city government is facilitated by memoranda -- particularly when the communications are from the top down -- and by telephone and radio. All city departments, the public works, telephone, municipal light and power, etc., with the exception of the police department, share the same radio frequency. The police department employs a separate frequency for intradepartmental communications.

The physical location of the departments also makes possible a considerable amount of face-to-face communication. Some administrative offices, like those of the city manager and the mayor, are located in the City Hall; those of the director of public works, the manager of the water division, and the entire engineering staff of the public works, are located in the City Hall Annex which stands directly across the street from the City Hall. The fire department, police department, and civil defense (and the court room and legal offices of the city) are found in the Public Safety Building about three blocks away. Some 14 blocks northeast of City Hall and City

Hall Annex is the city garage and shop; based in this building are the equipment maintenance, general maintenance, and sanitation sections of the maintenance division of public works. The water crews and the maintenance crews of the building construction and maintenance section of the engineering division also work from this building, although the administrative offices of these elements of the public works are in the City Hall Annex. The water treatment plant, located on Ship Creek, is some seven miles from downtown Anchorage; thus, communication between the offices of the water division in the annex and the plant is largely by radio and telephone.

Earthquake

Timing

In those disasters, like earthquakes and explosions, for which there is very little or no warning, the timing of the impact becomes a crucial, if an uncontrollable, factor. When warning is possible (in tornados, hurricanes, floods, and the like), time is available before impact to make certain preparations which will reduce the injuries and damage of the disaster. To that extent, the timing of the disaster is controllable, at least in the sense that persons and property threatened by the disaster can be removed from their normal locations to places of greater safety. There was, however, no warning in the Alaskan earthquake. This section briefly suggests some of the consequences of the particular time of day and season of the year in which the earthquake struck.

With the advantage of hindsight -- "After all, it could have been worse" -- a number of observers recorded some of the advantages of the earthquake coming when it did, at 5:36 p.m., Good Friday, March 27. Dr. Martha Wilson, Director of the Alaska Native Hospital in Anchorage, for example, made these comments in Public Health Reports:

> Had we planned this earthquake, we could not have chosen a better time. In the late afternoon of Good Friday many offices were closed and many people were driving home in automobiles, a relatively safe place to be. Everyone was awake and most persons were clothed. Even more important they had their shoes on, usually an important point in Alaska survival. Fortunately, on this day and during the following week, temperatures ranged from 20°F to 30°. During approximately four months of the year the weather is severe enough to cause fatalities in a disaster situation if suitable clothing and shelter is not immediately available. Building fires for warmth in this disaster would probably have been as hazardous as the freezing cold. When the quake started, the electricity went off immediately. Had it struck at the same time of day three weeks earlier it would have been dark, and no one without a flashlight would have been able to see to rescue children, avoid

> falling objects, escape from breaking and falling structures, or avoid the numerous crevasses which were opening and grinding closed in the earth.[8]

Associated with the early evening of a Friday before a holiday weekend, patterns of community life -- the early closing of shops, offices, and schools, -- undoubtedly helped to keep the toll of dead and injured relatively low. The count of dead in Anchorage as a result of the earthquake was, in fact, only nine. Likewise, although the ground was still frozen and the spring thaw was still several weeks away, the fact that the earthquake occurred near the end of winter probably reduced the hardships severe cold would have provoked. Similarly, the remaining hours of daylight facilitated immediate search-and-rescue operations which would have been much more difficult at night.

In his report on the geological characteristics of the earthquake, Hansen remarked on the fortuitous timing of the earthquake given the almost total destruction of the city's Government Hill Grade School. "If any good fortune accompanied the March 27 earthquake," he wrote,

> . . . it was its timing; had school been in session, the disaster would have been unthinkable. The south wing of the school dropped as much as 20 feet vertically into a graben after being split longitudinally. The playground was a mass of chaotic blocks and open fissures.[9]

For these, and numerous other reasons associated with the rhythm of community life, the timing of the earthquake may be seen as a crucial factor in explaining the relatively low toll in lives the disaster claimed.[10]

Vibratory Damage and Landslides Resulting from the Earthquake

Alaska is part of the seismic belt which circumscribes the Pacific Ocean. Following the southern side of the Aleutian Islands, the belt moves northeast, widening with the Kenai Peninsula and extending inland to the central Alaskan region of Fairbanks. Thus, Anchorage, located just at the mainland juncture of the Kenai Peninsula, is a part of that seismic belt. Evidence exists in the Anchorage area suggesting a number of previous earthquakes, but none resulting in damage comparable to that of 1964 has occurred during the 50 years of Anchorage's settlement.[11]

Indeed, the March 27 earthquake was probably the strongest yet experienced in North America, registering 8.2 on the revised Richter Scale. The quake apparently lasted from four to seven minutes in Anchorage and began with strong east-west movements followed by north-south waves. This rotation of shocks accounts for the damage to high-rise buildings in the area; however, the most extensive property loss was the result, not so much of the vibration itself, as of the combination of these shocks with landslides, surface cracking, and the instability of a substance known

locally as Bootlegger Cove clay which underlies many areas of Anchorage.[12] Brief descriptions of the major areas of damage follow, with particular emphasis on the effects of the earthquake on public property for which the public works is responsible.

With the exception of the six-story control tower which collapsed at the Anchorage International Airport, vibratory and ground cracking damage struck hardest at private property. The six-story Four Seasons Apartments, just completed and not yet occupied at the time of the disaster, was completely destroyed; Penney's five-floor downtown department store was also damaged beyond repair. Two identical fourteen-story apartment houses almost a mile apart sustained extensive vibratory damage. This selectivity of the physical effects of the earthquake is noted by Hansen. He writes that:

> . . . multi-story buildings having large floor areas commonly sustained significant structural damage. . . . Thus, direct seismic damage was highly selective. Aside from variations in design, construction practice, and workmanship, large buildings were more severely damaged than small ones. Inertia was a factor, of course; other things being equal, heavy structures are more susceptible to vibratory damage than small ones.[13]

Damage resulting from ground cracking was, in Hansen's word, "capricious." Such damage was, however, most likely in areas built on Bootlegger Cove clay or in areas with differential ground composition as, for example, areas in which fill had been used. Cracking also tended to follow street curbings and splits made by winter frost. The most extensive and severe damage resulting from cracking occurred in connection with the landslides, especially with the Turnagain Arm and 4th Avenue slides.

Five separate landslides resulted from the earthquake, one of which was small and caused little damage, relative at least to the other four. This smallest slide, variously called the Native Hospital or 1st Avenue slide, involved little more than four acres of land. Part of the lawn and parking lot of the Alaska Native Hospital broke away and slid down the bluff behind the hospital, destroying a fuel storage tank at the foot of the bluff. Surface fractures associated with this slide extended back as far as the hospital building itself and resulted in some damage to the building.

The most spectacular landslide affecting the downtown area of Anchorage was the 4th Avenue Slide. It was concentrated on the north side of the city, especially along the north side of 4th Avenue, an area of business and commerical concentration. In total, some 14 city blocks were damaged, the two blocks between B and D Streets being totally destroyed. Many businesses, apartment houses, and residences in the 36 acres affected by the slide were damaged beyond repair. Between B and D Streets, where the damage was most concentrated and property values were highest, the graben had a width of one hundred to two hundred feet and was as deep as eleven feet; in addition to this vertical displacement, there was in the same area lateral movement northward of as much as 17 feet. Given its central location, the 4th Avenue Slide received immediate attention following the quake.

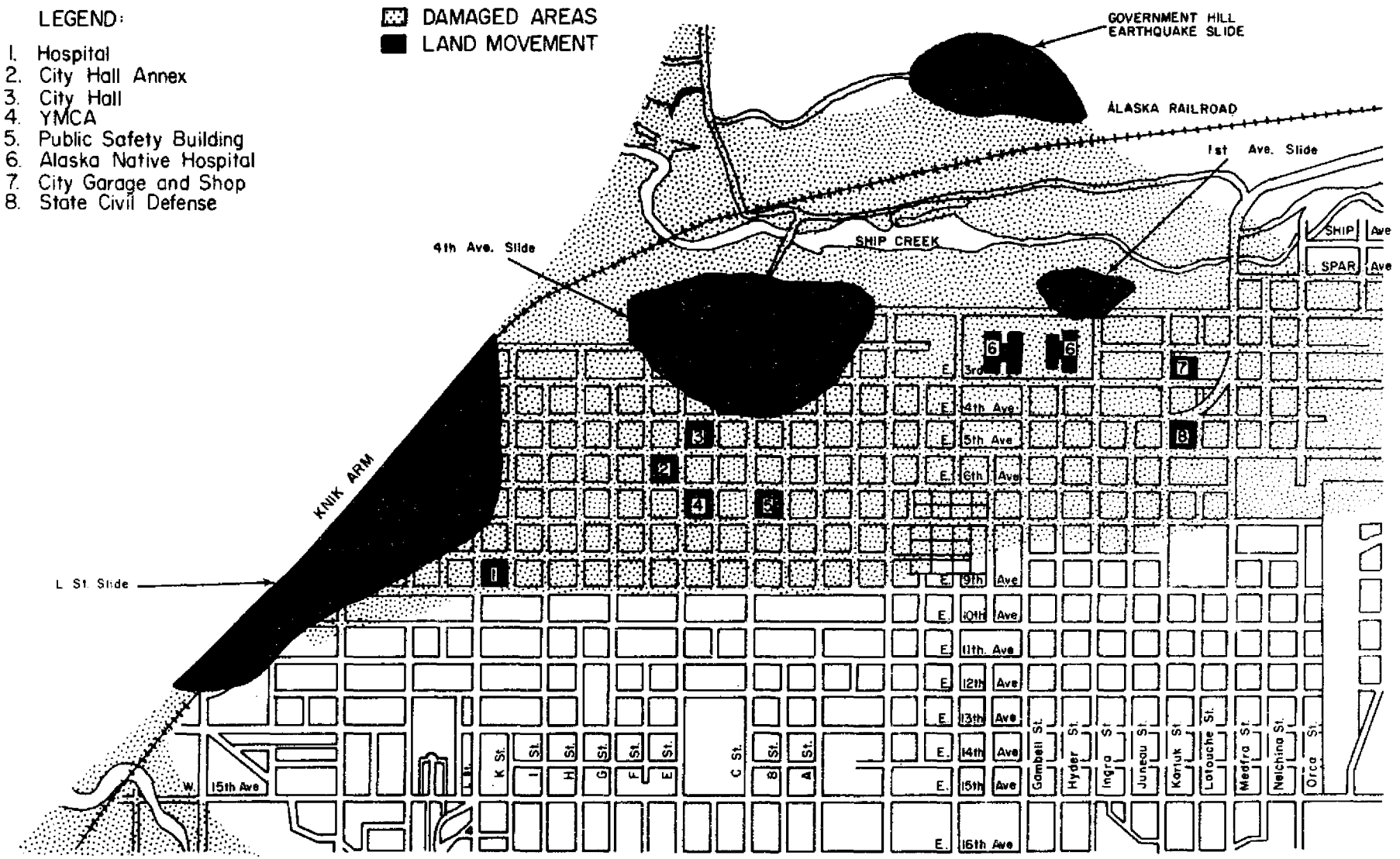

Fig. 1 - Anchorage, Alaska: Location of Damaged Areas and Selected Organizational Buildings, 1964

The Public Safety Building was two blocks south of the graben (at 6th Avenue and C Street), and City Hall and City Hall Annex were three blocks west on 5th Avenue. Because of the area's high value, it was also felt to be particularly susceptible to looting; for this reason, it was heavily guarded during the emergency period. Streets, as well as underground utilities such as water, sewers, and telephone were totally disrupted in this area. In addition, the danger of unstable buildings was acute owing to the concentration of taller buildings in this commercial district than was true of more residential areas. Despite its proximity to the slide, the Public Safety Building was not structurally damaged, and auxiliary power was almost immediately available to replace the normal sources which were cut off by the earthquake. Thus, the Public Safety Building became the disaster headquarters during the emergency period.

The City Hall and City Hall Annex, three blocks west of the 4th Avenue Slide, were also three blocks east of the second major slide to affect downtown Anchorage -- the L Street Slide. Most of the damage resulting from this slide was concentrated along the graben which extended for about 4800 feet above the bluff overlooking the Knik Arm of Cook Inlet. Together with its marginal fractures, this graben affected 14 acres of an area thickly settled with residential and commercial buildings. The graben itself was as wide as 200 feet and dropped as much as ten feet in some places. Lateral shifting of up to 14 feet occurred within the area bounded by the graben and its pressure ridges, but despite this horizontal movement, little obvious damage resulted. Not so obvious, however, was the extensive damage to the utilities systems in the area, as well as essentially hidden structural damage to some of the buildings.

Along the graben of the L Street Slide, the damage was both clear and extensive. The utilities directly affected sustained almost complete destruction, ultimately requiring completely new installations. Hansen describes the L Street graben in the following statement:

> Over all, the graben looked like a dry canal or a stream bed, and when contrasted with the lack of damage on either side, it stirred considerable speculation in the minds of early viewers. . . . One popular magazine account stated that it resulted from the collapse of an old buried but melted-out ice-filled channel![14]

Of its effects on streets and buildings, he adds:

> The whimsical pattern of destruction in Anchorage was perhaps best exemplified by the L Street slide; here wrecked buildings inside and astride the graben faced almost undamaged adjacent properties on either side. . . . Damage was equally capricious . . . in the compressed areas at the tow of the slide; here individual dwellings were buckled or shoved by pressure ridges that as often as not left adjacent buildings undisturbed.[15]

The remaining two slides occurred in the residential areas of the city: the smaller of the two affected the Government Hill area, and the largest of all five land dislocations, the Turnagain Heights section. The Government Hill slide resulted in the destruction of the Government Hill Grade School, contributing significantly to the total of three million dollars damage sustained by the Anchorage school system. In addition, the earthflow in this eleven-acre slide spread out in the yards of The Alaska Railroad just below the bluff on which the school was located. Together with other damage to the railroad such as the failure of bridges, damage to rolling stock and tracks, and vibratory damage to car shops, the cost of the yard damage was upwards of two million dollars. Three houses were also destroyed in the Government Hill slide.

The largest of the Anchorage landslides was suffered by the Turnagain Heights area, a residential neighborhood overlooking the Turnagain Arm of Cook Inlet to the southwest of Anchorage. According to Hansen, the Turnagain Heights slide was

> the largest, most complex, and physiologically most devastating landslide in the Anchorage area. It extended west to east along the bluff line about 8,600 feet. Its maximum headward retrogression from the bluff was about 1,200 feet; its average retrogression into the heavily populated residential section of Turnagain Heights, where 75 homes reportedly were destroyed, was about 500 feet. A total area of 130 acres was completely devastated by displacements that broke the ground into countless deranged blocks, collapsed and tilted at all odd angles. The ground surface within the slide was lowered an average of 35 feet below the old pre-quake level. The volume of earth within the slide was about 12½ million cubic yards.[16]

Hundreds of fractures opened behind the head of the slide in areas of the Turnagain neighborhood which, simply because the vibrations ended when they did, were not directly involved in the slide. However, these fractures added to the total disruption of utilities service and the damage to streets and curbing in Turnagain Heights. Within the slide area itself, hundreds of sharp-crested clay ridges were thrown up by the severe dislocations of the earth. These ridges, averaging between 15 and 20 feet high and as much as 300 feet in length, alternated erratically with ground depressions resulting from the quake. "The chief distinction of the Turnagain Heights slide," Hansen concludes, "was the utter totality of its disruption."[17]

Effects of the Earthquake on Utilities and Other Public Property

Extensive damage was done to private property, both commercial and residential, by the earthquake. The vibrations, the surface cracking, and the landslides contributed directly to the losses private property owners

sustained during the seven-minute disaster. While extensive damage resulted elsewhere, in other parts of Alaska and in California, especially from tsunamis generated by the quake, the concentrated property damage in Anchorage accounted for about 60 percent of the total. In less than five minutes, according to press estimates, some 2,000 people were made homeless in Anchorage.

Utilities, streets, and public buildings were also affected by the earthquake. The most extensive damage was sustained by underground utilities like water and sewers, although the telephone and gas systems (the latter is a private corporation) as well as the electrical system (which, like the telephone utility, is a city department separate from the public works) also sustained considerable damage. Losses to the storm sewer system were estimated as affecting about 50 percent of the system; twenty-five percent of the sanitary sewage collection system was damaged beyond repair. The water system was completely drained by numerous breaks resulting from the earthquake. These breaks were especially serious in the landslide areas, but about 75 additional breaks in other areas resulted from surface cracking and land dislocations. An estimated 50 percent of the underground distribution system was directly affected by the earthquake. In addition, the flow of streams like Ship Creek which are the major sources for the system was temporarily reduced by the loss of water into cracks and fissures in the earth. However, some water continued to enter the system as a result of natural gravity flow although landslides near the intake reduced the amount and subsequently turned this water muddy.

Because electrical power was lost when the earthquake struck, the water treatment plant, normally an automatic system, became a manual operation. The failure of electrical power also left the seven underground wells in the water system inoperative. Later inspection revealed that three of these wells were seriously damaged by the quake.

Hansen makes the following comment on the loss of electrical power in Anchorage, suggesting that it, like the fact that school was not in session, etc., was a blessing.

> Providentially, electric power failed at the very onset of the quake. . . . Although the loss of power might seem to be an added hardship to the stricken city, untold numbers of fires were probably avoided because of the lack of electric current in all the severed wires -- and at a time, too, when water was unavailable for fighting fires.[18]

Streets were disrupted in the areas of major slides -- 4th Avenue, L Street, and Turnagain -- and were also damaged in other areas by the surface cracking associated with the landslides and with the instability of earth materials. Government Hill Grade School was the only city-owned structure to suffer almost complete destruction; other public buildings received considerably less severe damage. For example, offices in City Hall and City

Hall Annex were disrupted as a result of the vibrations, although no serious structural damage was sustained. Similarly, the civil defense offices in the basement of the Public Safety Building were unusable for about three days following the earthquake. Total municipal damage, including that to underground utilities, was estimated at 19 million dollars.

The public works department itself also suffered minor vibratory damage of this kind. Stock in the garage warehouse, for example, was considerably disrupted by the shocks associated with the earthquake. Records and maps in the City Hall Annex offices of members of the public works engineering division were also disorganized. The only serious structural damage was the collapse of the garage roof over the sanitation trucks, damage which did not affect the trucks themselves except to keep them inaccessible for two days until the debris could be removed. With this exception no serious loss of equipment was sustained by the public works as a result of the earthquake.

While the public works experienced little direct damage to its structures and equipment, that department was immediately responsible for streets and utilities extensively damaged by the quake. In summary, then, the statement in the 1964 Annual Report that the public works, "probably more than any other agency of the City, was dramatically affected by the March 27th earthquake,"[19] is less year-end hyperbole than fact.

FOOTNOTES: Chapter II

1. The discussion of Anchorage, its climate and geography, is based primarily on two sources: George W. Rogers, The Future of Alaska: Economic Consequences of Statehood (Baltimore: The Johns Hopkins Press, 1962); and Wallace R. Hansen, Effects of the Earthquake of March 27, 1964 at Anchorage, Alaska (Washington: United States Department of the Interior, 1965).

2. Interestingly, however, the Anchorage construction companies were forced to continue certain ground and construction operations into the winter months following the earthquake. As a consequence of these disaster operations, they discovered that the building season can be profitably extended past the October freeze by the use of plastic coverings and similar equipment. Howard Kunreuther and Elissandra S. Fiore, The Alaskan Earthquake: A Case Study in the Economics of Disaster, Case Study F228 (Washington: Institute for Defense Analysis, Economic and Political Studies Division, 1966), pp. viii, 113-115.

3. Robert E. Graham, Jr., Income in Alaska: A Supplement to the Survey of Current Business (Washington: Office of Business Economics, U.S. Department of Commerce, 1960), pp. 22-23 cited in Rogers, Future of Alaska, p. 107.

4. Rogers, Future of Alaska, p. 109.

5. Ibid., pp. 18, 142-144. Comments indicative of these ideas often appeared in the interviews conducted by DRC. A number of respondents made reference to the "pioneer spirit" of the members of the community in their reactions to the earthquake and to the fact that everyone worked together for the good of all. That this cooperative response need not be attributed to the "pioneer spirit" of Alaskans, but rather to the effect of any disaster on the social system is suggested by Charles E. Fritz, "Disaster," in Contemporary Social Problems, ed. by Robert K. Merton and Robert A. Nisbet (New York: Harcourt, Brace and World, 1961), p. 685.

6. Rogers suggests that the ubiquity of the federal government in Alaska gave rise to one of the "myths" offered frequently as an argument for statehood: if only Alaska could determine her own destiny, all of her social and economic problems, which derived from the federal government anyway, would be solved. Cf. Rogers, Future of Alaska, pp. 145ff. That Alaska continues to be "economically underdeveloped" is suggested by the figures Rogers cites for 1959: during that year military payrolls totaled $112 million and the earnings of civilian employees of military installations added another $50 million to that total. These two sources accounted directly for almost one-third of all personal income in the state. The comparable figure for the United States as a whole was 3.5 percent. Ibid., p. 114.

7. Ibid., pp. 9-10.

8. Martha Richardson Wilson, M.D., "Effect of the Alaska Earthquake on Functions of PHS Hospital," Public Health Reports, LXXIX, No. 10 (1964), 853.

9. Hansen, Effects of the Earthquake, p. 54.

10. However, this kind of reasoning can go on indefinitely: "If's" arise almost automatically to compound the diaster. If it had been at night, if it had been in the coldest part of the winter, if school had been in session, if people had been living in the apartment house or had been shopping in the department store which collapsed, if, etc. . . .

11. Cf. Hansen, Effects of the Earthquake, pp. 66-67.

12. This, and other damage information contained in this section, is derived from Hansen, Effects of the Earthquake.

13. Ibid., p. 22.

14. Ibid., pp. 43, 47.

15. Ibid., p. 43.

16. Ibid., p. 59.

17. Ibid., p. 61.

18. Ibid., pp. 4-8.

19. City of Anchorage, Annual Report, 1964, Anchorage, Alaska (Anchorage: 1965), p. 18.