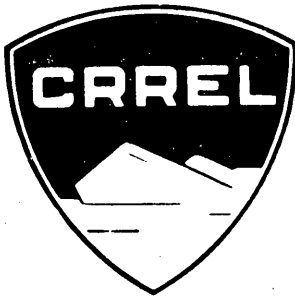


SR 213



Special Report 213

UNDERMANNING AND ARCHITECTURAL ACCESSIBILITY

C. Burgess Ledbetter

October 1974

PREPARED FOR
DIRECTORATE OF MILITARY CONSTRUCTION
OFFICE, CHIEF OF ENGINEERS
DA PROJECT 4A162121A894

BY

CORPS OF ENGINEERS, U.S. ARMY
COLD REGIONS RESEARCH AND ENGINEERING LABORATORY
HANOVER, NEW HAMPSHIRE

The findings in this report are not to be construed as an official Department of the Army position unless so designated by other authorized documents.

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PREFACE

This report was prepared by C. Burgess Ledbetter, Research Architect, Construction Engineering Research Branch, Experimental Engineering Division, U.S. Army Cold Regions Research and Engineering Laboratory. The work was done under DA Project 4A162121A894, *Engineering in Cold Environments*, Task 20, *Cold Regions Facilities Operations, Maintenance, and Engineering of Military Installations*, Work Unit 004, *Habitability Criteria for Military Installations in Cold Regions*.

The report was prepared as one part of a series on Undermanning Theory published in the proceedings of the 5th Environmental Design Research Association Conference, May 1974. It has been revised somewhat for publication by USA CRREL since in this form it is no longer accompanied by other papers.

Technical review of the report was performed by Dr. Robert Bechtel of the Environmental Research and Development Foundation, Kansas City, Missouri.

Manuscript received 22 April 1974

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C. Burgess Ledbetter

Introduction

Barker and Gump (1964), in calculating conditions of undermanning and overmanning, postulated that small organizations, e.g. schools and churches, had higher rates of occupant participation both as a whole and for individual settings* than large organizations. Benefits of undermanned settings and organizations are reported (Barker 1960, Wicker 1973) to include willingness to assume higher and broader levels of responsibility, greater diversity of tasks, willingness to work harder to keep the setting operating, less critical evaluation of other members, and more willingness to accept new members.

Research in organizational behavior and in business organizations is consistent with the theory of undermanning in which small organizations are consistently more undermanned than large organizations, and exhibit the beneficial results of undermanned settings. Reviews of literature by Thomas and Fink (1973) indicated that small organizations exhibit, among members, less disagreement in solving problems and less expression of dissatisfaction, and more opportunity to interact and display leadership behavior. As the size of the organization increases, group cohesiveness decreases and there is a greater tendency to develop cliques.

Porter and Steers (1972) in a review of literature reported that the size of an organization is highly correlated with absenteeism. Also, for small organizations work tasks are more varied, greater individual autonomy is obtained, and the opportunity for social interaction is greater, both vertically and horizontally.

The U.S. Army Cold Regions Research and Engineering Laboratory (USA CRREL) is responsible for a research project on the habitability of cold regions military installations. The author is project officer of the study, which is contracted to the Environmental Research and Development Foundation. The purpose of the study is to derive design, operating and management criteria for renovation and new construction programs which will provide environments more conducive to improved performance and greater satisfaction on the part of occupants.

Part of this study consisted of a behavior setting survey of three remote military stations in Alaska. Remote stations are generally manned by an average of 95-100 military personnel with a few civilians, and have an officer-to-enlisted-man ratio of one to ten. The stations are usually connected by road to towns, but in this case two of the towns were native villages, one accessible from the rest of Alaska only by air and the other by air and sea. The few civilians working at the stations either live on the station or commute from residences in the towns. Civilians tend to work at the bases for several years or longer, while the military are rotated on a one-year remote tour of duty. For some military job specialties the remote tour of duty is repeated every several years; for others, it is a one-time experience.

*An environment can be divided into distinct units called *behavior settings*. Settings are characterized by the people involved in the setting and their behavior, the location of the setting, the physical elements in the setting, and the time the setting occurs. Settings can overlap one another; the degree of this overlap determines whether two potential settings are one setting or separate settings. The Officer's Club Christmas party, supply counter, and trash run are all examples of settings at a military installation.

The remote stations were originally constructed in the early 1950's on a temporary basis, yet have become permanent through the addition of facilities or renovation of the original buildings. The condition of the buildings and the rigors of the climate result in maintenance of facilities being a critical operation.

To reduce repetition of remote duty tours for certain critical specialties and to reduce personnel and logistics costs in general, manpower surveys of the stations were conducted in an attempt to continually lower manning requirements. Callander (1970) reports that a Career Motivation Conference supports undermanning at remote stations, but in addition recommends a number of programs (which have not been implemented) to accompany the undermanning, such as drawing on volunteers, updating the facilities, increasing remote duty pay, exempting remote duty pay from income tax, granting extra credit for retirement, guaranteeing stabilized tours for a specified time between remote duty tours, and allowing families left behind to live in on-base housing.

Since these remote sites have been deliberately undermanned for a number of years, they provide living laboratories for tests of undermanning theory. While all the results of the behavior setting surveys are not complete, preliminary results from two specific areas illustrate the efficacy of undermanning theory and the interaction with design elements.

Accessibility and undermanning

According to Barker's theory (1960, 1968), the larger the organization, the lower the ratio of settings to persons. By Wicker, McGrath and Armstrong's findings (1972) one would also expect attendance to be influenced by capacity and the number of applicants available to a setting or organization. Keeping these factors in mind, the officers' lounges of the three sites provide an illustrative example of all factors in operation (Table I).

The lounge at station 3, which has the smallest population, has the greatest number of settings and the highest setting/population ratio. This would be expected from undermanning theory. But the lounge with the largest population has more settings than the lounge with an intermediate population. And the occupancy time, which is a good indicator of use, places the intermediate site at the highest level of usage. Capacities for each club were roughly the same for seating areas (approximately 600 ft²). The difference would seem to be explained by the accessibility of the lounges to the officers' quarters.

Station 1 (Fig. 1) has the officers' lounge at the end of several buildings housing officers. The lounge is accessible only by walking entirely through the officers' quarters. Station 2 (Fig. 2) has its officers' lounge in the middle of the officers' quarters and is at the juncture of three corridors. One must go through the officers' lounge to get in or out of the officers' quarters. Station 3 (Fig. 3) has its lounge upstairs within the officers' quarters but out of the flow of traffic.

Table I. Utilization of officers' lounges at three stations.

	<i>Station 1</i>	<i>Station 2</i>	<i>Station 3</i>
Design factors	End of corridor	Junction of 3 corridors	Upstairs along corridor
No. of settings	5	2	6
Occupancy time (man-hours/yr)	10,152	17,090	816
Population of settings	14	10	4
Setting/population ratio	0.357	0.20	1.5

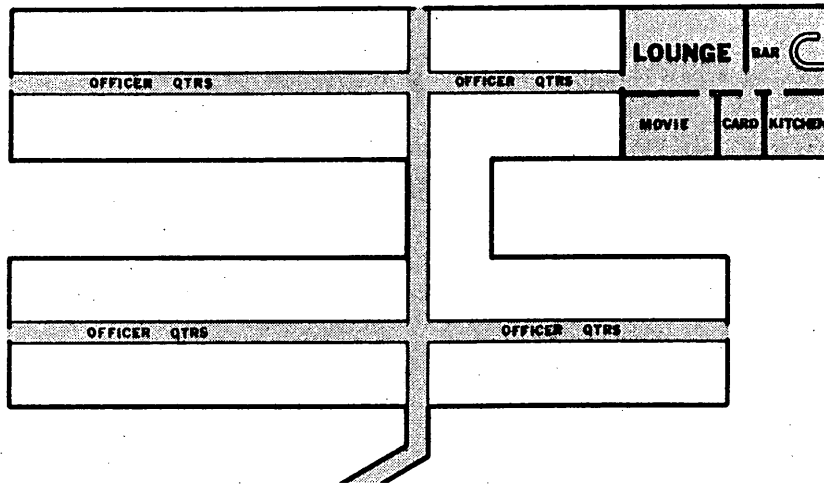


Figure 1. Officers' lounge, station 1.

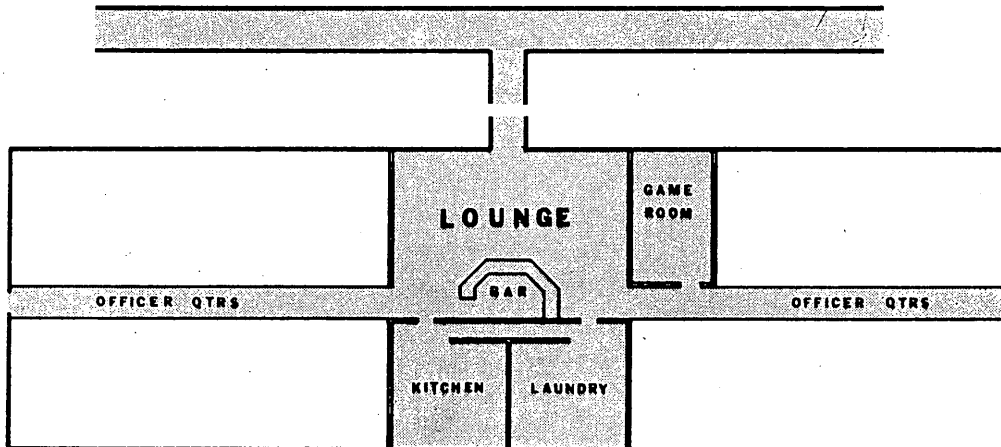


Figure 2. Officers' lounge, station 2.

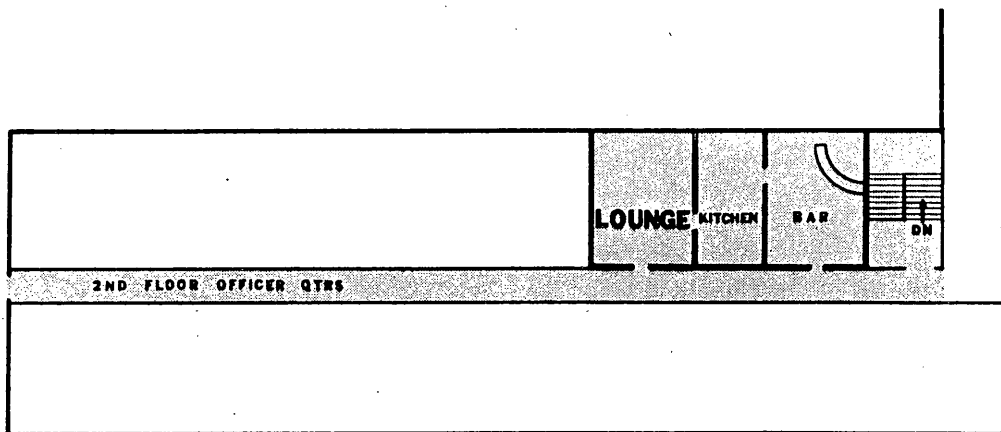


Figure 3. Officers' lounge, station 3.

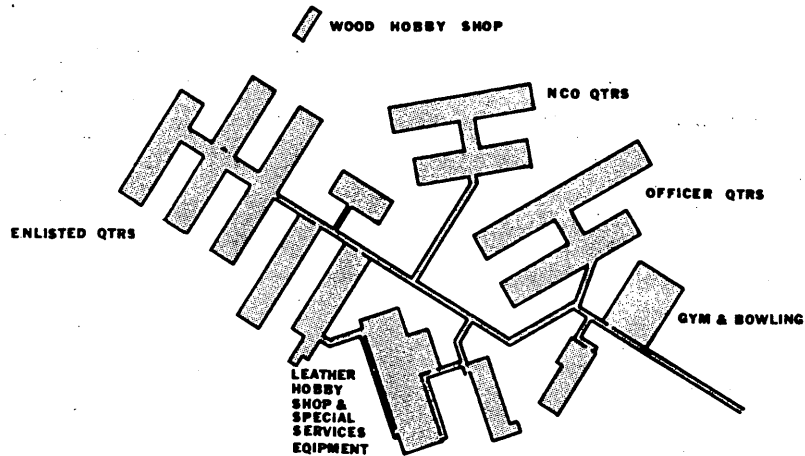


Figure 4. Tunnel system of dispersed station.

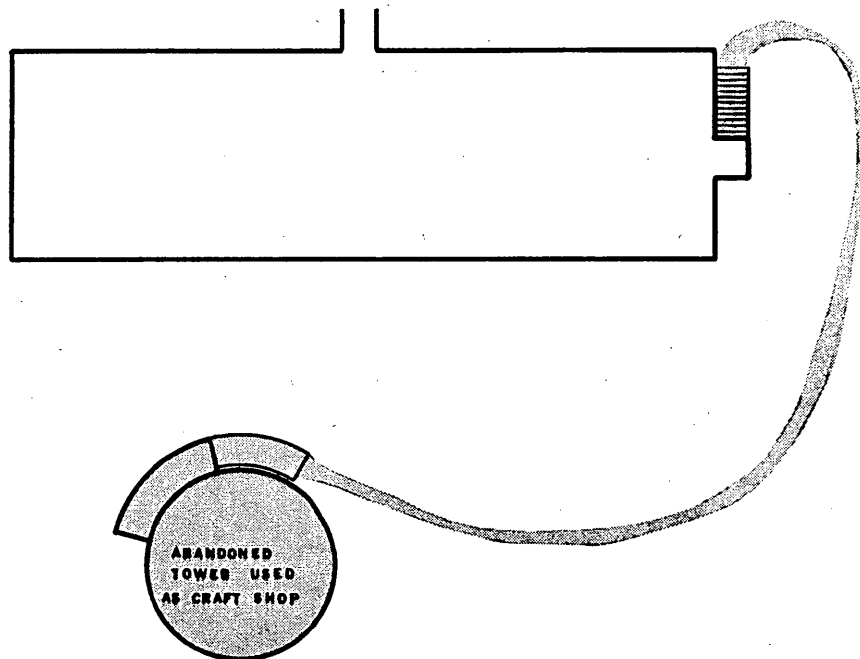


Figure 5. Craft shop unconnected by tunnel.

By observation it becomes obvious why station 2 has the highest occupancy time: it is straddling a main thoroughfare of traffic and provides an ideal social setting for watching the traffic or engaging the passersby in conversation. By contrast, station 3, while it lives up to the undermanning expectation of having more settings, is sparsely occupied because it is so far out of the flow of any traffic. In fact, the reason why station 3 has so many settings is that it provides a vacant space for many meetings. Stations 1 and 2 are so often occupied (relative to station 3) that it would never occur to anyone to assume the space could be taken over for meetings.

Thus, although the three lounges provide nearly equal physical capacities, the accessibility of the space to potential users seems to be the critical factor in determining occupancy. This is related to Wicker et al.'s (1972) "applicants" in that the applicants for station 2 are relatively much

more numerous than for the other two sites. This means there can be two ways to control the flow of population to a setting: one by deliberate design strategies, the other by social attractions within the setting. Presumably, in these cases, the design constraints prevail because beverages are supplied at the same prices in all three lounges.

Capacity of a setting, as explained by Wicker et al. (1972), is determined by physical and social factors. Social factors include the program of the setting, such as rules and standard operating procedures (SOP's) which for remote stations are mostly contained in manuals. Physical factors can include the size of a room, number of seats, and so on.

Physical factors which influence capacity can also influence manning of some settings, or the willingness on the part of potential performers (persons responsible for maintaining a setting) to enter the setting. For example, the building layout of two of the three remote stations surveyed is of the dispersed type; that is, there are separate buildings containing one or several activities dispersed around the site. These are connected by enclosed and heated walkways called tunnels (although they are above the ground). Figure 4 shows a schematic of the tunnel at one station.

Although the tunnels are not reported to be undesirable, the distances from quarters to several recreational activities were said to be a problem, especially when irregular hours were kept by those persons required to be on hand, for example if the leather crafts shop was to be used. Making the long walk, only to find the shop closed, was reported to discourage people from using the facility. In addition, the persons operating the shop would often show annoyance at having to go to the facility to let others use it. At another site this annoyance was even greater and there was less willingness to attend a woodworking and leather shop because it was not connected to the main complex by a tunnel. A trek through the snow at -60°F in a 30 mile per hour wind (-140°F wind chill factor) would often stop the shop's use altogether (see Fig. 5).

Focal point and community

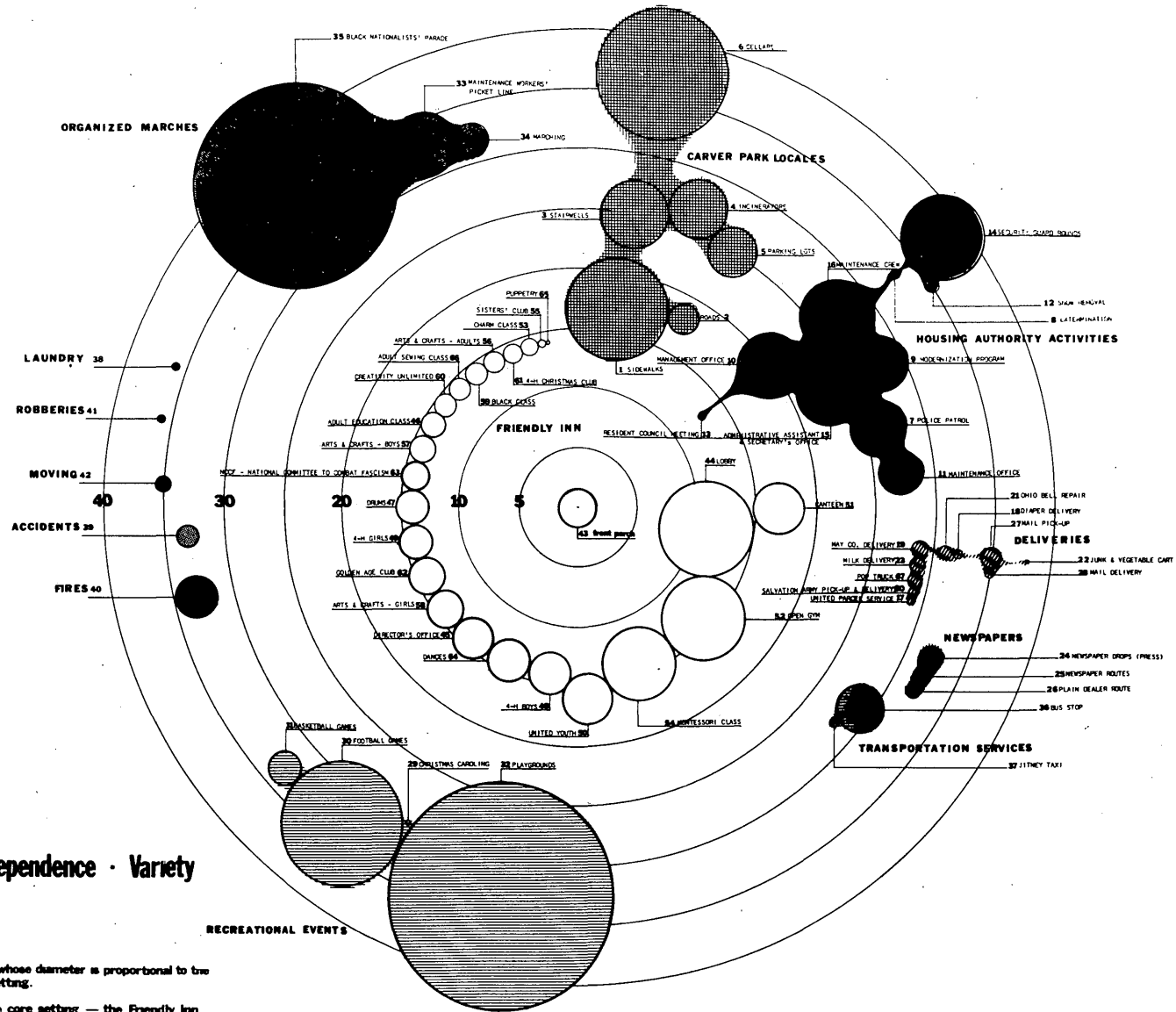
While final data are still lacking, sufficient data exist to show the three stations surveyed are handicapped by not having a community focal point or central gathering area. The focal point is a concept first used in Barker and Wright's (1955) original text on behavior setting methodology and later dropped in Barker's 1968 text. The concept was used by Bechtel (1971) to help diagnose a public housing project and has some utility in describing the influence of physical design properties on the functioning of each site as a community.

The focal point is the most central behavior setting in the community. In Barker and Wright's (1955) small town study it was a drugstore. This was the place where the greatest variety of persons could mingle. All the settings in a community can be portrayed by arranging them in circular fashion around the focal point (see Fig. 6).

What became apparent in the three remote stations studied was that it would not be as feasible to portray them around a single focal point as it would be to portray them arranged around two or more mini focal points. In other words, the sites were really several small communities. At least part of this is due to the design of the stations, which permitted no central gathering place where all personnel could mingle except under highly controlled conditions. Even the dining rooms had spaces for officers and enlisted men, and these were further split by the working shifts.

Observation revealed how a focal point could greatly facilitate the informal business of a community when one particular station commander made a practice of visiting the mini focal points that did exist, and informally managed a great deal of business that would ordinarily have gone through rather laborious channels.

This led to the hypothesis that focal points deliberately designed into remote stations could greatly facilitate the flow of communication among settings, and therefore decrease much of the



General Richness · Independence · Variety

Legend

Each setting is represented by a circle whose diameter is proportional to the GENERAL RICHNESS INDEX of the setting.

The distance of each setting from the core setting — the Friendly Inn front porch at the center of the diagram — is proportional to its INDEPENDENCE (K-value) from that setting.

The position of each setting is proximate to other settings belonging to the same VARIETY.

Figure 6. "ARROWHEAD" behavior-setting diagram.

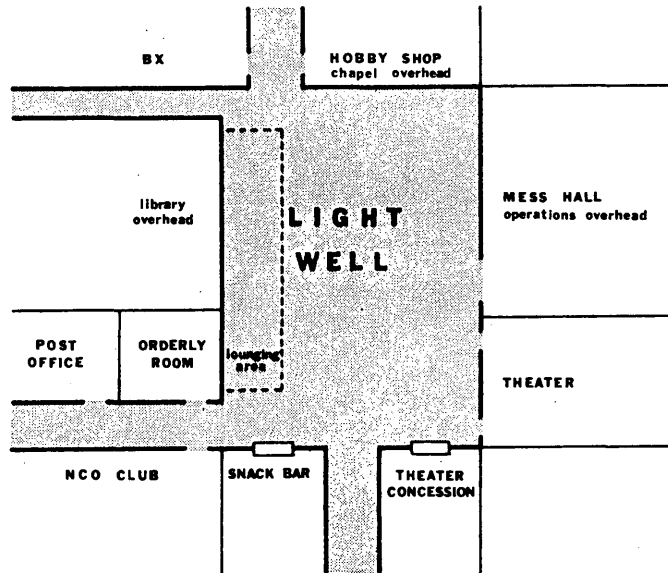


Figure 7. Light well as focal point in composite station.

formal workload. A station that may come close to incorporating these principles is shown in Figure 7.

Actually, the designer of this station did not intend the light well area to be anything more than an area of esthetic amenity. In the plans the only furnishing he showed in the space was a totem pole in one corner. After a time, however, the use of this area as an informal gathering place became so obvious that the personnel installed tables, rugs and chairs, and began eating, conversing and playing games there. The area began to identify with a genuine focal point setting.

The focal point setting may yet be another factor that relates to undermanning because if it functions as Bechtel maintains, it will actually decrease the work load of already undermanned settings. This could be true of both the administrative settings and the recreational settings. The necessary ingredients are that leaders become accessible in the focal point settings.

Conclusions

The behavior setting data from three remote stations in Alaska appear to qualify undermanning theory by adding a factor of architectural accessibility. This is actually a refinement of Wicker's capacity and applicant factors, but the results may demonstrate the architectural factor to be stronger. Since results are preliminary, further evidence may change them.

A hypothesis that structuring settings around a central focal point setting will influence the degree of undermanning may be partially supported by data. It is suggested that deliberately designing remote stations around focal points may permit even further undermanning by reducing the formal work load. While this hypothesis has intriguing design possibilities, it must await further evidence. The Cold Regions Habitability project suggests there are critical design factors that must be taken into account in explaining why undermanning theory does or does not apply to behavior in remote stations.

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DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY <i>(Corporate author)</i> U.S. Army Cold Regions Research and Engineering Laboratory Hanover, New Hampshire		2a. REPORT SECURITY CLASSIFICATION Unclassified	
		2b. GROUP	
3. REPORT TITLE UNDERMANNING AND ARCHITECTURAL ACCESSIBILITY			
4. DESCRIPTIVE NOTES <i>(Type of report and inclusive dates)</i>			
5. AUTHOR(S) <i>(First name, middle initial, last name)</i> C. Burgess Ledbetter			
6. REPORT DATE October 1974		7a. TOTAL NO. OF PAGES 11	7b. NO. OF REFS 10
8a. CONTRACT OR GRANT NO.		9a. ORIGINATOR'S REPORT NUMBER(S) Special Report 213	
b. PROJECT NO. DA Project 4A162121A894 Task 20, Work Unit 004		9b. OTHER REPORT NO(S) <i>(Any other numbers that may be assigned this report)</i>	
c.			
d.			
10. DISTRIBUTION STATEMENT Approved for public release; distribution unlimited.			
11. SUPPLEMENTARY NOTES		12. SPONSORING MILITARY ACTIVITY Directorate of Military Construction Office, Chief of Engineers Washington, D.C.	
13. ABSTRACT Preliminary results from behavior setting surveys conducted at remote military stations in Alaska for deriving habitability criteria for cold regions military installations reveal the architectural factor of accessibility to significantly influence undermanning. Undermanning is the organizational situation in which there are fewer people available to perform any job and hence each person is under pressure to participate. Centralized informal gathering areas, called focal points, were found to be determined by architectural design and appear to influence the degree of undermanning, permitting a reduction in the formal work load.			
14. KEY WORDS Architecture Arctic regions Construction Habitability Psychological effects			