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BUILDING PERFORMANCE EVALUATION OF THE EMERGENCY ANTARCTIC MODULES OF BRAZIL BASED ON THE SATISFACTION OF ITS USERS

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Abstract: *The Emergency Antarctic Modules (MAE) were installed in the area of the Comandante Ferraz Antarctic Station (EACF) in early 2013 to support the removal of the debris from the fire occurred in 2012 and for the continuation of the scientific activities undertaken at the site. The relevance of this work, further to generating key information for the technological improvement of Antarctic buildings, has contributed to the development of the building maintenance plan, which must ensure its best performance in the coming years. The method consisted in: I. Site visit and review of literature and documents; II. Definition of the aspects to be considered and the evaluation procedures to be adopted; III. Elaboration of a questionnaire applied to the current users; IV. Data collection and tabulation; V. Analysis of information and obtainment of results. The main results indicated that the MAE complex complies with its intended function and the overall performance is categorized as good and close to excellent. A few minor problems mainly related to tightness, thermal and acoustic comfort, equipment and privacy were identified. So it was concluded that due mainly to the speed with which the modules had to be installed, it was not possible to meet all the expectations, when compared with permanent buildings. However, as a temporary base – i.e. an advanced base camp – the MAE has qualities that allow people to stay in Antarctica with comfort and safety.*

Keywords: Emergency Antarctic Modules (MAE), Building Performance, Post-Occupancy Evaluation (POE) Methodology, Environmental Comfort

Introduction

The Emergency Antarctic Modules (MAE, Figure 1) were installed in the area of the Comandante Ferraz Antarctic Station (EACF) in early 2013 to support the removal of the debris from the fire in 2012 and for the continuation of scientific activities undertaken at the site. The MAE has been in use since February 2013 and has a minimum service life of 5 (five) years with the possibility of dismantling and relocation (Marinha do Brasil, 2012).

This research was conducted to obtain information for the preparation of the MAE maintenance plan, which must ensure its best performance in the next years. It must be noted that studies of this nature are essential when dealing with buildings in extreme environments, where any possible imbalance can cause potentiated consequences, compared with the occurrences in a different location (Alvarez & Yoshimoto, 2004).

Materials and Methods

The studied building recognition was conducted through site visits, in which possible aspects to be evaluated were identified, also creating an image database for posterior analysis and comparisons. For the theoretical basis a broad literature and documents review about the MAE and evaluation of buildings was made, in parallel with studies of similar examples.

Then the aspects to be evaluated were defined, taking as basis the list of user requirements presented in the Norm of Building Performance NBR 15575-1 (ABNT,

Figure 1. Exterior view of the MAE. Source: Laboratório de Planejamento e Projetos – LPP/UFES – Photographs Collection.

2013), for those that were considered applicable. Also the evaluation procedures were defined, using as reference the methodology of Post-Occupancy Evaluation (POE, or APO in Portuguese) of the Built Environment (Manning, 1987; Ornstein & Roméro, 1992; Altaş & Özsoy, 1998), which considers that the efficiency of the building during its phase of use is measured by user satisfaction. The method had been employed at earlier EACF installations, showing it to be suitable to the specific conditions of the Antarctic environment (Alvarez *et al.*, 2004).

A structured questionnaire was developed for the instrumentation and it was sent to users to be answered individually. This tool was chosen because of its widespread use and scope and also because it considers the user as a primary source of information (Ornstein & Roméro, 1992).

Values were established (-2 to +2) and different colors (from red to green) representing from the worst (very bad) to the best (excellent) performance level of the evaluated aspect, noting that in addition to the responses of multiple choice the methodology allowed the free manifestation of the respondent.

Results

The questionnaire was answered by all the 15 military personnel that spend the winter in the MAE and their responses of the multiple-choice questions are summarized in Table 1.

It can be observed that the overall average score of the evaluated aspects were close to the average score of user satisfaction, validating the approach criteria.

A few minor problems were identified, as shown in Chart 1.

Discussion and Conclusion

The acquired information serve as a starting point for the definition of what must be included in the maintenance plan of the MAE and what should be done for the improvement of building installations. Furthermore, the generated feedback can also be used as a reference for similar cases, just as proposed by Ornstein & Roméro (1992).

Due mainly to the rapidity with which the modules had to be installed, it was not possible to meet all the expectations, when compared with permanent buildings. However, as a temporary base – i.e. an advanced base camp – the MAE has qualities that allow people to stay in Antarctica with comfort and safety. It is also important to note that the previous buildings of EACF possessed a superior level of comfort, when compared to other nearby stations, so that comparative evaluations are natural for those who have been in the Station earlier, which is the case of most respondents.

Table 1. Evaluation of aspects related to the performance of the MAE buildings by the users.

Evaluated Aspects	Grades															Score	
Thermal sensation	+1	+1	+2	+2	+1	+2	+1	0	+1	+2	+1	+2	+1	+2	+1	+1,3	Excellent
Sound isolation – exterior	+1	0	0	+1	0	-1	+1	0	+1	0	+1	+1	+1	+2	+1	+0,6	Good
Sound isolation – between rooms	+1	+1	+1	0	+1	0	+1	0	+1	-1	0	0	+1	0	0	+0,4	Reg./Good
Sound quality – interior	+1	+1	+1	+2	+1	0	0	0	+2	+2	+2	+1	+2	0	0	+1,0	Good
Privacy	+1	0	+1	0	+1	+1	-1	0	0	-2	0	+1	0	+2	0	+0,3	Regular
Natural lighting	+1	+1	+1	0	+1	+1	-1	0	+1	+1	-1	+1	+1	+1	+1	+0,6	Good
Artificial lighting	+1	+1	+2	+1	+2	+2	0	+1	+2	+1	+2	+1	+1	+2	+1	+1,3	Excellent
Safety	+2	+1	+1	+1	+1	+1	+1	+1	+2	+2	+2	+1	+1	+1	+1	+1,3	Excellent
Functionality of the building	+1	+1	+1	+1	+1	0	+1	0	+1	+2	+2	+1	+1	+1	+1	+1,0	Good
Layout of the building	+1	+1	+1	0	+1	+1	0	0	+1	+2	+2	+1	+1	+2	0	+0,9	Good
Flexibility of the rooms	+1	+2	+1	0	+1	+1	0	0	+1	+2	+2	+1	+1	+2	0	+1,0	Good
Suitability of the equipment	+1	+1	0	+1	0	+1	0	0	+1	0	0	+1	+1	0	-1	+0,4	Reg./Good
Functionality of the equipment	+1	+1	+1	0	+1	0	+1	+1	+1	+2	+2	+1	+1	0	+1	+0,9	Good
Tactile sensation of the materials	+1	0	+1	0	+1	0	+1	0	+2	+2	+2	+1	+1	+1	+1	+0,9	Good
External appearance	+1	0	+1	0	+1	+2	+1	0	+2	+2	+2	+1	+1	+2	+1	+1,1	Good
Internal appearance	+1	+1	+1	+1	+1	+2	+1	0	+2	+2	+2	+2	+1	+2	+2	+1,4	Excellent
Building and landscape	+1	+1	+1	0	+1	+2	+1	0	+2	+1	+2	+2	+1	+2	+1	+1,2	Good/Exc.
														General mean =		+0,9	Good
General satisfaction	0	+1	+1	0	+1	+2	+1	0	+1	+2	+2	+1	+1	+2	+1	+1,1	Good

Subtitle of the Grades

+2 = Excellent; +1 = Good; 0 = Regular; -1 = Bad; -2 = Very bad

Subtitle of the Average Score

-2 = extremely bad; -1,9 to -1,3 = very bad; -1,2 = very bad/bad; -1,1 to -0,5 = bad; -0,4 = bad/regular; -0,3 to +0,3 = regular; +0,4 = regular/good; +0,5 to +1,1 = good; +1,2 = good/excellent; +1,3 to +1,9 = excellent; +2 = absolutely excellent.

Chart 1. Summary of the reports of minor problems. The numbers of respondents are in parentheses and the total number of respondents is 15.

	Minor Problems
Comfort	• Eventual entry of water or undesirable air currents (13) through frames and thermal discomfort (11), especially in the compartments assembled from expandable containers; • Temperature difference inside rooms (9), especially in the lodgings, depending on the proximity to heaters, windows, doors and floors, and difficulty to control temperature due to controlling system. • Occasional nuisance due to noise (11) from the heaters and generators, especially in the lodgings; • Entry of gases and particles (5) from the discharge of the generators, depending on the wind direction.
Equipment	• Certain equipment, facilities or furniture are inappropriate, damaged or malfunctioning (7): – Insufficient furniture in some rooms; – Unsatisfactory door components; – Repeated breakdowns of the Water and Sewage Treatment Stations and shortage of instructions regarding the use of the equipment.
Psychological	• Sporadic lack of privacy (4): showers and toilets closed by curtains; • Insufficient environments for socializing (4): small dining room and improvised living room. • Eventual sensation of instability (4) due to shaking of the building caused by strong winds or by the vibration of laundry machines; • Possible risk of accidents (3): slippery floor under the helipad and vertical accesses, lack of emergency signage in the outdoor area; concern about fire.

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