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Development of Fire Risk Assessment Procedure For The University Students' Hostel Buildings In Nigeria

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----------**ABSTRACT**----------

Fire safety in students' accommodation cannot be over emphasized, although, many institutions in Nigeria have given less attention to the program; despite its importance and the devastating effect of fire, thus may result in loss of lives and properties. This paper explores the criteria and attributes for evaluating fire risks in Students' hostel buildings of Abubakar Tafawa Balewa University, Nigeria. Analytical Hierarchy Process method (AHP) was applied in the questionnaire development base on the criteria and attributes extracted from the literature. Expert from building industry with experience in fire safety were selected to respond to the survey questionnaire. Expert choice was use for the analysis and the weightage of the criteria and attributes were obtained. Base on the criteria and attributes weightage the assessment tool was developed and the inspection was carried out. The result suggests that there was very little fire safety provisions in the University female Students' hostel and therefore, the building is at very high level risk of fire.

KEY WORDS: *Fire Safety, Assessment, Experts and Analytical Hierarchy Process*

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I. INTRODUCTION

Achieving an acceptable level of fire safety in University Students' hostel is one of the greatest responsibilities of the University administration. Students' hostel fire can easily cause devastating effect, if appropriate measures are not employed. Even though, the fire occurrence in students' hostel is not much frequent but if it occurs may result in loss of lives and properties. Hence it requires a full and continues devotion from both the University community and the administration. The basic ingredients for accomplishment of fire safety program includes; Thorough planning, Implementation and maintenance [1]. Conducting fire safety program has become part of university activities in developed countries, this help the students to be conscious of fire safety. The most important among all is educating the students about fire safety prevention, detection and suppression [2].Legislation has been passed in USA concerning student housing to be equipped with Sprinklers and smoking is barred on campus [1]. Some universities like Texas have already improved its students' residential accommodation by installing sprinkler system [3].

II. FIE RISK ASSESSMENT

According to [4], the reduction of risk of life and properties to the acceptable level is the objective of risk management or fire safety [5]. There are several ways to achieve risk assessment which can be qualitative, quantitative or the combination of both [6]. Several researches have been conducted on risk assessment and assessment of fire safety in different occupancies. Fuzzy fire safety assessment framework was proposed by [7] for housing block utilizing AHP [8], [9] and Delphi methods to identify the fire safety attributes and the weighting of each respective attributes. The 10-point fire safety ranking system and 20 point ware proposed by Chow [8], [9] using Hong Kong fire codes for the assessment of old high-rise non residential buildings and evaluation of fire safety level of karaoke establishments respectively. Watts [10] elucidates the fire safety ranking systems and he also establishes the fuzzy theory application which may be of significant important in fire safety studies [11]. Although several researches have been conducted in fire risk assessment and evaluation of different facilities, including students' hostel building in many developed countries; however, same studies are still relevant in developing countries like Nigeria.

III. METHODOLOGY

The methodology used in this Study was adopted from [12] which is summarized in the Figure below. AHP application was used to develop the survey questionnaire. The questionnaire was administered to 7 experts in the field of construction industry all with experience in fire safety risk assessment, to prioritized the fire safety criteria and attributes obtained from the literature [13] [12][14][15][8]. The experts includes; Architect, Quantity surveyor, Engineers, Building contractor and fire safety prevention officer. Expert choice software was used in the analysis. The weightage of each criterion and attribute of fire safety was obtained base on the opinion of the experts. The checklist was established based on [16][17]and [18]. Both the weightage of the criteria/attributes of fire safety and the check list that have been established were put together as a tool for assessing fire safety in the university students' hostel in Nigeria.

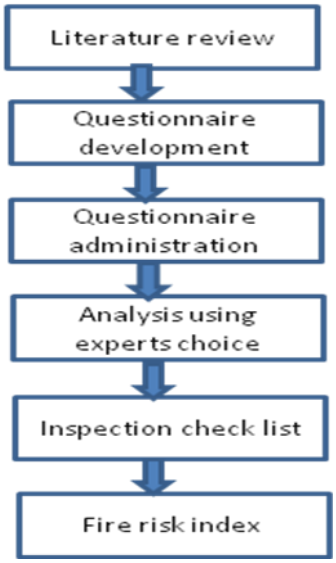

Figure 1. Methodology Process (adopted from M. N Ibrahim et al, 2011)

Table 1 Sample of Inspection Checklist (Passive Protection System criterion)

WALK THROUGH INSPECTION CHECKLIST			
CRITERIA 1 : PASSIVE PROTECTION SYSTEM			
Attributes	Assessment Criteria	Observation	Grade
Number of exits	1.2 exits shall be provided for occupant load 1- 500		
Occupant Load	Minimum area of 4.5m^2 shall be consider		
Width of exit routes	1. 7.5mm per occupant for non-sprinklered 2. 5.1mm occupant for stairways		
Exit doors	1. Door width shall be 813mm or more 2. Door leave width (each) shall be 813mm or more 3. Maximum door width shall be1219mm 4. Door height shall be 2032mm or more Side-hinged swinging shall swing to the direction of exit travel.		
Maximum travel dist.	61m for non sprinklered and 45 for sprinklered		
Corridor width	Shall be 1118mm or more and 9mm or more within a sleeping unit		

Table 2 Assessment grade, corresponding point and its interpretation

Assessment grade	**Corresponding point**	**Interpretation**
1	**0**	**Non existence of fire safety attribute**
2	**0.25**	**Non fulfillment of the assessment criteria in the check list**
3	**0.5**	**Low fulfillment of the assessment criteria in the check list**
4	**0.75**	**High fulfillment of the assessment criteria in the check list**
5.	**1.0**	**Full fulfillment of the assessment criteria in the check list**

IV. RESULTS

The data obtained from A H P Questionnaire surveys of experts was analyzed using Expert Choice software. The score for each of the three criteria were calculated and the following results were obtained.

Table 3. Scores for Criteria and Attributes (**Passive Fire Protection**)

Criteria 1	**Passive FireProtection System**	**AssessmentGrade**	**AttributesWeightage**	**Attributes Score**
Weightage	**0.4564**	**(S)**	**(W)**	**S x w**
1	Number of exit	2 (0.25)	0.2164	0.0541
2	Occupant load	2 (0.25)	0.1213	0.0303
3	Width of exit routes	5 (1.00)	0.1341	0.1341
4	Exit doors	3 (0.50)	0.1561	0.0781
5	Maximum travel dist.	4 (0.75)	0.1345	0.1009
6	Elevator	1 (0.00)	0.2452	0.0000
Total Attributes Score For Criteria **0.3975**				
Resultant Score For Criteria 1 is Total attributes scores x Criteria score = **0.3975** x **0.4564**. Therefore the resultant score for criteria 1 is **0.1815**				

Table 4 Scores for Criteria and Attributes (**Active Fire Protection**)

Criteria 2	**Active FireProtection System**	**AssessmentGrade**	**AttributesWeightage**	**Attributes Score**
Weightage	**0.3956**	**(S)**	**(W)**	**S x W**
1	Fire Alarm / Notification System	3 (0.50)	0.2164	0.1082
2	Smoke Detector/ Fire Detection System	4 (0.75)	0.1213	0.0909
3	Portable fire extinguisher	2 (0.25)	0.1341	0.0303
4	Automatic Sprinkler	1 (0.00)	0.1561	0
5	Fire Hydrant	1 (0.00)	0.1345	0
6	Hose reel/ Stand pipe	1 (0.00)	0.2452	0
7	Emergency Lighting	1 (0.00)	0.3251	0
8	Smoke Management System	1 (0.00)	0.1762	0
9	Exit signage	1 (0.00)	0.2456	0
Total Attributes Score For Criteria 2 **0.2294**				
Resultant Score For Criteria 2 is Total attributes scores x Criteria score = **0.2294** x**0.3956**. Therefore the resultant score for criteria 1 is **0.0907**				

Table 5 Scores for Criteria and Attributes (**Fire Safety Management**)

Criteria 3	**Fire Safety Management and maintenance criteria**	**AssessmentGrade**	**AttributesWeightage**	**Attributes Score**
Weightage	**0.2123**	**(S)**	**(W)**	**S x W**
1	Fire Safety Plan	0	0.2164	0
2	Fire Evacuation/ Emergency Plan	0	0.1213	0
3	Fire Safety Inspection	0	0.1341	0
4	Fire wardens	0	0.1561	0
5	Fire Drills	0	0.1345	0
6	Conducting Programmes and Campaigns awareness	0	0.2452	0
7	Housing Keeping	0	0.3251	0
8	Maintenance of exit routes	0	0.1762	0
9	No Smoking	0	0.2456	0
Total Attributes Score For Criteria 3 **0.0000**				
Resultant Score For Criteria 3 is Total attributes scores x Criteria score = **0.0000** x**0.2123**. Therefore the resultant score for criteria 1 is **0.0000**				

V. DISCUSSION AND CONCLUSION

From the result of the analysis, the female students' hostel score as low as 0.2722 which according the interpretation, is non fulfillment with the fire safety regulations and thus the facility is at great risk of fire. However, this may be as a result of lack of awareness from the Management concerned, because most of organizations need to be made aware of the importance of fire safety provision for their facilities.

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REFERENCES

[1] M. . Us shan, "A Risk Assessment Approach To Fire Safety Ranking of Student Housing Facilities," Msc, King Fahad University of Petroleum and Minerals, Dhahran, Saudi Arabia, Dhahran, Saudi Arabia, 2008.

[2] F. . Mowrer, Fire Save Student Hostel: A Guide for Campus Housing Administration. .

[3] G. Weisenberger, "A Texas-Sized Sprinkler Installation," Consulting Specifying Engineers Magazine, vol. 40, no. 3, p. 50, 2006.

[4] S. Manchester and P. Bardos, Fire Hazards from Self-Heating at composite and waste processing Sites. Watford: Environmental Technology Limited, Building ResearchEstablishment Limited UK, 2004.

[5] G. Ramachandran, "Fire safety management and risk assessment," Facilities, vol. 17, no. 9/10, pp. 363–377, Sep. 1999. [6] D. Amaratunga, D. Baldry, M. Sarshar, and R. Newton, "Quantitative and qualitative research in the built environment: application of 'mixed' research approach," Work Study, vol. 51, no. 1, pp. 17–31, Feb. 2002.

[7] S. M. Lo, "A Fire Safety Assessment System for Existing Buildings," Fire Technol., vol. 35, no. 2, pp. 131–152, May 1999.

[8] W. K. Chow, L. T. Wong, and E. C. Y. Kwan, "A proposed fire safety ranking system for old highrise buildings in the Hong Kong Special Administrative Region," Fire Mater., vol. 23, no. 1, pp. 27–31, 1999.

[9] W. K. Chow and G. C. H. Lui, "A proposed fire safety ranking system for karaoke establishments and its comparison with the NFPA-fire safety evaluation system," Build. Environ., vol. 37, no. 6, pp. 647–656, Jun. 2002. [10] J. R. Hall and J. . Watts, Fire risk analysis. fire protection hand book, 20th edition NFPA. 2008.

[11] S. M. Lo, B. Q. Hu, M. Liu, and K. K. Yuen, "On the Use of Reliability Interval Method and Grey Relational Model for Fire Safety Ranking of Existing Buildings," Fire Technol., vol. 41, no. 4, pp. 255–270, Oct. 2005.

[12] M. N. Ibrahim, K. Abdul-Hamid, M. S. Ibrahim, A. Mohd-Din, R. M. Yunus, and M. R. Yahya, "The Development of Fire Risk Assessment Method for Heritage Building," Procedia Eng., vol. 20, pp. 317–324, 2011.

[13] A. Umar, M. Rashid Embi, and Y. Mohamad Yatim, "Fire Safety Evaluation Frame Work for Existing Plastic Factory Buildings in Nigeria," Appl. Mech. Mater., vol. 584–586, pp. 746–752, Jul. 2014. [14] C. M. Zhao, S. M. Lo, J. A. Lu, and Z. Fang, "A simulation approach for ranking of fire safety attributes of existing buildings," Fire Saf. J., vol. 39, no. 7, pp. 557–579, Oct. 2004.

[15] J. M. Watts Jr and M. E. Kaplan, "Fire Risk Index for Historic Buildings," Fire Technol., vol. 37, no. 2, pp. 167–180, Apr. 2001.

[16] "International Building Code 2012 (IBC)," About.com Home Renovations. [Online]. Available: http://homerenovations.about.com/b/2009/09/22/international-building-code-ibc-free-download.htm. [Accessed: 19-Mar-2014].

[17] International Code Consortium, International Fire Code 2012(IFC). ICC, 2012. [18] "NFPA 101 A Life Safety Code," Quincy MA:National Fire Protection Association,, 1994.