

IMPROVING MAINTENANCE CONDITIONS OF RESIDENTIAL BUILDINGS AND INFRASTRUCTURE THROUGH COMPARATIVE ANALYSIS: A STUDY OF HOUSING DEVELOPMENT CORPORATION ESTATES IN ENUGU

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Abstract

Enugu metropolis has faced high building and infrastructure maintenance needs, whose solutions require the synergy of both residents and facility providers. This is because robust solutions are required as the rate of the population increase could overwhelm the capacity of the residents to cope. The objective of the study was to examine the difference in maintenance conditions of residential buildings and infrastructure between Enugu State Housing Development Corporation (ESHDC) estates in Enugu Metropolis with a view to improving the existing building maintenance practices in the city. Survey design method was applied. A multistage, stratified random sampling technique was adopted in the selection of the sample. Four estates were chosen and representative buildings within these estates were selected. Analysis of Variance (ANOVA) tool was used to test the difference between the ESHDC estates in the Maintenance Conditions of Residential Buildings within them. With p < 0.05, the study found that there was a significant difference between the housing estates investigated in the state of maintenance conditions of the buildings. The policy implication of these findings was that for improved building maintenance conditions, the lessons learned from the better performing estates would be used for guidance on achieving better maintenance conditions in the estates that performed poorer. This could also be applied to other estates which are managed in a similar manner.

Keywords: building maintenance, estate management, maintenance conditions, residential buildings

INTRODUCTION

To enable building occupants carry out their daily activities of work, study, leisure and family life, as well as social interactions, buildings are designed, planned, constructed and managed, based on standards and specifications. These guides have been established by government agencies and professionals who are conversant with the needs and expectations of residents. However, these static standards and specifications often do not adapt to the ever-changing needs and expectations of residents (Meir, Garb, Jiao, & Cicelsky, 2009). As a result, users constantly seek to improve the conditions of their buildings and infrastructure for continued satisfactory

use. This they do through maintenance programmes. Such programmes are the works undertaken on the buildings, their services and infrastructure to keep them in, restore them to, or improve upon their acceptable liveable standards. This leads to the sustenance of the utility value of the buildings. The upgrade of an existing residential building not only extends its useful life, but is often a more affordable option than demolition and reconstruction.

Poor maintenance culture has become a widely recognized problem in Nigeria and has affected the quality of public residential buildings. Occupied residential buildings, in public housing estates in Nigeria, have been found to lack adequate maintenance attention from the estate managers. Similarly, the infrastructural facilities are in very poor and deplorable conditions. A pilot survey of estates in Enugu metropolis appeared to corroborate these assertions. It was against this background that research was conducted to evaluate building maintenance and infrastructural conditions in ESHDC residential buildings with a view to developing improved maintenance and design guidelines for public residential buildings in the study area. The study is a part of that research. The specific objective, here, was to examine the difference between the estates, in Enugu metropolis, in maintenance conditions of residential buildings and infrastructure. To guide the research, the following null hypothesis was proposed: 'there is no significant difference in maintenance conditions of residential buildings, between ESHDC estates in Enugu Metropolis'.

LITERATURE REVIEW

Hsieh (2008) agreed with Kantrowitz and Nordhaus (1980), that the study of maintenance conditions of residential buildings stemmed from the need to document the problems of public residential buildings, develop solutions to them, as well as recommend framework for future public building maintenance programmes. These authors agreed on open-ended evaluation, broad based and multifaceted data gathering approaches and analyses, for distinguishing the outcome of different building maintenance strategies in public residential buildings.

Several researchers opined that professionals design and construct buildings that they often never use, and so their views on liveability should weigh less than the views of the residents who occupy them, particularly as concerning maintenance (Preiser, 1999; Nawawi & Khalil ,2008; Chohen, Che-Ani, Memon, Tahir, Abdullah & Ishak, 2010). Zagreus, Huizenga, Arens, and Lehrer (2004) pointed out how important the views of residents were in investigating the performance of building components to meet the needs and expectations of the residents. Equally, Vischer (2002) affirmed this, noting that users give their views and feelings about buildings-in-use based on their experience and interactions with buildings. However, Fatoye and Odusami (2009) opined that, whereas users' satisfaction with buildings, in public residential housing projects in Nigeria, was associated with the performance of these buildings, the existing studies rarely associated occupants' satisfaction with the maintenance conditions of the building.

Odediran, Opatunji, and Eghunure (2012) stated that the ability of a building to remain continuously usable for human activity is a measure of its functionality. Therefore, as the components of a building begin to deteriorate; it becomes necessary to ensure that the desired characteristics of that building are retained. Likewise, Zeiler and Boxem (2008) as well as Meir, Garb, Jiao, and Cicelsky, (2009) showed that sometimes, original standards and specifications do not conform to the ever-changing needs and expectations of residents. As a result, users would usually seek improved maintenance conditions of their buildings for continued satisfactory use of their spaces. Abdul Lateef, Khamidi, and Idrus, (2011) stated that Physical

elements in buildings may become worn-out and require maintenance, a few months after they are occupied, owing to poor quality of available building materials in the market (at the time of construction). If all the building elements were of good quality, and were built according to international best practices, from the onset, they may last for between fifty to sixty years before maintenance is required.

Also, while reporting a study of public buildings in Malaysia, Waziri and Vanduhe (2013) listed the following factors that led to poor maintenance conditions as; (i) moisture problems from wet areas leading to leakages, (ii) infrastructural conditions, (iii) aging of the buildings, (iv) poor quality control e.g. preventive methods, (v) lack of trained/skilled maintenance crew, (vi) lack of motivation (amongst users) to take care of buildings, (vii) poor communication in maintenance process, (viii) use of defective materials for maintenance works, and (ix) inability (of providers) to appreciate the site conditions. Similarly, Usman, Gambo and Chen (2012), averred that most buildings in Nigeria, whether owned or rented by government, corporate bodies or individuals were very poorly maintained, due largely to (i) poor building maintenance culture and (ii) relatively high cost of maintenance.

Enugu town is the capital city of Enugu State, which is located in south-eastern part of Nigeria. It is located approximately between latitudes 6^0 21" N and 6^0 30" N of the equator and longitudes 07^0 26' E and 7^0 37" E of the Greenwich Meridian. The city played the role of the administrative headquarters of the Eastern provinces (1939-51) and the regional capital (1951-1967). This region was comprised of the five South-Eastern States of Nigeria, i.e. Abia, Anambra, Ebonyi, Enugu and Imo States (see Figure 1). It is comprised of the following local government areas: Enugu East, Enugu South and Enugu North (see Figure 2). The population of Enugu was estimated in 2020 to be 772,872. This estimate represents the urban agglomeration of Enugu, which typically includes Enugu's population and that of surrounding suburban areas. In 1950, its population was 59,663. It grew by 20,549 between 2015 and 2020, an annual change of 2.73% (Encyclopaedia Britannica, 2019; World Population Review, 2020).



Figure 1: Administrative Map of Nigeria showing the 36 States of Nigeria and Federal Capital Territory (Enugu State is highlighted) Source: (nationsonline.org, 2021)



Figure 2: Map of Enugu State showing the Local Government Areas in Enugu Metropolis (Enugu East, Enugu North, and Enugu South) Source: (Umeora, 2016)

METHODOLOGY

The research design for this study was survey design. It focused on public residential buildings of ESHDC housing estates in Enugu metropolis. The zones within the metropolis where these estates are located are shown in Figure 3. The total number of all ESHDC housing estates in the metropolis is 15, as shown in Table 1. This constituted the research population.

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Figure 3: Location of zones housing the public housing estates in Enugu Metropolis Source: (scrip.org, 2021)

S/ N	Name of Estate	Location	Year developed	Number of residential
1		TT :	10(2	units
1.	African Real Estate, Uwani	Uwani	1963	108
2.	Riverside Estate phases I & II	Abakpa Nike (low, medium and high density)	1966	821
3.	Trans Ekulu Phases I to VI including RCC Plots and RD Plots	Trans Ekulu	1976	2589
4.	Republic Layout Phase I, II, III, IV (former EHOCOL	Independence Layout (low, medium and high density)	1990	273
5.	Harmony Estate	Umuchigbo (Not yet functional)	1998	1338
6.	Q-series Mini Estate		2000	9
7.	Golf Course Estate phases I, I ext, II, IV, V	GRA (medium and low density)	2000	509
8.	Independence Avenue Pocket layout	Independence Layout	2001	38
9.	Ekulu East Estate	Former Zoo (Low Density only)	2002	142
10.	Greenland Estate Phases I, II, III	Bungalows @ RACK	2003	216
11.	New Abakaliki Road Layout Area A	Emene	2004	275
12.	Maryland Estate Phases I, II. (Former Loma Linda)	Independence Layout	2007	406
13.	Coal City Gardens Estate, GRA	GRA, behind CAN	2007	323
14.	Liberty estate I, II		2008	101
15.	Ivory Quarters Parcel A. B. C	T/E Near CBN Quarters	2010	78

Fable 1: E	SHDC housing	estates in	Enugu	Metropolis	Occupied	By 2012
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Source: Fieldwork, 2015

A multistage, stratified random sampling technique was adopted in the selection of the study sample. At the first stage, the ESHDC estates were stratified based on their ages (see Table 2). This gave rise to four categories following the age groupings (5 to 15; 16 to 25; 26 to 34; and 35 and above). Four estates (one from each group) were then selected by simple balloting. These were Ekulu East, Golf, Republic and Riverside estates.

Table 2:	Stratification	of	occupied	Housing	Estates	by age
		-				

5 - 15 YEARS OLD	16 - 25 YEARS OLD	26 - 35 YEARS OLD	ABOVE 35 YEARS OLD
Coal City	Golf Estate	Republic Layout	African Real Estate
Ekulu East	Harmony Estate		Riverside Estat
Greenland	Ind. Avenue Layout		T/Ekulu
Maryland	Ivory Quarters		
Pocket Layout	New Abakaliki Rd		
	Q-Series		

Source: Field Work, 2015

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At the next stage, simple random sampling technique was, again, used to select the residential buildings (in the estates) where questionnaires will be administered. Here, the technique involved choosing the first building on a street and, subsequently, every fifth house on that street, alternating between the two sides of the street. The questionnaire was administered to one household head living in each of the chosen buildings. The number of residential buildings in the estates is shown in Table 3. this was comprised of one hundred and forty-two (142) in Ekulu East Estate; Five hundred and nine (509) in Golf Estate Phases I to V; 273 buildings in Republic Housing Estate; eight hundred and twenty-one (821) in Riverside Housing Estate, Phases I and II. The total number of this sampling frame was One thousand, seven hundred and forty-five (1745) residential buildings.

	ESTATE	LOCATION	YEAR OF	NO. OF
			ESTABLISHMENT (AGE)	UNITS
1.	Ekulu East Estate	Former Enugu Zoo	2002 (16 years)	142
2.	Golf Course Estate	Government Reserve	2000 (18 years)	509
	phases I, I ext, II, IV, V	Area (GRA)		
3	Republic Layout Phase	Independence Layout	1990 (28 years)	273
	I, II, III, IV			
4	Riverside Estate phases	Abakpa Nike	1966 (52 years)	821
	I & II			
	Total			1745

Table 3: Selected Housing Estates of the ESHDC and Available number of units

Source: Fieldwork, 2015

The sample size was determined using the formula for the calculation of sample size given by Taro Yamane (University of Florida (IFAS), 1992). A 95% confidence level was assumed.

$$n = \frac{N}{1 + N(e)^2}$$

Where n = Sample Size, N =1745 (population of buildings in sample), e = 0.05 (precision/acceptable error). This gave 326 respondents. The obtained figure was then redistributed among the sampled housing estates according to the proportion of their contribution to N. As a result, the distribution of the questionnaires to the estates was as follows: Ekulu East Housing Estate - 27, Golf Estate - 95, Republic Housing Estate - 51, and River Side Estate -153.

RESULTS AND DISCUSSION

Specific variables were investigated individually to gather data on maintenance conditions of the building elements. A composite variable (Maintenance condition of Buildings) was obtained by computing a mean score variable from these variables. They included: *Condition of Floor in the house, Condition of Wall finishes (tiles) in the house, Condition of Roof frames in the house, Condition of roofing sheets on the house, Condition of Ceilings in the house, Condition of external works around the building, Condition of outdoor paint of the building, Condition of indoor paint of the building.* This composite variable was then used to test the difference between the four housing estates in the study sample.

i. Condition of Floor in the house

The area-wise data analysis of floors, indicate that generally there are good floors (85.1%) at Ekulu East. Percentage of buildings with good floors at Golf estate are only 31.1%. 40.4% of

the buildings have good floors though a few buildings have bad floors shown as 11% at Ekulu east, 47.2% at Golf estate, 46.2% at Republic estate and only 13.5% at Riverside estate. Higher percentages of respondents in Golf and Republic Estates have very bad condition of floors. Surprisingly higher percentages of floors are good at the Riverside like in Ekulu East estates. The interpretation may be that the floors were well constructed from the onset, particularly if they were finished with terrazzo or ceramic tiles. This is illustrated in Table 4

Value label	Ekulu Ea	Ekulu East		Golf Estate		Republic Estate		Riverside Estate	
	%	Cum %	%	Cum %	%	Cum %	%	Cum %	
Very bad (1)	0	0	32.1	32.1	43.9	43.9	4.7	4.7	
Bad (2)	11.1	11.1	15.1	47.2	12.3	56.1	8.8	13.5	
Neutral (3)	3.7	14.8	21.7	68.9	3.5	59.6	14.7	28.2	
Good (4)	48.1	63.0	18.9	87.8	38.6	98.2	62.4	90.6	
Very good (5)	37.0	100.0	12.2	100.0	1.8	100.0	9.4	100.0	
4Total	100.0		100.0		100.0		100.0		

Table 4: Area-wise data on Conditions of Floor in the house

Source: Fieldwork, 2018

ii. Condition of Wall finishes (tiles) in the house

Area-wise data on Condition of Wall finishes *(tiles)* in the house: The area-wise data analysis of this variable, indicate that the walls at Ekulu East and Riverside Estates are not very bad. Higher percentages of respondents in these two estates have good wall conditions. The buildings at Riverside estate though older appear to be built with more durable wall finishes materials, than even those at Ekulu East which are relatively younger, and the other estates, Golf and Republic. Lower percentages of respondents in Golf and Republic Estates indicate that the conditions of their walls are bad. This is illustrated on Table 5.

Value label	Ekulu East		Golf Estate		Republic Estate		Riverside Estate	
	%	Cum %	%	Cum %	%	Cum %	%	Cum %
Very bad	0	0	4.7	4.7	10.2	10.2	0	0
Bad	10.7	10.7	32.1	36.8	39.0	49.2	12.9	12.9
Neutral	7.1	17.9	27.4	64.2	13.6	62.7	17.6	30.6
Good	50.0	67.9	22.6	86.8	32.2	94.9	56.5	87.1
Very good	32.1	100.0	13.2	100.0	5.1	100.0	12.9	100.0
Total	100.0		100.0		100.0		100.0	

 Table 5: Area-wise data on Condition of Wall finishes in the house

Source: Fieldwork, 2018

iii. Condition of Roof frames in the house

The area-wise data analysis of this variable indicate that the roof frames are relatively new reflecting the age of Ekulu East estate. It is interesting to observe that Republic and Riverside Estates do not have very bad roof frames. Apart from the high percentages of the roof frames across the four estates that indicate good conditions (classified as Good and Very Good), those of Republic and Riverside estates are better than the other two. This is illustrated on Table 6.

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Value label	Ekulu East		Golf Estate		Republic Estate		Riverside Estate	
	%	Cum %	%	Cum %	%	Cum %	%	Cum %
Very bad	0	0	1.9	1.9	0	0	0	0
Bad	10.7	10.7	8.6	10.5	5.1	5.1	7.1	7.1
Neutral	3.6	14.3	10.5	21.0	8.5	13.6	17.6	24.7
Good	50.0	64.3	49.5	70.5	69.5	83.1	61.8	86.5
Very good	35.7	100.0	29.5	100.0	16.9	100.0	13.5	100.0
Total	100.0		100.0		100.0		100.0	
			Sauraa I	Tialdwork	2010			

Table 6: Area-wise data on Condition of roof frames in the house

Source: Fieldwork, 2018

iv. Condition of roofing sheets on the house

The area-wise data analysis of this variable indicated that 89.3% of the roofing sheets at Ekulu East are in good conditions, at Golf estate 75.5% of the roofing sheets are in good condition, at Republic estate it is 74.6% and at Riverside Estates 91.7% are in good condition. A huge number of the roofing sheets have undergone repairs recently. Only very small percentages of roofing sheets ranging from 7.6 to 25.4% are bad across the estates. Very small percentage of 0.6 and 0.9 are very bad at Riverside and Golf estates respectively. If the percentage of residents that were neutral in their decision are added to those that were good, then majority of the roofing sheets were good. Many residents particularly owner-occupiers repaired their roofs not too long ago. See the illustrations on Table 7.

Table 7: Area-wise data on Condition of Roofing sheets on the house

Value label	Ekulu East		Golf Estate		Republic Estate		Riverside Estate	
	%	Cum %	%	Cum %	%	Cum %	%	Cum %
Very bad	0	0	.9	.9	0	0	.6	.6
Bad	10.7	10.7	23.6	24.5	25.4	25.4	7.6	8.2
Neutral	3.6	14.3	12.3	36.8	22.0	47.5	24.7	32.9
Good	46.4	60.7	50.0	86.8	39.0	86.4	53.5	86.5
Very good	39.3	100.0	13.2	100.0	13.6	100.0	13.5	100.0
Total	100.0		100.0		100.0		100.	

Source: Fieldwork, 2018

v. Condition of Ceilings in the house

The area-wise data analysis of this variable indicates that most of the ceilings at Ekulu East and Republic Estates are good. A low percentage of respondents indicate bad ceiling conditions while high percentages of residents are undecided about the condition of their ceilings in Golf, Republic and Riverside estates. This illustration is in Table 8.

Value label	Ekulu East		Golf Estate		Republic Estate		Riverside Estate	
	%	Cum %	%	Cum %	%	Cum %	%	Cum %
Very bad	0	0	1.9	1.9	0	0	.6	.6
Bad	3.6	3.6	2.8	4.7	1.7	1.7	2.9	3.5
Neutral	3.6	7.1	34.0	38.7	30.5	32.2	23.5	27.1
Good	53.6	60.7	47.2	85.8	45.8	78.0	57.6	84.7
Very good	39.3	100.0	14.2	100.0	22.0	100.0	15.3	100.0
Total	100.0		100.0		100.0		100.0	

Table 8: Area-wise data on condition of Ceiling

Source: Fieldwork, 2018

vi. Condition of external works around the building

These include fences, boundary walls, outbuildings, drainages, paths and other features on the site. The area-wise data analysis of '*Maintenance Condition of external works around the building*' indicates that 92.9% of external works are in good condition in Ekulu East, in Golf Estate it is 66%. Republic and Riverside estates have 100% and 85.9% respectively for the external works in good maintenance condition. This illustration is particularly true when the percentage of the undecided respondents are added to the good and very good as illustrated on Table 9.

Value label	Ekulu East		Golf Est	Golf Estate		Republic Estate		Riverside Estate	
	%	Cum %	%	Cum %	%	Cum %	%	Cum %	
Very Bad	0	0	1.9	1.9	0	0	0	0	
Bad	7.1	7.1	32.1	34.0	0	0	14.1	14.1	
Neutral	3.6	10.7	35.8	69.8	30.5	30.5	32.4	46.5	
Good	53.6	64.3	25.5	95.3	33.9	64.4	50.0	96.5	
Very Good	35.7	100.0	4.7	100.0	35.6	100.0	3.5	100.0	
Total	100.0		100.0		100.0		100.0		

Table 9: Area-wise data on maintenance condition of external works around the house

Source: Fieldwork, 2018

vii. Condition of outdoor paint of the building

The area-wise data analysis of this variable indicates that 78.6% of the outdoor paints of the house are in good maintenance condition in Ekulu East; 80.2% in Golf estate; 81.4% in Republic estate and 71.2% in Riverside Estate hence the general indication is that outdoor paints are good and very good. This is illustrated on Table 10.

Value label	Ekulu East		Golf Estate		Republic Estate		Riverside Estate	
	%	Cum %	%	Cum %	%	Cum %	%	Cum %
Very Bad (1)	0	0	2.8	2.8	0	0	2.4	2.4
Bad (2)	21.4	21.4	17.0	19.8	18.6	18.6	26.5	28.8
Neutral (3)	3.6	25.0	34.0	53.8	45.8	64.4	15.3	44.1
Good (4)	64.3	89.3	37.7	91.5	33.9	98.3	49.4	93.5
Very Good (5)	10.7	100.0	8.5	100.0	1.7	100.0	6.5	100.0
Total	100.0		100.0		100.0		100.0	

Source: Fieldwork, 2018

viii. Condition of indoor paints of the house

The area-wise data analyses of indoor paints indicate that 92.9% of indoor paints are in good maintenance condition in Ekulu East; 88.7% at Golf estate; 98.3% in Republic estate and 97.6% in Riverside estate, hence it can be concluded that indoor paints are in good maintenance condition. This is illustrated on Table 11.

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Value label	Ekulu East		Golf Estate		Republic Estate		Riverside Estate	
	%	Cum %	%	Cum %	%	Cum %	%	Cum %
Very Bad (1)	0	0	6.6	6.6	0	0	.6	.6
Bad (2)	7.1	7.1	4.7	11.3	1.7	1.7	1.8	2.4
Neutral (3)	3.6	10.7	33.0	44.3	35.6	37.3	14.1	16.5
Good (4)	57.1	67.9	46.2	90.6	57.6	94.9	75.3	91.8
Very Good (5)	32.1	100.0	9.4	100.0	5.1	100.0	8.2	100.0
Total	100.0		100.0		100.0		100.0	

Table 11: Appraisal of Area-wise data on Condition of indoor pai	aint of the house
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Source: Fieldwork, 2018

From the analysis of the results it can be concluded that (i) a larger proportion of floors of houses in Ekulu East and Riverside estates were in good or very good conditions; (ii) Higher percentages of walls of houses at Ekulu East and Riverside Estates were in good condition; (iii) a larger proportion of roof frames in Ekulu East and Riverside estates were in good or very good conditions; (iv) a greater proportion of the roofing sheets on the buildings in all the estates were in good or very good condition; (v) most of the ceilings in the houses at all estates were in good or very good condition; (vi) Only the condition of external works around a third of the houses in Golf estate were indicated to be bad or very bad. The results in other estates were negligible; (vii) the condition of the outdoor paintwork on majority of buildings in the estates were either in good or very good condition; (viii) the condition of the indoor paintwork on majority of buildings in the estates were either in good or very good condition; (viii) the condition of the indoor paintwork on majority of buildings in the estates were either in good or very good condition; (viii) the condition of the indoor paintwork on majority of buildings in the estates were either in good or very good condition; (viii) the condition of the indoor paintwork on majority of buildings in the estates were either in good or very good condition; (viii) the condition of the indoor paintwork on majority of buildings in the estates were either in good or very good condition.

Difference in maintenance condition of buildings between the estates

The hypothesis for research was that there *is no significant difference between the estates in maintenance conditions of residential buildings in ESHDC estates in Enugu Metropolis*. The results of a one-way ANOVA analysis done at 95% confidence level is shown in Table 12. As seen in Table 12, the result of the ANOVA test for this variable indicates a significance value of 0.000, implying that there is a highly significant difference between the four groups (of buildings) with regard to it. This, therefore, leads to a rejection of the null hypothesis. The alternate is thus affirmed, which is that there is significant difference in maintenance conditions of residential buildings between ESHDC estates in Enugu Metropolis.

ANOVA						
		Sum of	degree of	Mean	F	Sig.
		Squares	freedom	Square		
Maintenance	Between Groups	18.176	3	6.059	14.191	.000
condition	Within Groups	151.990	356	.427		
	Total	170.167	359			

 Table 12: One-way ANOVA analysis test results, showing the differences between

 ESHDC Estates in in Enugu Maintenance condition of their buildings

To further establish, more clearly, the nature of difference between the groups, a Tukey HSD posthoc test was carried out on the data. This is shown in Table 21. The results indicate a significance value of 0.000 for difference between Ekulu East and Golf Estate, a significance

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Source: Fieldwork, 2018

value of 0.000 for difference between Ekulu East and Republic Estate, a significance value of 0.000 for difference between Golf Estate and Riverside Estate and a significance value of 0.000 for difference between Republic Estate and Riverside Estate. These imply that for any set of tests within the groups, there is significant difference between every pair, excepting one, with regards to the maintenance condition of buildings.

The results of the difference in means (Table 13) showed that Ekulu-East Estate had a higher ratio of maintenance condition of buildings than Golf Estate (.675^{*}), Ekulu-East Estate had a much higher ratio than Republic Estate (.732^{*}) and Riverside Estate also had a higher ratio than Golf Estate (.362^{*}) as well as a higher ratio than Republic Estate (.418^{*}). This indicates that Ekulu-East Estate had a higher level of maintenance condition of buildings than Golf Estate and that Ekulu-East Estate also had a much higher level of maintenance condition than Republic Estate. It also showed that Riverside Estate had a higher level of maintenance condition than Golf Estate. There was no significant difference between Ekulu east and Riverside estates as well as between Golf estate and Republic estate.

Multiple Comp	arisons						
TukeyHSD							
Dependent Variable	(I) ESHDC Estates	(J) ESHDC Estates	Mean Difference	Std. Error	Sig.	95% Confidence Interval	
			(I-J)			Lower Bound	Upper Bound
Maintenance	Ekulu-East	Ekulu-East Golf Estate		.145	.000	.30	1.05
condition	Estate	Republic Estate	.732*	.156	.000	.33	1.13
		Riverside Estate	.313	.140	.115	05	.67
	Golf Estate	Ekulu-East Estate	675*	.145	.000	-1.05	30
		Republic Estate	.057	.106	.950	22	.33
		Riverside Estate	362*	.081	.000	57	15
	Republic	Ekulu-East Estate	732*	.156	.000	-1.13	33
	Estate	Golf Estate	057	.106	.950	33	.22
		Riverside Estate	418*	.099	.000	67	16
	Riverside Ekulu-East Estate		313	.140	.115	67	.05
	Estate	Golf Estate	.362*	.081	.000	.15	.57
		Republic Estate	.418*	.099	.000	.16	.67

 Table 13: TukeyHSD Post Hoc analysis test results showing the nature of difference between ESHDC Estates of Residents and Maintenance condition

Source: Fieldwork, 2018

The implications were that the buildings in Ekulu-East Estate were better maintained than those in Golf Estate and Republic Estate; that the buildings in Riverside Estate were also better maintained than those in Golf Estate and Republic Estate; that the buildings in Ekulu east and Riverside estates were at similar levels of maintenance while performing better than the buildings in other two estates; and that the buildings in Golf estate and Republic estate were at similar levels of maintenance while performing more poorly than the those in other two estates.

CONCLUSION AND RECOMMENDATIONS

The quest to ensure that public residential buildings provide liveable conditions for the occupants within their lifespan cannot be achieved without adequate and regular maintenance. This is because the maintenance process ensures that the spaces remain secure, healthy, comfortable, safe and conducive, thus enabling their occupants to carry out life activities. Finding ways to improve the existing maintenance conditions is therefore imperative as well as feasible, particularly as relevant catalysts for this have been identified through research. From the study, it can be concluded that there was significant difference in maintenance conditions of residential buildings between ESHDC estates in Enugu Metropolis. Closer examination of these results of analysis of the variables investigated can provide preliminary actionable information about which elements of the building structures are most at risk in the particular estates. This information should surely be of use, to the managers of such estates, for focusing remedial action in the short run, while seeking long-term guidelines for improving maintenance. In fact, the incorporation of a research mechanism for receiving feedback on the state of maintenance in the estates will serve the estate managers well.

While it is instinctive to suppose that all housing estates built and managed by ESHDC would have similar states of maintenance conditions, it is evident that other extenuating factors are able to ensure that this is not the case. Also, as has been shown in the analyses of the different variables, different estates showed different performances with regards to each variable. The implication, therefore, is that further study and analysis of extenuating factors is necessary to understand why this is so. It is recommended that this be conducted. It will enable ESHDC to track performance of the estates under the variables listed. The lessons learned would then be used for guidance on achieving better maintenance conditions in the estates that performed poorer; this could also be applied in other estates which are managed in a similar manner. Regular comparative analysis of estates is also recommended, as a means of evaluating performance. This would bring attention to the estates who perform poorly to incentivize those responsible to improve. The findings in this research could be used in this manner.

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