

ASSESSMENT OF BUILDING MAINTENANCE PRACTICES ON RESIDENTIAL BUILDINGS IN MAKURDI LOCAL GOVERNMENT AREA, BENUE STATE

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ABSTRACT

The study assessed building maintenance practices in residential buildings in Makurdi local government area of Benue state. To guide the study, three (3) research questions were stated while three hypotheses were formulated and tested at 0.05 level of significance. The study adapted survey research design. A total population of 4424 was used for the study. The sample comprised of 367 respondents drawn from the population using Yaro Yemen formula and disproportionate stratified random sampling technique. A self-developed questionnaire titled ABMPRB was used as instrument for data collection. The instrument was validated by five experts. The reliability coefficient of the study was .882. Data collected for the study was analyzed using Descriptive statistics of Mean and Standard deviation, t-test was used in testing the hypotheses. This was done with the aid of SPSS at 0.05 level of significance. The study establish that maintenance practices is not been proficiently carried out by occupants and building professionals on residential buildings. The study shows no significant difference between the mean responses of occupants and building professionals on preventive, corrective and predictive to improve on maintenance practices on residential buildings. The study mainly recommended the need for public occupant to embrace preventive maintenance practice as a high priority rather than waiting for corrective maintenance and also a regulation to effect maintenance of specific building systems

INTRODUCTION

The importance of buildings to mankind can never be over emphasized especially when they are well designed, built and functioning properly. Buildings according to Amobi (2006) are very important because they connect people with their past as well as represent the greatest legacies for the future. They provide shelter as well as embody the culture of the people. Buildings also encourage productivity by providing facilities for the storage of goods storage and services. Odediran, Opatunji and

Eghenure (2012) asserted that the condition and quality of buildings reflects the level of prosperity in the area, social values and behavior which combine to give a community its unique character. In line with this assertion, lack of an effective building maintenance setup can affect communities and even a nation's unique characteristics. They accommodate life support facilities for medication, telecommunication industries and centre of education for all levels. There are different types of buildings designed to serve different

purposes. Federal Republic of Nigeria; National Building Code (2007) has classified buildings into assembly, business and professional, educational, high hazard, and institutional, mercantile, residential, storage, utility and miscellaneous uses. Residential buildings, which are the concern of this study, are used as apartment blocks (Brian, 2009). Although different designs of residential buildings are available, the choice of any of them depends on location, usage, nature of occupants, economy, government policy and demand by occupant. The types of residential building available include apartment block, dormitory, duplex, house, nursing home and bungalow (Bjamason, 2013). Residential buildings mainly provide shelter in form of a house, home, abode, cover, and lodge and so on. In view of the value of buildings to mankind, successive Nigeria government have been making concerted effort in housing delivery intervention through policies and programmes either as a provider and facilitator or an enabler in recent times (Aminu and Ruhizal 2013). Although several housing programmes have been put in place, the housing need has not been completely achieved. The few ones available appeared not to have been adequately maintained. In order to preserve the available ones to serve us well, such buildings need to be periodically maintained to function

effectively over their life circle. This study is focused on the maintenance of residential buildings located in the high, medium and low density areas of Makurdi Local Government Area and exclusively assessed maintenance practices carried out on such buildings. This is because, the researcher has observed that most residential buildings own by both government and individuals in Makurdi Local Government Area are dilapidated due to inadequate maintenance. Hence, the need for assessment of building maintenance practices has become very important to verify the causes of the neglect and possible remedies. Assessment is defined as a judgment about something based on an understanding of the situation. Bakare, Abiodun and Idris (2016) defined assessment as a systematic collection review and use of information about a programme undertaken for the purpose of improvement and development. In the context of building maintenance, assessment is referred to as the process of gathering information from different sources in order to develop a deep understanding of what the occupants of buildings and building professionals understand about buildings in terms of its maintenance practices.

Maintenance is considered generally as the act of keeping something in good condition by checking or

repairing it regularly. It is the art of controlling the rate at which structures deteriorate towards a state of disrepair and collapse (Smith, 2003). Building maintenance according to BS3811 (1974) as cited in Amobi (2006) is a combination of actions associated with initiation, organization and implementation carried out to retain an item or restore it to an acceptable standard. Olanrewaju, Mohd and Arazil (2011) view building maintenance as the processes and services to preserve, repair, protect and care for a building's fabric and engineering services after completion, repair, refurbishment or replacement to current standards. This is to enable it to serve its intended functions throughout its entire life span without drastically upsetting its basic features and use by its occupants. Therefore, maintenance is not just about the building, it also concerns the occupants or users. There are basically three types of maintenance: preventive, predictive and corrective maintenance. Szvedo (2012) has equally identified the following as types of maintenance. They are; Preventive, corrective and predictive maintenance. Jody (1999) has identified the followings as best maintenance practices necessary for building maintenance. They include; assessing the condition of building components, ranking of the maintenance work to be done and evaluating their cost, planning for

building in the short and long-term maintenance. It also involves structuring a preventive maintenance framework, using the right tools and competency of maintenance workers as well as involving appropriate personnel in decision making and in communicating building needs. It is in the light of the above that this study is carried out to assess the maintenance practices on residential buildings in Makurdi local Government Area of Benue State

STATEMENT OF THE PROBLEM

Building maintenance is focused mainly on preserving a building to ensure that it serves its anticipated purpose. Maintenance is a key factor in extending the economic life of buildings. The maintenance of buildings generally seems to have been deserted. The neglect of building maintenance has led to the deterioration of the components of buildings which results to harmful effects on the occupants and component of the building. Also the neglect of building causes defects which result to extensive and unavoidable damage to the building fabric or structure. This has often led to the collapse of the buildings which results to damage of properties, injuries, deterioration of building components and death of its occupants. Neglect of maintenance also causes fire and safety hazard

which results to and eventual collapse. This alarming situation of lack of appropriate maintenance practices has depicted a negative national image to the outside world about Benue and Nigeria at large. Although building professionals are trained on maintenance practices, they do not always carry out building maintenance as prescribed by relevant authorities. Several researches have been conducted on the use of substandard materials, poor workmanship, poor design, and faulty construction methods as factors that have necessitated the deterioration of building components which gradually lead to building collapse. However, not much has been done on the aspect of building maintenance practices by occupants and building professionals as it could impinge on the deterioration of building component, hence, the need to embarked on this study to assess maintenance practices on residential buildings in Makurdi local government area.

PURPOSE OF THE STUDY

The specific objectives of the study included to:

Assess preventive, corrective and predictive maintenance practices by occupants and building professionals on residential buildings;

RESEARCH QUESTIONS

The following research questions are raised to guide the study:

1. What are the preventive, corrective and predictive maintenance practices used by occupants and building professionals on residential buildings?

RESEARCH HYPOTHESES

The following null hypotheses were Formulated and tested at 0.05 level of significance:

Ho₁: There is no significant difference between the mean responses of occupants and building professionals on preventive maintenance practices on residential buildings.

Ho₂: There is no significant difference between the mean responses of occupants and building professionals on corrective maintenance practices on residential buildings.

Ho₃: There is no significant difference between the mean responses of occupants and building professionals on predictive maintenance practices on residential buildings.

METHODOLOGY

An analytical cross-sectional survey design was used for the study. The study was carried out in Makurdi local government area of Benue state, Nigeria. The study utilized a total population of 4424 which comprise 1107 occupants of government residential estates, 2863 occupants of privately owned residences and 454

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building professionals who include; 120 builders, from Nigeria Institute of Builders (NIOB) Makurdi Branch, 294 engineers from Nigerian Society Engineers (NSE) Makurdi Branch and 40 Architects Nigerian Institute of Architect (NIA) Makurdi Branch. The Taro-Yamens formula was used to determine the sample size of 367 at 0.05 level of significance. A 49 item questionnaire Titled "Assessment of Building Maintenance Practices on Residential Buildings Questionnaire" (ABMPRB) was developed and used by the researcher. The instrument was given to measurement and evaluation expert from Science and Technical

Education Board Headquarters, Makurdi, experts from the building construction section in the Department of Vocational and Technical Education, Faculty of education, Benue State University, Makurdi and also to a Builder, an Architect and an Engineer from Ministry of Works and Housing Makurdi for both content and face validation of the instrument.

RESULTS

The result in Table 1 were obtained from the field for analysis and discussion

Table 1: Mean Scores of Preventive Maintenance Practices Carried out by Occupants and Building Professional's on Residential Buildings

S/no.	Item Statement	N	X	SD	Remarks
1	Creating an inventory of building components and assessment of their conditions	367	2.03	1.196	Disagree
2	Tackle cracks early before they spread	367	2.07	1.319	Disagree
3	Building professionals calculate total costs over the expected lifetime of buildings and its components	367	1.87	1.148	Disagree
4	Plan for regular painting of the house at specified intervals	367	1.83	1.152	Disagree
5	Planning strategically for preventive maintenance in the long- and Short-Term	367	1.90	1.278	Disagree
6	Study materials used and determine when they will be due for replacement or change	367	1.98	1.330	Disagree
7	Landscape to control and prevent erosion	367	2.14	.931	Disagree
8	Fill up and level ditches around the house where stagnant water may collect to affect buildings	367	3.05	1.266	Agree
9	Structuring a framework for operating a preventive maintenance program	367	1.61	1.042	Disagree
10	Involving appropriate maintenance personnel in decision making and in communicating buildings' needs	367	1.90	1.169	Disagree
11	Maintenance professionals evaluate the	367	1.65	.954	Disagree

	preventive maintenance program to improve it over time				
12	Insurance policies are carried out before the commencement of maintenance work	367	3.21	1.099	Agree

Table 3 show the mean values of 10 items ranging from 1.61 to 2.14. This indicated that the mean of each of the ten (10) items is below 2.50 which is the cut-off point. This revealed that preventive maintenance practices are not being effectively carried out by both building professionals and occupants. However two out of the

twelve items with mean range of 3.05 to 3.21 had positive responses. This shows that out of the identified practices, only 2 are being carried out as prescribed. Also given that the standard Deviation ranges from 0.931 to 1.330 the instrument is said to be homogenous.

Table 2: Mean Scores of Corrective Maintenance Practices Carried out by Occupants and Building Professionals on Residential Building

S/no.	Item Statement	N	X	SD	Remarks
1	carry out a comprehensive survey to investigate a maintenance challenge before remedy	367	2.46	.815	Disagree
2	Failed component and materials of buildings are replaced with new ones	367	2.79	.820	Agree
3	Corrective maintenance work consists of modernization, alteration, replacement and renovation	367	3.31	.794	Agree
4	Major corrective maintenance activities to be carried out are carefully scheduled and programmed	367	2.51	.946	Agree
5	Corrected component are verified to ensure they operates appropriately	367	2.69	.797	Agree
6	Localization of the failed parts and determination of the failure cause	367	2.14	1.192	Disagree
7	Repainting and decoration of failed and discolored wall surface	367	3.40	.750	Agree
8	Apply underpinning to correct failed foundation	367	3.05	.706	Agree
9	Shoring on walls to correct failed portions of the wall and other components	367	3.14	.642	Agree

From Table 4, items 2,3,4,5,7,8 and 9 out of the nine items had means which range from 2.51 to 3.40 while the other two items, 1 and 6 receive means that range from 2.14 to 2.46. This indicates that the seven items had higher means

scores which are above the cut-off point of 2.50. This implies that the seven items are agreed upon by the respondent while the remaining two items were disagreed upon. Consequently corrective maintenance

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practices are been effectively carried out within the study area by both building professionals and occupants. The instrument is also considered

homogenous since the standard Deviation range from 0.642 to 1.192

Table 3: Mean Scores of Predictive Maintenance Practices used by Occupants and Building Professionals on Residential Buildings

S/no.	Item Statement	N	X	SD	Remarks
1	Diagnosing equipment are applied for detecting impending problems in a building	367	1.96	.912	Disagree
2	Builders are trained to monitor, test and inspect building system in order to forecast component degradation and perform planned maintenance prior to equipment failure	367	1.37	.852	Disagree
3	All engineers are trained on the use of the predictive maintenance equipment	367	2.28	.918	Disagree
4	Predictive maintenance applies various sensor technology and analytical tools to measure and monitor various system and their components	367	3.34	1.187	Agree
5	Architect and builders are consulted to run periodic test on buildings to ascertain their condition and possible remedy to avert it break down	367	1.71	1.093	Disagree
6	Scan is conducted on components to determine when maintenance work is required	367	1.95	.507	Disagree

From table 5, five items got means scores which range from 1.37 to 1.96. Since the cut-off point for the 4-point scale is 2.50, the items are disagreed upon. However items four (4) had means scores of 3.34 which is above 2.50 and therefore considered agreed. Given that a greater number of the items are disagreed upon, it is

concluded that predictive maintenance practices are considered not to have been effectively used by both building professionals and occupants within the study area. The instrument is also considered homogenous since the standard Deviation range from 0.507 to 1.18

Table 4: t-test Result for the Mean Responses of Occupants and Building Professionals on Preventive Maintenance Practices on Residential Buildings

S/no.	Item Statements	\bar{X}_1	\bar{X}_2	\bar{X}_T	SD ₁	SD ₂	SD _T	p-value	Remarks
1.	Creating an inventory of building components and assessment of their conditions	3.33	1.21	2.27	0.83	0.41	0.62	0.36	NS
2.	Tackle cracks early before they	3.66	1.07	2.37	0.53	0.26	0.40	0.36	NS

spread									
3. Building professionals calculate total costs over the expected lifetime of buildings and its components	3.23	1.03	2.13	0.62	0.16	0.39	0.00	S	
4. Plan for regular painting of the house at specified intervals	3.16	1.00	2.08	1.75	0.00	0.88	0.17	NS	
5. Planning strategically for preventive maintenance in the long- and Short-Term	3.35	1.00	2.78	0.91	0.00	0.46	0.00	S	
6. Study materials used and determine when they will be due for replacement or change	3.55	1.00	2.28	0.78	0.00	0.39	0.38	NS	
7. Landscape to control and prevent erosion	2.94	1.65	2.30	0.92	0.48	0.07	0.00	S	
8. Fill up and level ditches around the house where stagnant water may collect to affect buildings	4.00	2.46	3.23	0.00	1.30	0.65	0.23	NS	
9. Structuring a framework for operating a preventive maintenance program	2.60	1.00	1.08	1.12	0.00	0.56	0.00	S	
10. Involving appropriate maintenance personnel in decision making and in communicating buildings' needs	3.23	1.08	2.16	0.77	2.64	1.71	0.13	NS	
11. Maintenance professionals evaluate the preventive maintenance program to improve it over time	2.70	1.00	3.07	0.77	0.00	0.39	0.18	NS	
12. Insurance policies are carried out before the commencement of maintenance work	4.00	2.71	3.36	0.00	1.15	0.56	0.15	NS	

Result presented in table 9 above revealed that eight (8) out of the twelve (12) items had their *p*-values ranged from 0.13 to 0.38 which are greater than 0.05 at 365 degree of freedom. This indicates that there is no significant difference in the mean responses of building professionals and occupant on use of preventive

maintenance practices in residential buildings in Makurdi local government. Although, items 3, 5, 7 & 9 had *p*-values of 0.00 each which are below 0.05. This indicates a significant difference, but the null hypothesis of no significant difference was affirmed based on simple majority of

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Table 5: t-test Result for the Mean Responses of Occupants and Building Professionals on Corrective Maintenance Practices on Residential Buildings

S/no.	Item Statements	\bar{X}_1	\bar{X}_2	\bar{X}_T	SD_1	SD_2	SD_T	p-value	Remarks
1.	Carry out a comprehensive survey to investigate a maintenance challenge before remedy	3.36	1.89	2.27	0.49	0.31	0.62	0.11	NS
2.	Failed component and materials of buildings are replaced with new one	3.50	2.35	2.93	0.50	0.66	1.16	0.07	NS
3.	Corrective maintenance work consists of modernization, alteration, replacement and renovation	4.00	2.88	3.44	0.00	0.74	0.37	0.09	NS
4.	Major corrective maintenance activities to be carried out are carefully scheduled and programmed	3.50	1.89	2.70	0.50	0.55	0.53	0.19	NS
5.	Corrected component are verified to ensure they operates appropriately	3.55	2.16	2.86	1.50	0.37	0.94	0.00	S
6.	Localization of the failed parts and determination of the failure cause	3.48	1.30	2.39	0.65	0.46	0.56	0.00	S
7.	Repainting and decoration of failed and discolored wall surface	4.00	3.02	3.51	0.00	0.74	0.37	0.21	NS
8.	Apply underpinning to correct failed foundation	3.71	2.63	3.17	1.46	0.48	0.97	0.09	NS
9.	Shoring on walls to correct failed portions of the wall and other components	3.74	2.77	3.26	0.44	0.44	0.44	0.23	NS

Results presented in table 10 above revealed that seven (7) out of the nine (9) items had their p -values ranged from 0.07 to 0.23 which are greater than 0.05 at 365 degree of freedom. This indicates that there is no significant difference in the mean responses of building professionals and occupant on the use of corrective maintenance practices on residential

buildings in Makurdi local government. However, items 5 & 6 had p -values of 0.00 each which are less than 0.05. This indicates a significant difference, but the null hypothesis of no significant difference was affirmed based on simple majority of items indicating no significance difference.

Table 6: t-test Result on Mean Responses of Occupants and Building Professionals on Predictive Maintenance Practices on Residential Buildings

S/no.	Item Statements	\bar{X}_1	\bar{X}_2	\bar{X}_T	SD_1	SD_2	SD_T	p-value	Remarks
1.	Diagnosing equipment are applied for detecting impending problems in a building	2.65	1.44	2.06	0.84	0.50	0.67	0.01	S
2.	Builders are trained to monitor, test and inspect building system in order to forecast component degradation and perform planned maintenance prior to equipment failure	1.82	1.00	1.41	1.06	0.00	0.53	0.29	NS
3.	All engineers are trained on the use of the predictive maintenance equipment	3.06	1.70	2.38	0.80	0.46	0.63	0.26	NS
4.	Predictive maintenance applies various sensor technology and analytical tools to measure and monitor various system and their components	4.00	2.83	3.42	0.00	0.38	0.19	0.46	NS
5.	Architect and builders are consulted to run periodic test on buildings to ascertain their condition and possible remedy to avert it break down	2.70	1.00	1.85	1.04	1.00	1.02	0.00	S
6.	Scan is conducted on components to determine when maintenance work is required	2.14	1.75	1.95	0.35	0.44	0.40	0.13	NS

Data presented in table II above revealed that four (4) out of the six (6) items had *p*-values of 0.26, 0.29, 0.46 and 0.13 respectively which are greater than 0.05 at 365 degree of freedom. This indicates that there is no significant difference in the mean responses of building professionals and occupant on the use of predictive maintenance practices on residential buildings in Makurdi local government. Though, items 1 & 5 had *p*-values of 0.01 and 0.00 respectively

which are below 0.05. This indicates a significant difference but the null hypothesis of no significant difference was affirmed based on simple majority of items indicating no significance difference.

DISCUSSION OF FINDINGS

Findings from the study revealed that, preventive maintenance practices are not efficiently carried out in residential buildings. Based on the results of the study, preventive

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maintenance focuses on scheduling routine inspections and performing necessary upkeep and service on components in order to prevent and fix problems before failure occurs. The result on the use of preventive maintenance practice was addressed in the study and presented in table 3. The study revealed that only two out of the twelve items got mean scores above 2.50 which are agreed. On the other hand, ten (10) items were disagreed upon. This implies that preventive maintenance practices are not been effectively carried out by both building professionals and occupants. This shows that, inventory of building components, assessment of building condition and tackling of cracks early before they spread, planning strategically for preventive maintenance in both long and short term, careful study of materials, landscape for erosion control and involvement of appropriate maintenance personnel in decision making are not effectively coordinated by both building professionals and occupants. This is in agreement with Bismark (2013) who posited that, a well-structured preventive maintenance greatly encouraged and improve equipment's and component operating efficiency, preventing premature replacement of components and avoid interruptions of building occupants.

The findings are also consistent with the work of Kaiser (2007) who has

emphasised that routines should be scheduled for maintenance work by analyzing failure time and data for a population of components involved. Result presented in table 8 above revealed that eight (8) out of the twelve (12) items had their p-values ranged from 0.13 to 0.38 which are greater than 0.05 at 365 degree of freedom. This indicates that there is no significant difference in the mean responses of building professionals and occupant on use of preventive maintenance practices in residential buildings in Makurdi local government. Although, items 3, 5, 7 & 9 had p-values of 0.00 each which are below 0.05. This indicates a significant difference. But the null hypothesis of no significant difference was affirmed based on simple majority of items indicating no significance difference.

The study also found out that, Corrective maintenance practices are not efficiently carried out in residential buildings. The results to assess the use of corrective maintenance practices in residential buildings by occupant and building professionals are presented in Table 4. The result shows that, seven out of the nine (9) items raised for the study are disagreed upon. This indicates that, corrective maintenance is not effectively carried out by building professionals and occupant. Leung (2002) in affirmation to this finding

posited that, corrective maintenance practice is not always handled by well trained maintenance managers, untrained personnel are also involved, lack of immediate replacement of failed components with new ones, non compliance with quality assurance standard and inability of maintenance team to set out goals to be achieved during corrective maintenance.

Results presented in Table 9 revealed that seven (7) out of the nine (9) items had their p-values ranged from 0.07 to 0.23 which are greater than 0.05 at 365 degree of freedom. This indicates that there is no significant difference in the mean responses of building professionals and occupant on the use of corrective maintenance practices on residential buildings in Makurdi local government. However, items 5 & 6 had p-values of 0.00 each which are less than 0.05. This indicates a significant difference. But the null hypothesis of no significant difference was affirmed based on simple majority of items indicating no significant difference. Also the study found out that, Predictive maintenance practices are not carried out as prescribed in residential buildings. The study revealed that preventive maintenance is not been effectively used by building professionals and occupants. This is because most of the buildings professional are aware of the availability of equipment for detecting impending problems on building component but do not use them

because they are not readily available for use and most of the professionals are not trained on the use of these equipment. Similarly, most occupants are not sentient of the possibility of using various sensor technology and analytical tools to measure and monitor building component in order to detect an impending problem. Therefore, they do not consult building professionals to run periodic test on buildings to ascertain their condition and possible remedy to avert a break down. The finding also agree with Stephens (2004) who observed that, predictive maintenance is best carried out when the characteristics of a system is compared with established standards and specifications in order to predict (forecast) system or component failures. Similarly, Szwedo (2012) opined that, predictive maintenance actually evaluates the existing equipment condition based on a projected trend of the deterioration process and predicts failures and appropriate steps taken to avert breakdown. Data presented in table 11 revealed that four (4) out of the six (6) items had p-values of 0.26, 0.29, 0.46 and 0.13 respectively which are greater than 0.05 at 365 degree of freedom. This indicates that there is no significant difference in the mean responses of building professionals and occupant on the use of predictive maintenance practices on residential buildings in Makurdi local

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government. Though, items 1 & 5 had p-values of 0.01 and 0.00 respectively which are below 0.05. This indicates a significant difference, but the null hypothesis of no significant difference was affirmed based on simple majority of items indicating no significance difference.

CONCLUSION

The study found out that building professionals and occupants do not carry out preventive, corrective and predictive maintenance practices (standard maintenance practices) as prescribe in the National Building Code (2007), Architect data, and as it is contained in literature reviewed. This situation justifies the neglected maintenance practices noticed on residential buildings within Makurdi Local Government Area which has brought the buildings to the present deteriorating state. Similarly, no significant difference was established between building professional and occupants on the use of predictive, corrective and preventive.

RECOMMENDATION

Based on the findings of this study, the following recommendations were made:

1. Public occupant should embrace preventive maintenance practice as a high priority rather than waiting for corrective maintenance.

2. A National Maintenance Policy should be formulated as part of the National Housing Policy to compel people to undertake maintenance on the buildings they occupy to avoid a situation where huge sums of taxpayers' money go down the drain through deterioration of public buildings due to lack of maintenance.
3. Building designs and specifications should incorporate materials with least maintenance problems, for instance tiling the external walls of high rise buildings will solve the problem of painting due to the height of the building.
4. Individuals should embrace maintenance as a practice and government should engineer action towards more advocacy, policy and awareness on the essence of maintenance as a practice for national sustainability

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