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RESEARCH ARTICLE OPEN ACCESS

Inspection, evaluation of degradations and maintenance of public primary and secondary school buildings in the city of Yaoundé, Cameroon

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ABSTRACT
The maintenance of administrative or public buildings in general and in particular those of public schools is a serious problem in Cameroon. Very few administrative or public buildings undergo maintenance works in Cameroon after their service. The purpose of this study was to assess the degradations and maintenance of public primary and secondary school buildings in the city of Yaoundé, Cameroon.The methods employed in the collection of data included the administration of questionnaires as shown in appendix to the various principals of public primary and secondary schools in the seven districts of Yaoundé namely, Yaoundé 1, Yaoundé 2, Yaoundé 3, Yaoundé 4, Yaoundé 5, Yaoundé 6 and Yaoundé 7, site inspections and case studies for the sites. The data collected were transformed into frequency counts and percentages for purposes of analyses and interpretation. The findings show that the poor condition of these school buildings is partly due to several causes, namely Non-compliance with the school's internal regulations by the students, thus leading to acts of vandalism, the use of poor quality building materials, lack of an infrastructure monitoring and control team, the absence of a real maintenance policy for public buildings, lack of a fire safety system amongst others. The paper concludes by recommending permanent maintenance in these school buildings.

Keywords: Evaluation, Degradations, Maintenance, Primary school buildings, Secondary school buildings, Yaoundé

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I. INTRODUCTION

Public buildings are those which most of the time house public service activities; these are the buildings belonging to the state or which are the properties of the state, the quality of the place is of significant importance and cannot last without regular maintenance. A school building is any building construction or shelter made of temporary or final materials intended for collective teaching [1,2] and a building in general is a structure constructed to serve as shelter for man, his properties and activities [2-9]. Educational establishment is the set of buildings of a school, college or high school. School buildings must permanently offer correct working conditions and guarantee the safety of people and goods. Since education is at the center of human concerns, planning good maintenance [5, 10,11] of school buildings would help on the one hand to improve the study conditions of young pupils or students for integration into society and to reduce expenses on the other hand.

Couffinal et al. [12] reported the different periods essential for the proper functioning and maintenance of certain equipment in a building, they stated that for electrical work, for example, servicing or maintenance should be done at less every three years by qualified technicians.

A large body of literature is available on evaluation of degradations and maintenance of public school buildings [2, 5, 13-17]. However, there is no paper on Yaoundé, Cameroon on inspection, evaluation of degradations and maintenance of public primary and secondary school buildings. This paper presents a study on inspection, evaluation of

degradations and maintenance of public primary and secondary school buildings in the city of Yaoundé, Cameroon. The remaining portion of the paper is organized as follows: Section 2 is dedicated to the description of the study area; Section 3 presents the methods used in this study; Section 4 presents the results and analyses them. The conclusions of the paper are given in Section 5; finally, Section 6 provides recommendations to the work.

II. DESCRIPTION OF THE STUDY AREA

Yaoundé is the political capital of Cameroon and the capital of the Center Region and the Department of Mfoundi. Yaoundé is called city of the seven hills, cosmopolitan, it includes seven districts namely, Yaoundé 1, Yaoundé 2, Yaoundé 3, Yaoundé 4, Yaoundé 5, Yaoundé 6 and Yaoundé 7 and it is the seat of the republican institutions, it is also the place of convergence of the populations of all the other regions of the country and elsewhere. Located in the equatorial zone, it has a humid equatorial climate and alternating two dry seasons and two wet seasons [18]. Yaoundé is located at about 250 km from the Atlantic Ocean between latitudes 3° and 5° North and longitudes 11° and 12° East [18]. The hydrologic system is made up of the following rivers Mfoundi and Ntem in the North; Ntongou, Ekozoa, Abiergue and Mingoa in the West; Djongolo in the East; Olezoa, Ebogo, Ewoute, Ake and Odza in the South [18]. Its strategic position added to its demography has earned it the proliferation of university, secondary, primary and kindergarten institutions for the supervision and training of the future generation.

III. METHODOLOGY

To achieve the goal assigned to this study, we administered questionnaires as shown in appendix to the various principals/ heads of public primary and secondary schools in the seven districts of Yaoundé namely, Yaoundé 1, Yaoundé 2, Yaoundé 3, Yaoundé 4, Yaoundé 5, Yaoundé 6 and Yaoundé 7, we also did site inspections and case studies for the sites.

This survey was conducted in Yaoundé during the period of March-September 2018. The data collected were transformed into frequencies (fd, fe) counts and percentages (%) for purposes of analyses and interpretation.

III.1. Difficulties encountered in the field

In the field, collecting information was not easy because it was marred by obstacles such as :

- The categorial refusal of certain school heads to receive us
- Partial provision of information in relation to the questionnaire
- The marked absence of certain service managers
- Distrust of visitors to certain heads of establishments for fear of being trapped by intelligence people

The total number of establishments by district in the city of Yaoundé that was the subject of our study is shown in Table 1 below.

Table 1. Summary of the number of secondary and primary school establishments visited as part of our surveys

District	Secondary schools	Primary schools	Total
Yaoundé 1	04	06	10
Yaoundé 2	03	08	11
Yaoundé 3	05	06	11
Yaoundé 4	04	08	12
Yaoundé 5	04	07	11
Yaoundé 6	04	05	09
Yaoundé 7	02	05	07
Total	26	44	70

IV. ANALYSIS OF DATA AND DISCUSSION OF RESULTS

Figure 1 and Figure 2 respectively show the types of windows and doors that can be found on the buildings of secondary and primary school establishments in the city of Yaoundé visited. We observe that most of the windows and doors are made of metal with a percentage of 61% respectively, this is the case for some classrooms, 7% of the windows and 11% of the doors are made of wood this is the case of some offices, 25% of windows and 28% of doors are made of mixed materials and 7% of windows are made of concrete.

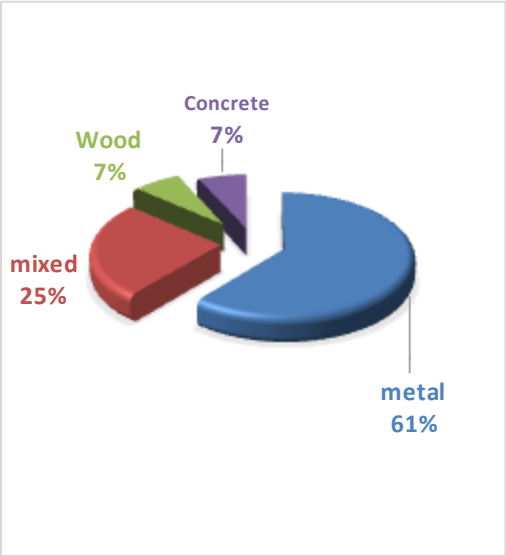


Figure 1. Types of windows

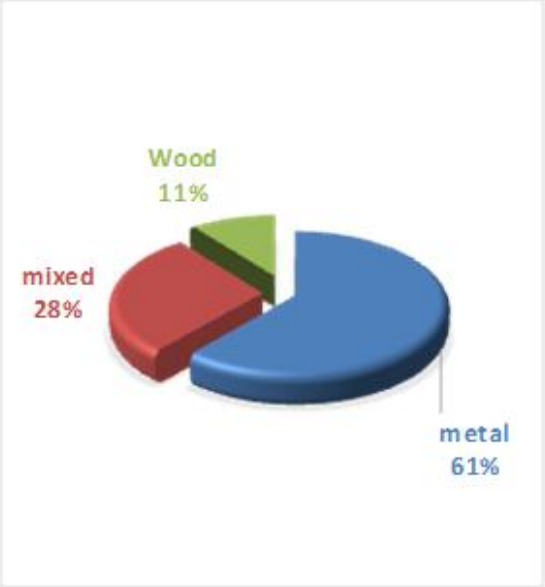


Figure 2. Types of doors

Figure 3 shows the types of roofing found on the buildings of secondary and primary school establishments in the city of Yaoundé visited. We observe that 49% of the roofs are respectively in sheet pan and corrugated sheet and 2% of the buildings are in flat roof.

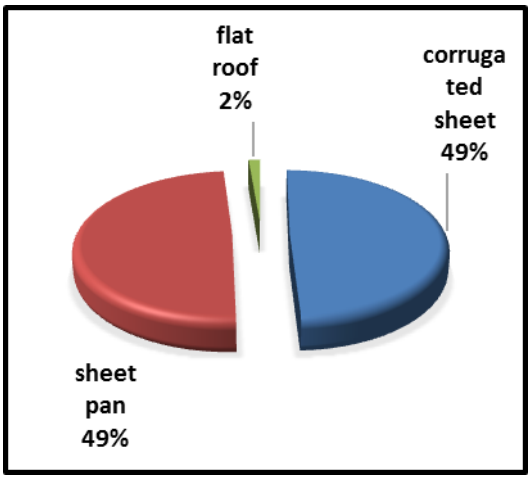


Figure 3. Types of roofing

Figure 4 reports the types of framework that can be found on the buildings of secondary and primary school establishments in the city of Yaoundé visited. It appears that most of the frames, namely 93% are traditionally made, 6% are made of metallic materials and 1% of mixed materials.

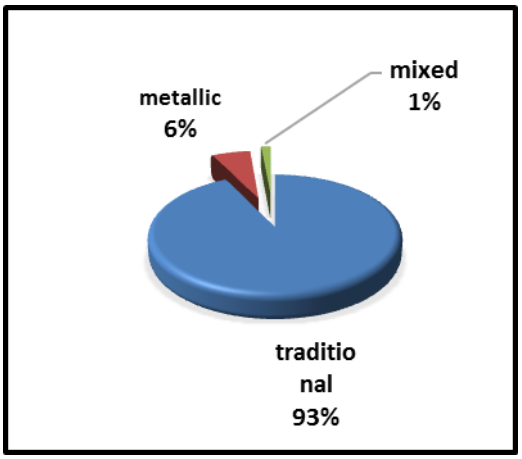
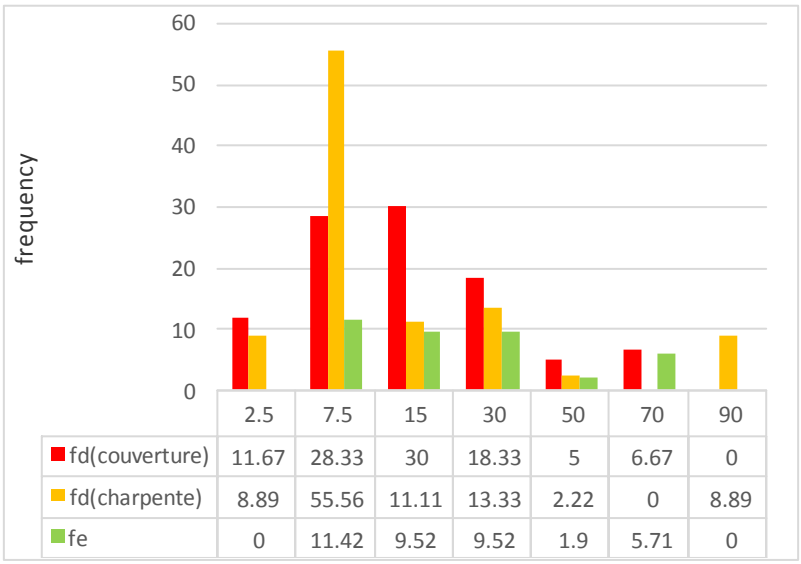


Figure 4. Types of framework

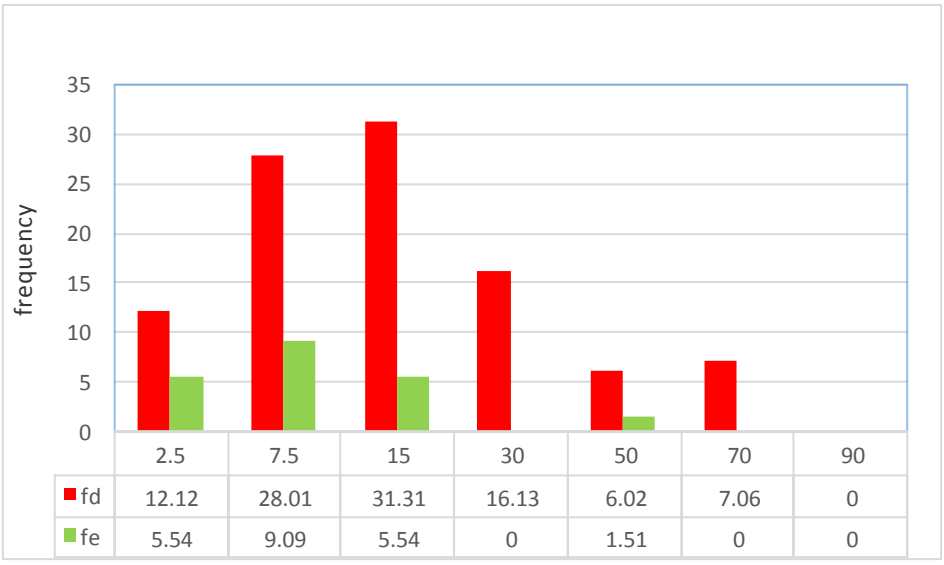
Figure 5 reports the frequencies of degradations (fd) and maintenance (fe) of the roofs and trusses/frames of the buildings of secondary and primary school establishments in the city of Yaoundé visited. We can see that the degradation of the frame has a frequency of 55.56 of center 7.5. This is the consequence of the deterioration of the covers in the same center. It also shows that maintenance only takes place when the building is seriously degraded and working and study conditions are impossible.



	2.5	7.5	15	30	50	70	90
fd(couverture)	11.67	28.33	30	18.33	5	6.67	0
fd(charpente)	8.89	55.56	11.11	13.33	2.22	0	8.89
fe	0	11.42	9.52	9.52	1.9	5.71	0

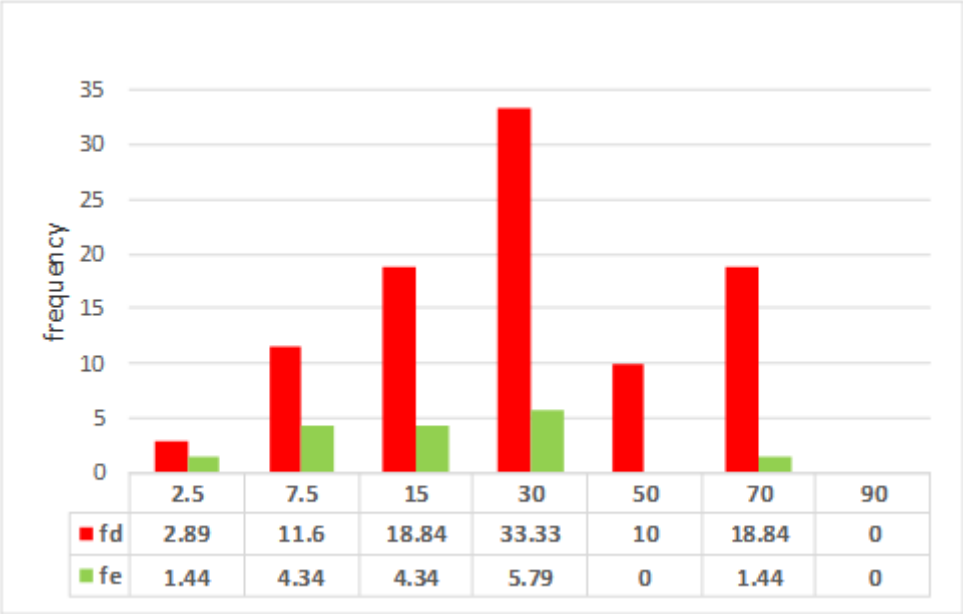
Figure 5. Frequencies of degradation (fd) and maintenance (fe) of the roofs and trusses/frames

Figure 6 shows that in center 15 the degradation frequency (fd) is 31.31 and the maximum maintenance frequency (fe) is 9.09 in center 7.5; this shows the poor condition of the paint on the interior walls of most of the classrooms.



	2.5	7.5	15	30	50	70	90
fd	12.12	28.01	31.31	16.13	6.02	7.06	0
fe	5.54	9.09	5.54	0	1.51	0	0

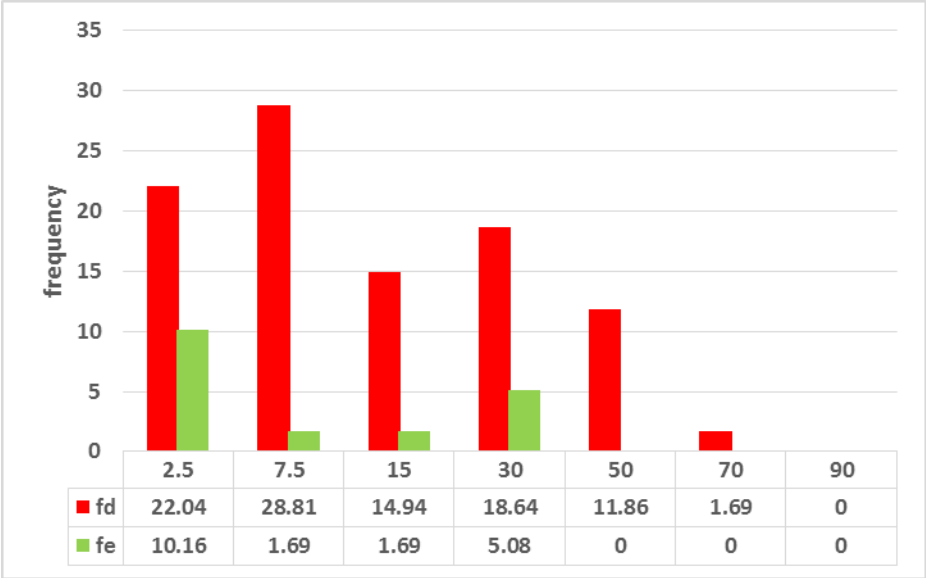
Figure 6. Frequencies of degradations and maintenance of the interior walls



	2.5	7.5	15	30	50	70	90
fd	2.89	11.6	18.84	33.33	10	18.84	0
fe	1.44	4.34	4.34	5.79	0	1.44	0

Figure 7. Frequencies of degradations and maintenance of the exterior walls

Compared to the interior, the exterior walls are more degraded, judging by the very high frequency of degradation (fd) (33.33) (Figure 7) for very low maintenance (fe) (5.79) (Figure 7).
Figure 8 shows that the cracks in the walls have a frequency of 28.81 in the center 7.5 with a consequent maintenance frequency of 1.69. Overall, the degradation is decreasing and the maintenance measures do not always follow.



	2.5	7.5	15	30	50	70	90
fd	22.04	28.81	14.94	18.64	11.86	1.69	0
fe	10.16	1.69	1.69	5.08	0	0	0

Figure 8. Frequencies of degradations and maintenance of the cracks in the walls

Figure 9 shows that for all of the buildings surveyed, 64% have downspouts compared to 36%; good reason to explain the recurring problems of deterioration in exterior walls and ceilings.

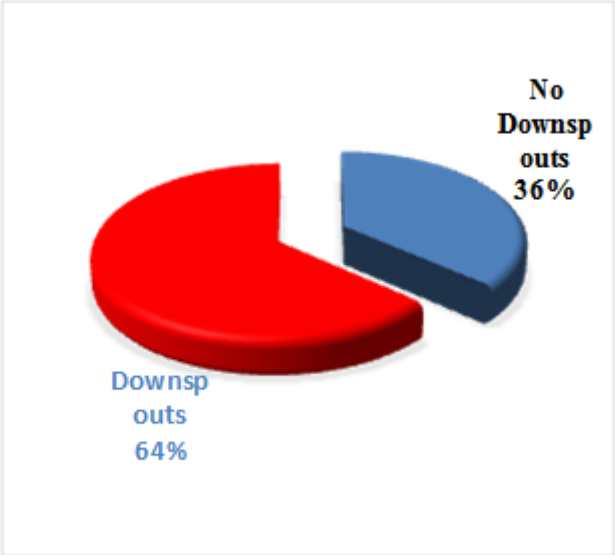
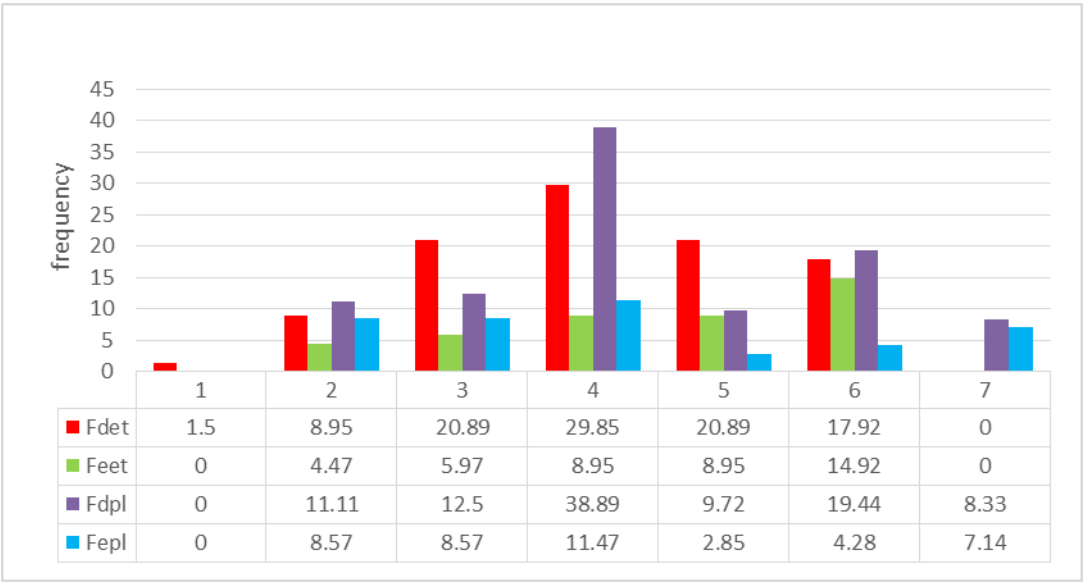


Figure 9. Downspouts

Figure 10 shows that the degradations of the toilets reaches 29.85 in frequency and that of the plumbing reaches 38.89 in the 4th class with respective maximum maintenance frequencies of 17.92 in the 6th class and 11.47 in the 4th class. This is explained by the fact of the perpetual and almost permanent state of dirtiness of the toilets affecting the plumbing thus leading to the regular abandonment of the students' toilets in most of the establishments visited.



	1	2	3	4	5	6	7
Fdet	1.5	8.95	20.89	29.85	20.89	17.92	0
Feet	0	4.47	5.97	8.95	8.95	14.92	0
Fdpl	0	11.11	12.5	38.89	9.72	19.44	8.33
Fepl	0	8.57	8.57	11.47	2.85	4.28	7.14

Figure 10. Frequencies of degradations and maintenance of the toilets, plumbing

Figure 11 shows the degradations (fd) and maintenance (fe) frequencies on the electrical elements of the buildings of secondary and primary school establishments in the city of Yaoundé visited. From this figure 12, we can see that in amplitude 30 the degradation is 32.85; with that of maintenance at 11.42 in the same amplitude.

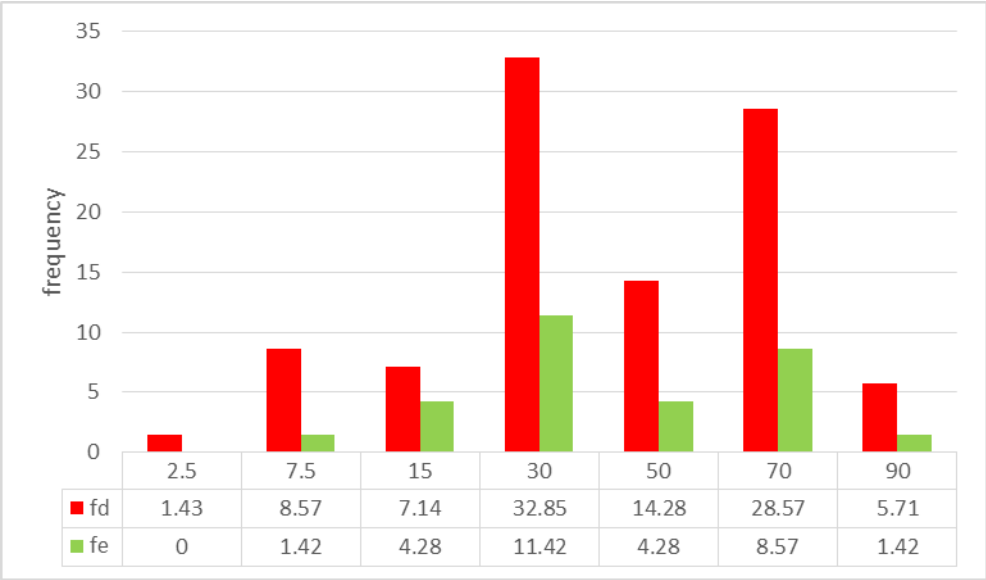


Figure 11. Frequencies of degradations and maintenance on the electrical elements

Figure 12 shows that for most establishments, the degradation has an average frequency of 19.37 for the doors, and maintenance occurs very often after observation; this seems to be explained by the regular replacement of the locks and hinges when the latter fail, in order to better contain the educables.

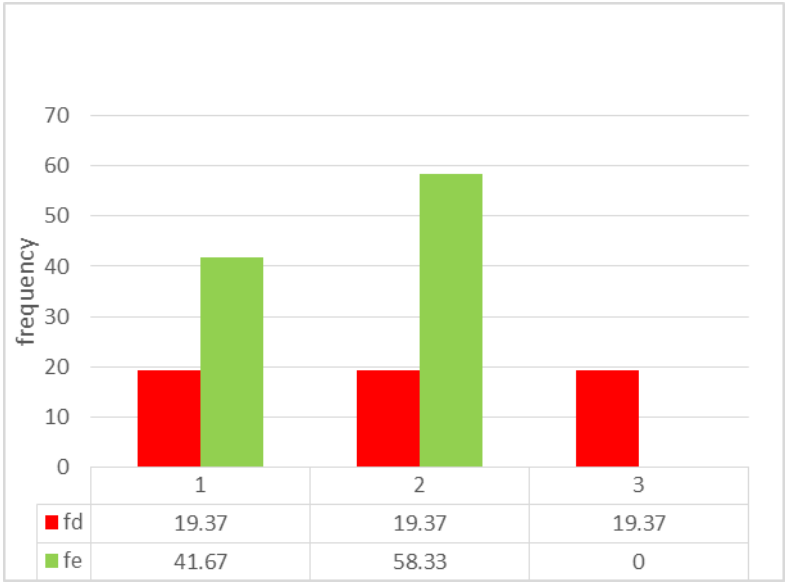


Figure 12. Frequencies of degradations and maintenance of the doors

Figure 13 reports the frequency of degradation (fd) and maintenance (fe) of the fences of the buildings of the secondary and primary school establishments in the city of Yaoundé visited. From this figure 13, we can seen that in the amplitude 30 the degradation is 33.33; and that in most establishments the fences are in a state of disrepair without any maintenance measures being considered.

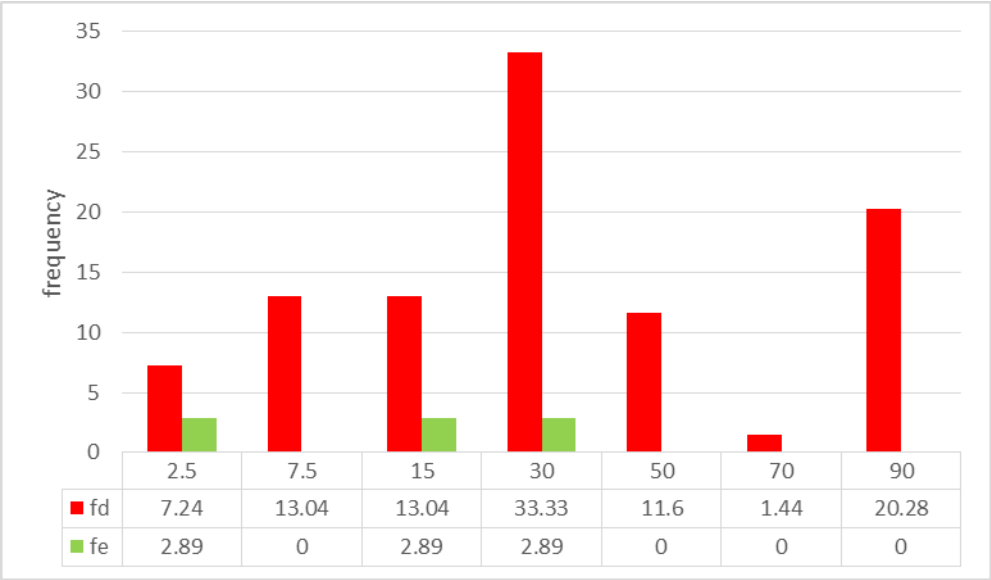


Figure 13. Frequencies of degradations (fd) and maintenance (fe) of the fences

The state of degradation illustrated in Figure 14 attests that in most schools in the capital city, the VRDs (Road and various networks) are not part of the habits of those in charge and even if they exist, maintenance does not always follow.

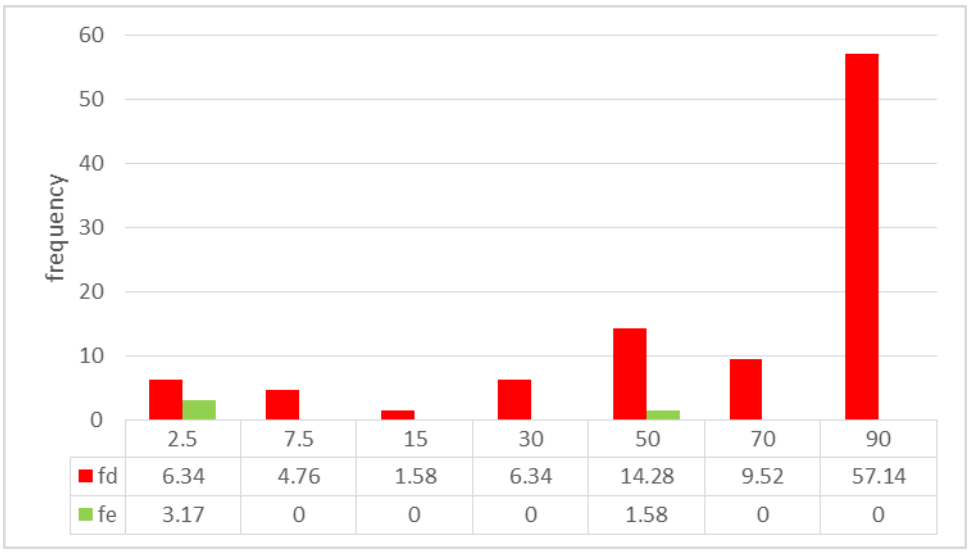


Figure 14. Frequencies of degradations and maintenance of the VRDs (Road and various networks)

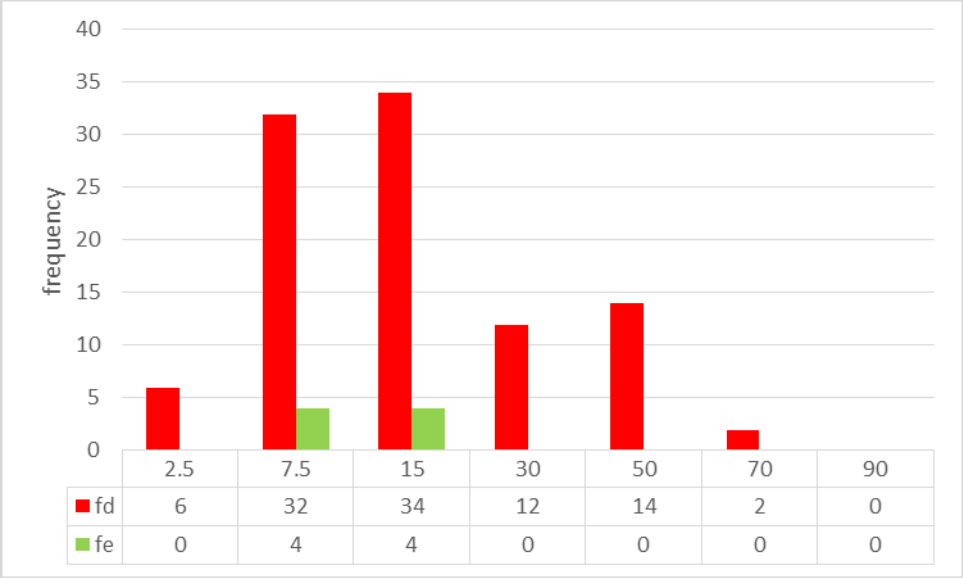


Figure 15. Frequencies of degradations and maintenance of the interior ceilings

Figure 15 shows that the degradations of the ceilings culminate at 34 in terms of frequencies for the interior and to 40.9 (Figure 16) for the exterior of respective amplitudes 15 and 30; with almost non-existent maintenance; proof the torn off, spotted ceilings do not seem to attract anyone's attention. This probably proves that the exterior appearance of a building does not always tell us about its interior condition.

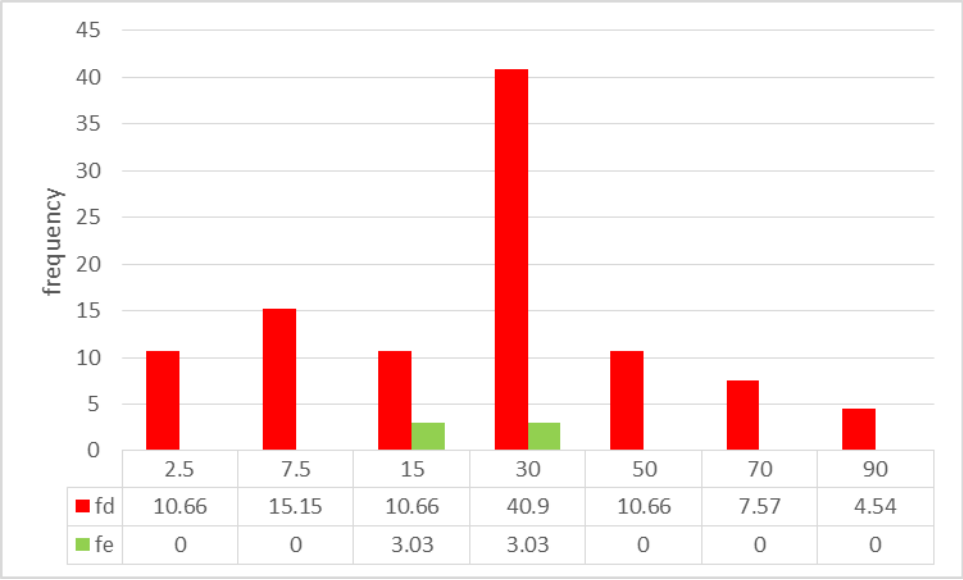


Figure 16. Frequencies of degradations and maintenance of the exterior ceilings

The degradation of the floors of school buildings (mostly coated with slip) is at 43.47 frequency (Figure 17) in amplitude 30 with almost no maintenance overall, it seems that during construction work technicians have not respected the dosages of materials because even young buildings also know this phenomenon and the overcrowding of students is also for something.

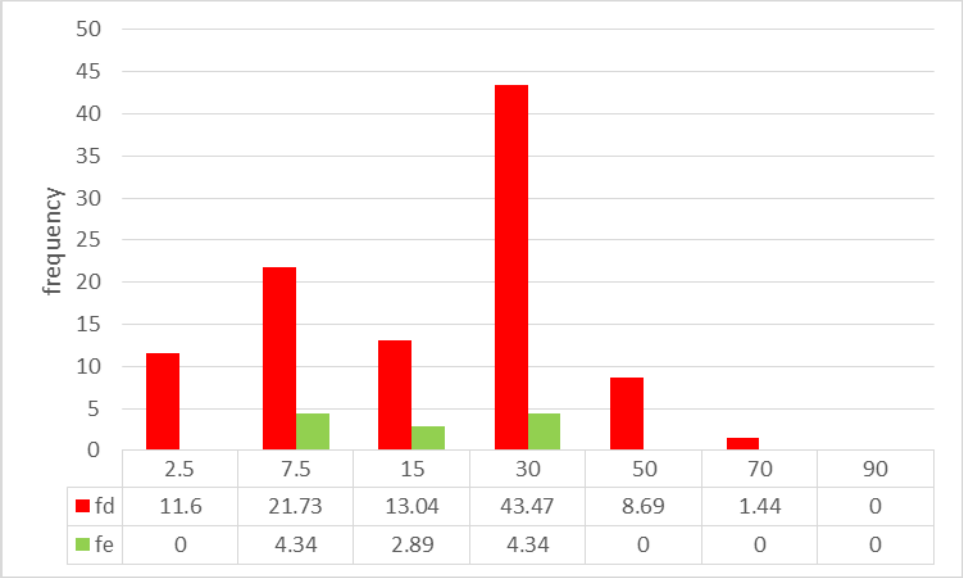


Figure 17. Frequencies of degradations and maintenance of the floors

Figure 18 shows that the structural degradation frequency is very strong (34.86) of amplitude 30 with that of the maintenance at 7.57 in the same amplitude; Hence the old overall appearance of the buildings which were the subject of our investigations because of lack of maintenance. The observer will have the impression that these buildings were constructed during the colonial era.

Figure 18. Frequencies of degradations and maintenance of structural elements

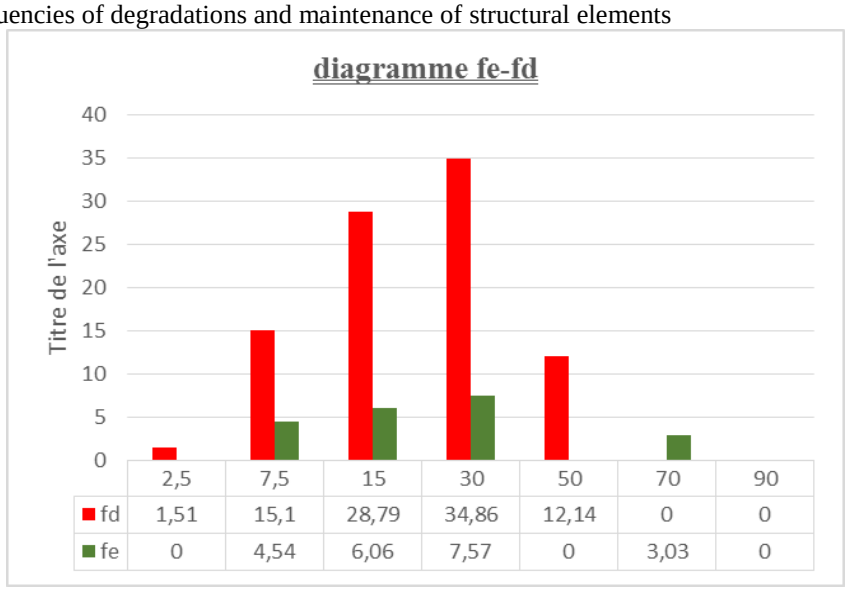
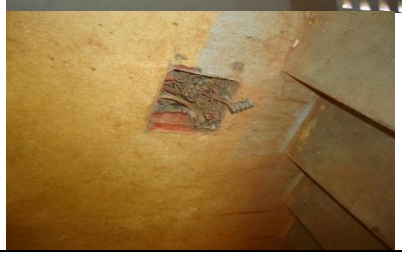


Table 2 shows some degradations and suspected causes in certain primary and secondary school buildings in the city of Yaoundé visited.

Table 2. Some damage encountered on certain buildings during our surveys

Titre	Illustrations	Observations	Causes& Sources
• Ceiling	 	Torn off ceiling	The state of this ceiling is the result of repeated infiltration of rainwater
• Roof and frame	 	Roof torn off	The wind action and the lightness of the structure were right with this cover
• Concrete window and electricity	 	Box showing the malfunction of the electrical appliance	Empty case shows failure of maintenance-free electrical installation and vandalism

• Wooden window and exterior ceiling	 	Ceiling, window and exterior wall appearance in poor condition It should be noted that the degradation of this wall is also caused by sporadic posters	Flat iso door and degraded ceiling, this degradation is due to the current of humid air, and the lack of maintenance
• Toilet state	 	Pitiful state of the toilets	The lack of cleanliness of the toilets leads to this state of abandonment, due to the lack of water
• Toilet state with degraded door		Toilet without door	Malfunction due to the absence of the door; vandalism or ultimate service

• Absent of door		Toilet out of order	Toilet out of order due to lack of door
• Soil conditions		Soil degradation	Failure to comply with construction standards and disregard of the operating load caused this soil to degrade
• VRD (Road and various networks)	 	Road and various networks well maintained Road and various networks non-existent	The contrast between the Road and various networks of schools in the city of Yaoundé is very significant
• Fencing		Fence in good condition	The condition of this fence shows its good construction and the regularity of its

			maintenance
• Major works	 	Ideal shell appearance	This establishment is the only one which displays a proud appearance

V. CONCLUSIONS

This work focused on the assessment of damage and the maintenance of public buildings for primary and secondary schools in the city of Yaoundé, Cameroon. At the end of the surveys carried out in primary and secondary schools in the city of Yaoundé, we recorded different frequencies of degradations and maintenance.

After a methodical treatment of the collected data it becomes clear that in most of the educational establishments the buildings are seriously dilapidated and the public authorities remain deaf faced with this situation.

The poor condition of these school buildings is partly due to several causes, namely:

• Non-compliance with the school's internal regulations by the students, thus leading to acts of vandalism
• The use of poor quality building materials
• Lack of an infrastructure monitoring and control team
• The absence of a real maintenance policy for public buildings
• Lack of a fire safety system
• Lack of good monitoring in the construction of buildings
• Engineers' non-compliance with construction standards
• Failure to comply with specifications in the award of construction contracts
• Climatology
• The lack of a good study of the subsoil
• Hydrography
• The doubtful qualification of the technicians
• The plethora of students in the classrooms
• Poor soil study

VI. RECOMMENDATIONS

To reduce the degradation process and improve the level of maintenance of public school buildings in the city of Yaoundé, Cameroon, it is necessary to:

✓ Establish a service of maintenance or permanent maintenance in these school buildings
✓ Use good quality materials and perform the work according to building rules and standards

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APPENDIX

Région	.....	**Nom bâtiment**	.....
arrondissement	.....	**Type bâtiment**	.....
ville	.....	**Date création**	.....

Données spécifiques

Lot structure

"Gros œuvre"

- Béton ☐ maçonnerie ☐ bois ☐

-Dernière date de réhabilitation .....

-Etat de dégradation actuel.....%

0 %		10%		20%		30%		40%		50%		60%		70%		80%		90%	

Couverture

-type : tôle ondulé ☐ tôle BAC ☐ terrasse ☐

-état dégradation toiture.....%

-date la dernière réhabilitation.....

Charpente

-types : traditionnelle ☐ métallique ☐ mixte ☐

- état dégradation charpente.....%

-date la dernière réhabilitation.....

Revêtement des murs

- mur intérieur : peinture ☐ grès cérame ☐

-état dégradation des murs intérieurs.....%

-date la dernière réhabilitation.....

- mur extérieur : peinture ☐ grès cérame ☐

-état dégradation des murs extérieurs.....%

-date la dernière réhabilitation.....

Ouvertures

-porte : bois ☐ métallique ☐ mixte ☐

-fenêtre : bois ☐ métallique ☐ mixte ☐ béton ☐

-état dégradation des portes et fenêtres.....%

-date la dernière réhabilitation.....

Plomberie

-toilette : traditionnelle ☐ modeme ☐

-alimentation en eau.....

-état de propreté des toilettes.....

-point d'eau.....%.....%.....%

-descente eau pluviale.....

-état dégradation de la plomberie.....%

-date la dernière réhabilitation.....

Electricité

-dans les salles de classe : existant ☐ inexistant ☐

- dans les bureaux : existant ☐ inexistant ☐

-état dégradation de l'électricité.....%

-date la dernière réhabilitation.....

Clôture

Existant ☐ inexistant ☐

-état dégradation clôture.....%

-date la dernière réhabilitation.....

Dispositif anti-incendie

Extincteur ☐ bouche d'incendie ☐ inexistant ☐

Voirie et réseau divers (VRD)

Existant ☐ inexistant ☐

-état dégradation VRD.....%

-date la dernière réhabilitation.....

Plafond

Intérieur

État dégradation plafond intérieur.....%

-date la dernière réhabilitation.....

Extérieur

état dégradation plafond extérieur.....%

-date la dernière réhabilitation.....