

Monitoring of structural health and safety of Flores Hall and Valencia Hall: Inputs for repair, renovation and retrofitting phase I

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Abstract

The study focused on evaluating the structural health and safety of Flores Hall and Valencia Hall. The parameters used were the age of the building, carrying capacity or a number of occupants, the position or location, and geological and hazard maps, including building adjacency and the current state of structural members. The researchers used rapid visual screening in identifying observable hazards in terms of structural and non – structural components and utilized the mixed method of research. A rapid visual screening checklist was developed and followed by an interview to support the result of the checklist.

Both Flores Hall and Valencia Hall already exceeded the number of years wherein the engineers and contractors can be held liable for any damages of the building. Both buildings are located approximately 35.7 km away from the West Valley Fault Line. Most of the structural components of the buildings were observed with no signs of degradation like major cracks, spalling, misalignment, etc. Most non-structural components manifest damages on the architectural finishes, electrical lines, and plumbing system.

Based on the findings of the study, the researchers concluded that Rapid Visual Screening is an important tool in the preliminary structural and non-structural investigation of Flores Hall and Valencia Hall. Also, the data gathered during the Rapid Visual Screening will serve as inputs for the Non-Destructive Testing to determine the health and safety of the Flores Hall and Valencia Hall.

Keywords: Rapid Visual Screening; Structural Health and Safety; Structural Components; Non-Structural Components

1. Introduction

The assessment of structures such as buildings, bridges, dams, tunnels, and other industrial facilities is imperative as these structures age and are exposed to different external and internal stresses and resistances. The strength of any structure, inclusive of its components, can be proven through its health and safety. When there are no usual or sudden changes in resistance, structural assessment should be initiated. The structural deterioration which may happen due to time and changes are corrosion, fatigue, structural damage by accident actions, change in loading, and extension of its planning and design working life. Assessing the strength of the structure is required in different conditions, such as standard of concrete being compromised and not complying with the specifications; change in the use and function of the structure; damage due to man-made or natural ruins; environmental degradation; seismic retrofitting issues [2].

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There are different methods to assess the health and safety of the structures. In this particular study, the two approaches considered are Rapid Visual Screening or building inspection (Phase I) and Non-Destructive test (NDT) (Phase II). This proposal was focused on Phase I Rapid Visual Screening. Rapid Visual Screening is a method to estimate the seismic vulnerability of a large number of structures/buildings (Shah et al. 2016). A procedure for Rapid Visual Screening (RVS) was first proposed in the US in 1988, which was further modified in 2002 to incorporate the latest technological advancements and lessons from earthquake disasters in the 1990s. This RVS procedure, even though originally developed for typical constructions in the US, has been widely used in many other countries after suitable modifications. The most important feature of this procedure is that it permits vulnerability assessment based on the walk-around of the building by a trained evaluator. The Rapid Visual Screening method is designed to be implemented without performing any structural calculations. The procedure utilizes a scoring system that requires the evaluator to (1) identify the primary structural lateral load resisting system and (2) identify building attributes that modify the seismic performance expected for this lateral load resisting system. The inspection, data collection, and decision-making process typically occurs at the building site and is expected to take around 30 minutes for each building [3].

Bulacan State University is one of the premier state-operated Higher Education Institutions in Region 3. It has five campuses; the main campus is located in the City of Malolos. Other campuses are located in other municipalities and a city; Bustos, Bulakan, Hagonoy, and the City of San Jose Del Monte. Over the years, several infrastructures were built to accommodate the students, faculty members, and non-teaching personnel. On the main campus, there are more than ten medium-rise buildings which are a combination of old and newly built. The Valencia Hall and Flores Hall were built in 1980 and 1988, respectively. The National Structural Code of the Philippines (NSCP) 2015 states that “buildings used for college or adult education with a capacity of 500 or more occupants is one of the structures under special occupancy”. The Flores Hall is the Administration Building of Bulacan State University; it is a two-storey building with L-shape. The offices of key officials, registrar, cashier, accounting, budget, human resource management, infirmary, project management, and auditors of the University occupy this building to manage and operate the academic and administrative services of the University. While the Valencia Hall is the University Gymnasium, where all the convocations, sports and academic programs, classes, cultural and technical training, I, symposia, seminars, and conferences were being held. Considering its years of existence, different internal and external stresses may have been present in these structures. Thus, structural health and safety should always be monitored and assessed. The need to monitor and assess the structural strength of the building is very essential to continue its service to the occupants and users. It is true and necessary that “Prevention is better than cure”.

1.1. Statement of the Problem

The general problem of this study was: “How may the structural health and safety of Flores Hall and Valencia Hall be monitored and consequently use the results as inputs in its repair, renovation, and retrofitting?”

Specifically, this study sought answers to the following questions.

1.1.1. What is the status of the Flores Hall and Valencia Hall in terms of?

- age of the building;
- carrying capacity or number of occupants;
- position or location along with geological and hazard maps including building adjacency; and
- Current state of the structural members such as beams, columns, slabs, stairs, bleachers, walls, and trusses?

1.1.2. What are the identified and observable hazards of the Flores Hall and Valencia Hall through rapid visual screening with consideration on?

Structural components

- Columns
- Beams
- Slabs
- Stairs
- Bleachers
- Walls
- Trusses

Non-structural components

- Architectural (such as partitions/walls, ceilings, glazing, cladding, veneers, fences, and architectural ornamentation);
- Mechanical, electrical, and plumbing (such as pumps, fans, air conditioning units, distribution panels, transformers, and distribution systems including piping and conduit);
- Furniture, fixtures & equipment, and contents (shelving and bookcases, industrial storage racks, books, computers, desktop equipment, wall and ceiling-mounted TVs and monitors, file cabinets, kitchen, and museum artifacts and collectibles)?

2. Material and methods

2.1. Methods and techniques of the study

The monitoring of structural health and safety of Flores Hall and Valencia Hall was done considering the Rapid Visual Screening Inspection. The Rapid Visual Screening Inspection Form was developed through the presentation of the considerations based on the FEMA checklist; it was modified and subjected to validation by the professionals and, in turn, customized to the visual screening inspection form for Flores Hall and Valencia Hall. The approved customized visual screening inspection form was used in the visual screening inspection of Flores Hall and Valencia Hall. The two halls were investigated from the ground floor to its topmost covering. Structural components such as beams, columns, slabs, stairs, bleachers, walls, trusses, and non-structural components within the structure were inspected considering the range of defects such as spalls, seepage, cracks, and crazing.

A plan was prepared to accomplish the objectives of this study. Based on the identified specific objectives, activities were identified by researchers who performed and were involved in the activities; scheduled in terms of weeks, days, and time to execute the activities; and included the preparation like computers, laptop, software, printer, bond papers, printer ink, measuring device, and recording.

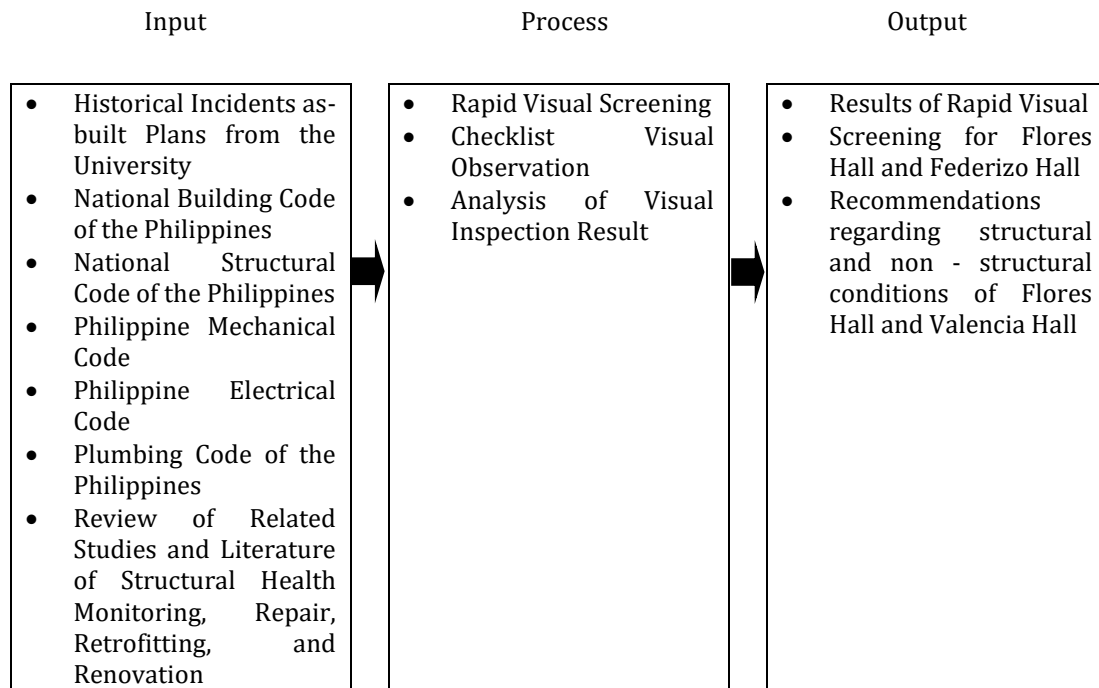


Figure 1 The conceptual paradigm of the study

Figure 1 shows the input-process-output conceptual framework applied to this study. The researchers identified the suitable Checklist Form to conduct Rapid Visual Screening for the structural and non-structural components that were monitored. These checklists were discussed and developed; seek the assistance of professional experts to validate/critique and incorporate their suggestions to improve it further and customize with the existing components and materials used in the construction of the Flores Hall and Valencia Hall. Also, the existing old approved and as-built plans of Flores Hall and Valencia Hall were requested to the Project Management Office.

Assistance from the Facilities Management and Maintenance Office staff was requested during the Rapid Visual Screening site inspection. Flores Hall was the first inspected, from the first floor to the second floor and roof framing, the structural components like the columns, slabs, beams, walls, and trusses, while the non-structural components like the architectural finishes and fenestration, mechanical facilities (heat and ventilation equipment), plumbing and water supply pipes and fixtures, and electrical wiring system, and other miscellaneous had been checked. The Rapid Visual Screening in the Valencia Hall was also performed similarly to what the researchers did in the Flores Hall. Interviews with the occupants of the offices of both buildings were also conducted.

The data gathered were presented, analyzed, and interpreted, specifically the results of the Rapid Visual Screening of Flores Hall and Valencia Hall. Afterward, the summary of findings, conclusions, and recommendations was finally written, including the references.

2.2. Population and Sample of the study

Samples of the study for the checklist of Rapid Visual Screening were taken from related codes, literature, and studies, as well as the opinions/recommendations of the professional experts from the field of retrofitting. Data gathered from visual inspection and occupants' interviews were the samples in analyzing and interpreting the actual health condition of structural and non-structural components of the two buildings.

2.3. Research Instruments

The researchers prepared the rapid visual inspection form/checklist composed of the different structural components such as columns, beams, slabs, stairs, bleachers, walls, and trusses; and the non-structural components, which contains the architectural, mechanical, electrical, plumbing, and the furniture, fixtures, equipment, and contents which are found in the Flores Hall and Valencia Hall. The rapid visual inspection form/checklist contains descriptions of the Flores Hall and Valencia Hall and current conditions of structural and non-structural components of the two halls.

2.4. Data Gathering Procedure

The data gathering procedures used in this study were sought assistance from professional experts, and the data that were already available and supported points of view. The researchers sought the permission and approval of the Vice President for Administration and Finance to conduct the Rapid visual screening of Flores Hall and Valencia Hall, including the assistance of staff in the Building and Ground Management Office (BGMO). Likewise, as-built plans were requested from the Director of the Project Management Office (PMO) to guide the researchers in the rapid visual screening of the old and extension areas of the Flores Hall and Valencia Hall and at least identify the estimate of occupants, aside from the structural components and non-structural components of the two halls.

2.5. Data Processing and Statistical Tools used in the study

The data gathered were tabulated and processed using the Microsoft Excel Program. The observed data upon rapid visual screening were noted or checked if the corresponding structural and non-structural components have damages. During the rapid visual screening, some of the occupants were interviewed about some defects and experiences encountered about the major and minor cracks on structural members, spalling, scaling, leaking on pipes and ceiling, condition of the air conditioning units, tripping of electrical loadings, backflow of flash water in the water closets, and others.

3. Results and discussion

The Chapter deals with the presentation, analysis, and interpretation of data gathered by the researchers through rapid visual screening or ocular visual inspection of the Flores Hall and Valencia Hall. The specific problems in Chapter I were addressed and presented in order of specific questions.

Part I describes the status of the Flores Hall and Valencia Hall in terms of age of the building, carrying capacity or number of occupants, position or location, along with geological and hazard maps including building adjacency, and current state of the structural members such as beams, columns, slabs, stairs, bleachers, and trusses.

Part II presents the identified and observable hazards of the Flores Hall and Valencia Hall through Rapid Visual Screening with consideration on the following: structural components like columns, beams, slabs, stairs, bleachers, walls, and trusses; non -structural components such as architectural, mechanical, electrical, plumbing, and furniture, fixtures, equipment, and contents.

Part III features interviews with the Flores Hall and Valencia Hall occupants.

3.1. Part I: Status of the Flores Hall and Valencia Hall

3.1.1. Age of Building

The age of the building is usually defined based on the construction date. For both buildings, evidence of construction documents was not secured since they were not available at the time of visual inspection; however, drawings for renovation/extension were obtained. Also, most of the offices on Flores Hall and Valencia Hall noticed that the finishing materials were already dilapidated, such as drop ceilings and the wallpaper's already teared-up and faded, old wooden doors, termite houses, some cracks, leaks in the concrete slab which serve as the roof of offices in Valencia Hall, etc., which indicates that it is not regularly maintained. According to ACI 365.1R-17, the remaining life span of a building depends on the degradation of its concrete material from the interaction of its environment and loading conditions. The researchers confirm that based on the actual condition of these buildings, a further step is needed to assess the remaining life, which is the different degradation test in accordance with ACI 365.1R 17 recommendations. Based on the interview from the senior officials who are occupants of the building, the Flores Hall was occupied by the administrative officials in 1988; hence, it can be concluded that it is 33 years old, while the Valencia Hall is older, the senior official mentioned that it was used in 1980; thus, it exists for 41 years already.

3.1.2. Carrying capacity or number of occupants

Flores Hall based on the occupants; the building occupancy category is considered to be "Office" while Valencia Hall is "Assembly Area" as per NSCP 2015. The usage of each space of the building was not checked with the original design and construction since design and construction documents, including the history, were not secured during the rapid visual inspection. This means that any alterations were not identified, and the researchers were not confident if the proper loads based on its usage complied with the original structural design. After the degradation test, the structural analysis and design are also needed to properly check the structural integrity of each member based on actual usage and conditions. The Valencia Hall can accommodate a maximum capacity of more or less 2,900 persons by considering the area in square meters, while the Flores Hall can accommodate 500 persons.

3.1.3. Position or location along with geological and hazard maps including building adjacency

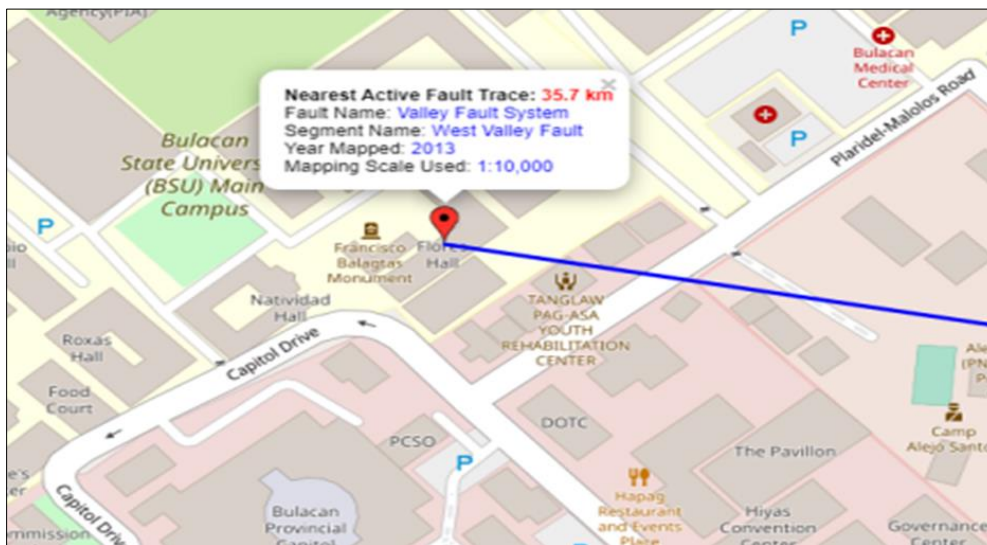


Figure 2 Distance between Flores Hall and Valencia hall and the West Valley Fault line

Flores Hall and Valencia Hall are approximately 35.7 km away from West Valley Fault, an active earthquake fault considered seismic source type "A". The NSCP code provision changes from time to time to ensure the safety of every structure, especially from an earthquake strike. As documents are not available for the structural analysis and design, alteration or changes or extension of the existing structure has potential for collapse when not properly checked. As noted during the visual inspection, both buildings undergo an extension/renovation based on the drawings obtained. Any changes in a structural structure have a major impact on the earthquake forces (geometry and loadings are among them); therefore, structural analysis and design are needed to check the drift and its strength is still within the allowable limits set by the NSCP structural codes, especially for old buildings. The Flores Hall is only three meters away from

Valencia Hall, while the Flores Hall is also three meters away from the Alumni Hall; the three halls are adjacent to each other.

3.1.4. Current state of the structural members such as beams, columns, slabs, stairs, bleachers, walls, and trusses

As per rapid visual inspection, only the visible structural members are being observed since ceilings and other finishing materials obstruct seeing other parts like beams and trusses. As noted in the Research Office (significant diagonal crack of the exterior wall, from ceiling to floor) and Infirmary (long straight vertical crack of about 1 mm was found on one of the columns) of Flores Hall, a possible deflection of the beam above and strength reduction is suspected, respectively. For other structural parts of both buildings, there were no significant cracks or signs of degradation observed.

3.2. Part II: Identified and Observable hazards in the Flores Hall and Valencia Hall through Rapid Visual Screening

3.2.1. Structural Components

Columns

Most of the columns of Flores Hall and Valencia Hall were observed with no signs of degradation such as cracks, spalling, misalignment, etc.; if there is one, the cracked was found on the newly constructed Flores Hall extension, which is located at the Infirmary on the ground floor. However, the researchers are still not confident to conclude that there is no degradation since design and construction documents were not available. It needs to conduct a non-destructive test to assess the remaining strength of the concrete materials.

Beams and Slabs

For beams and slabs that are exposed or visible, signs of degradation were not also found. The majority of these, including the trusses, were only partially observed since ceilings and other finishes obstruct it.

Walls

A significant diagonal crack was found at the perimeter wall of the Research Office on the second floor of Flores Hall, other parts including the Valencia Hall, there are no signs of cracks or spalling.

Trusses

The truss of the Flores Hall was observed to be old and made of wooden structures. As reported by the Facilities Management Office, some broken ceilings were already replaced; this may be due to a possible termite infection. For the Valencia Hall, the truss is made of steel structure; there were no signs of deterioration, rusting, buckling, and misalignment of the steel members; thus, it was observed to be in good condition.

Stairs and Bleachers

During the rapid visual screening, the two reinforced concrete stairs in the Flores Hall have no signs of deterioration, but the other reinforced concrete stair has concrete spalling on some steps while the bleachers in the Valencia Hall have no signs of deterioration, only minimal concrete spalling at some edges (plastering).

3.2.2. Non-Structural Components

Architectural

Flores Hall and Valencia Hall are considered old buildings; most of its architectural finishes were observed dilapidated and already served its life service such as wallpaper, floor tiles, ceilings finishes, doors, windows, and even its painted finishes.

Mechanical, Electrical, and Plumbing

The roof drainage system of both buildings was noted as the main problem during the rainy season. At the time of inspection, the researchers witnessed the water drops and spills between the old and newly extended area of Flores Hall and the Valencia Hall offices under the bleacher. Non-waterproofing and insufficient gutter area were the expected reasons for the water drops and spill since the trace comes directly under the concrete gutter (Flores Hall) and concrete bleacher (Valencia Hall). Also, the drainage at the ground floor comfort room of Flores Hall, the water backflows, this is

because the outlet elevation of the new septic tank is higher than its inlet elevation. Electrical and communication lines layout at the Registrar's Office of Flores Hall were observed not properly in-placed; thus, it is hazardous.

Furniture, Fixtures & Equipment

Furniture, fixtures, and equipment were observed in good condition for both buildings, except the wall shelves in the Auditor's Office on the ground floor were noted unsafe due to insufficient clearance in the installation. There are many furniture, fixtures, and equipment in all offices, which were located in the hallway indicated in the initial plan, but the area of the hallway is now being used as offices of the clerks.

3.3. Part III: Results of the Interviews with the Occupants of Flores Hall and Valencia Hall

3.3.1. Flores Hall

Occupant A. The office has been repaired on the following aspects: change of window type to wall split type after the construction of the extension, and it follows that the electrical system was changed. The tables and cabinets' arrangement were changed, and since the office was beside the pantry, the door was installed in their working area. Although many repairs were made, the problem of water drifting in the ceiling was not remedied, and the water seeped into the lowered glass windowsill. The entire extension part of the building has this problem every time there is a heavy downpour.

Occupant B. The ceiling of the different offices also experienced rainwater seeping, which caused the warping of plywood materials with paints. There are some offices where the wallpaper partitions slowly detach from the wall. When it rained, you can observe trash cans used to catch the rainwater, and the utility worker poured the trash cans full of water in the slop sink of the comfort room.

Occupant C. The Flores Hall is an L-shaped building, where the right wing was extended first, and the left wing followed. It was observed that there are problems with the construction joints, specifically in the roofing area; at the joints, water is seeping into the ceiling, which causes damage to the ceiling, and therefore it should be replaced. Most offices use window-type air conditioning units, and in the extended area have split-type Air Conditioning units.

Occupant D. There are three male and five female comfort rooms being used by the officials and staff on the second floor. These often underwent repairs due to some parts to be replaced, like the water flash tank fittings, gate valves, faucet, bidets, but water closets are still the old ones. Sometimes, the occupants experienced water from the faucets having a foul odor and low pressure. There was no increase in the number of comfort rooms, although there was an increase in the users of the comfort room, so there are times you have to wait for others to finish their thing before you can enter, especially after the lunch break.

Occupant E. Before, the occupants of Flores Hall, experienced brownout due to overloading of the main circuit breaker, but it was already provided with solutions. In the previous electrical plans, few employees occupied the Flores Hall, so there are few window type air conditioning units installed, but now there are different equipment being used to operate the University like the main server equipment, computers, photocopying machines, printers, and appliances in the pantry. The extension part has its own circuit breakers.

Occupant F. All offices have a minimum staff of one, others have more than one, and all are using computers and printers and provided cubicle type tables with cabinets and ergonomic chairs and telecommunication facilities. The official inside the small office has filing cabinets, visitor chairs, office table and ergonomic chairs, with telecommunication fixtures also. The extension areas were used also as an office and conference room with conference table and ergonomic chairs.

Occupant G. There is a room on the ground floor used to store various documents, but there are termites' mounds on the ceiling and walls. The comfort room was repaired, replacing the entire area and the plumbing and water supply fixtures, including the floor tiles, and sometimes experienced backflow of water during flashing. Rainwater is drifting into the air conditioning unit, going to the glass windowsill.

Occupant H. The water is coming out from the flooring, maybe due to an old catch basin that was not properly covered, and this office is part of the extension in the left wing.

Occupant I. The electrical wirings are not yet properly installed and are covered by the threshold. The door being used by the employees to enter the office will be replaced, including the wall where it was installed. There are many minor cracks in the flooring and walls. The cement tiles are not of the same color and design.

Occupant J. The Auditor's office has many walls hanging cabinets but is not properly installed. The vertical clearance of the cabinet is low or does not provide vertical clearance to employees standing below the cabinet. There are times we were injured by the cabinet edges and its lower part.

Occupant K. During rainy days, we experienced the water drifting in that column. The very reason why we put some cans or containers on the floor is to catch the water from the leak. This is an infirmary; as expected, everything should be clean, well arranged, and in order. In terms of the comfort room, a new septic tank was constructed to avoid that backflow of water.

Occupant L. The public comfort room for the males and females on the ground floor is experiencing backflow of water because the elevation of the septic tank inlet is higher than that of the outlet of the sewer lines in the comfort rooms.

3.3.2. Valencia Hall

Occupant A. All of the offices under the bleachers are experiencing water leaks from the concrete roofing, as you can see, the drops of water because it is raining from the beam to the wall and flooring slab. The offices under the bleachers were not included in the construction or repair during the extension renovation. There are times that we experience water inside the office.

Table 1 Visual Inspection Checklist of Flores Hall (Modified 2nd Edition FEMA 155 checklist [1])

VISUAL INSPECTION FORM			
DESCRIPTION OF THE STRUCTURE:			
Bldg. Name:	Flores Hall	Use/Function:	Administration Office Bldg.
Location:	Guinhawa, Malolos, Bulacan	Area/Size:	2,278.92 sq. m.
Owner:	Bulacan State University	No. of Floors:	Two
Project engineer:	N/A		
Contractor:	N/A		
Architectural As-built Available (Y/N):	N	Structural As-built Available (Y/N):	N
Building Plan Approval Date:	N/A	Occupation Certificate Date:	
Earthquake Code used:	N/A		
Construction/Renovation/Alteration History	Date(s)	Remarks	
Extension 1	2009	Completed	
Extension 2	2017	Completed	

MATERIALS USED FOR STRUCTURAL MEMBERS:						
Concrete Description	Normal weight aggregate type	Compressive strength	Concrete Modulus of elasticity	Rebars size	Rebars Yield Strength	Rebars Modulus of elasticity
Concrete Columns	Not Available					
Concrete Beams	Not Available					
Concrete Slabs	Not Available					
Concrete Walls	Not Available					
Concrete Bleacher	Not Available					

PRESENT CONDITION OF NON-STRUCTURAL MEMBERS:					
Description	Material Used	Location of the components	Extend of Damage		
			Minor/None	Moderate	Severe
Wall Finishes	Concrete Finish	Typical to all offices	x		
Floor Finishes	Tiles	Typical to all offices	x		
Ceiling Finishes	Concrete Finish	Typical to all offices	x		
Doors	Wood	Typical to all offices			x
Windows	Steel frames and glass	Typical to all offices	x		
T&B	Tiles	Typical to all offices	x		
Plumbing & Sanitary System	PVC (outlet problem)	Typical to all offices	x		
Electrical System	Wire and Communication	Typical to all offices	x		
Roofing	Steel	roof	x		
Drainage	Roof Gutter	roof			x
Others	Hazardous Termites	Registrar Accounting			x

PRESENT CONDITION OF CONCRETE STRUCTURAL MEMBERS:								
Concrete Description	Formed and finished surfaces							
	Smoothness	Bug holes (surface air voids)	Sand streaks	Deflection/Alignment	Honeycomb	Soft areas	Cold joints	Staining
Concrete Columns	fair	none	none	none	none	none	none	none
Concrete Beams	fair	none	none	none	none	none	none	none
Concrete Slabs	fair	none	none	none	none	none	none	none
Concrete Walls	fair	none	none	none	none	none	none	none
Concrete Stairs	fair	none	none	none	none	none	none	none
Concrete Description	Cracking					Scaling		
	Location and frequency	Crack map	Width and pattern	Leaching, stalactites	Working versus nonworking (dormant)	Area, depth	Type	
Concrete Columns	none	none	none	none	none	none	none	
Concrete Beams	none	none	none	none	none	none	none	

Concrete Slabs	none	none	none	none	none	none	none
Concrete Walls	none	none	none	none	none	none	none
Concrete Stairs	none	none	none	none	none	none	none

Concrete Description	Spalls and pop outs		Stains, efflorescence	Exposed reinforcement: corrosion	Curling and warping	Erosion	
	No., size, and depth	Type				Abrasion	Cavitation
Concrete Columns	none	none	none	none	none	none	none
Concrete Beams	none	none	none	none	none	none	none
Concrete Slabs	none	none	none	none	none	none	none
Concrete Walls	none	none	none	none	none	none	none
Concrete Stairs	none	none	none	none	none	none	none
Concrete Description	Surface coatings, protective systems, linings, toppings			Previous patching or other repair	Penetrating sealers		
	Type and thickness	Bond to concrete	Condition		Type	Effectiveness	Discoloration
Concrete Columns	none	none	none	none	none	none	none
Concrete Beams	none	none	none	none	none	none	none
Concrete Slabs	none	none	none	none	none	none	none
Concrete Walls	none	none	none	none	none	none	none
Concrete Stairs	none	none	none	none	none	none	none

PRESENT CONDITION OF STRUCTURAL STEEL MEMBERS:								
Steel Description	Extend of Rust			Deflection	Alignment	Joint Connection		Buckling /Shearing /Tearing
	Minor/None	Moderate	Severe			Welded	Bolted	
Steel Truss	x			none	none	none	none	none
Base Plate	x			none	none	none	none	none

Occupant B. The cloth curtains being used for the acoustics of the main area of Valencia have been installed since 2016, it is still hanging all over the main hall, dust were accumulated, maybe its efficiency in producing modulated sounds is no longer good, while we are in the pandemic period it has to be requested for replacement. Also, the split-type air-conditioning units should be well maintained to provide better circulation of air and the same for electrical systems.

Occupant C. The Valencia Hall has been used as a vaccination area for many days already; we don't know if the disinfection of the main hall is properly done, we are requesting for its everyday disinfection to get rid of the virus. The public comfort rooms are three for males and three for females in the plan, but the female comfort room near the stage does not exist; it was converted as an office. The water supply in the Valencia Hall and its corresponding sewer lines should also be checked even if it is only used as a vaccination area.

4. Summary of Findings

An analysis of the data gathered revealed the following findings correspond to the specific problems in Chapter I.

4.1. The status of Flores Hall and Valencia Hall

4.1.1. Flores Hall

The age of Flores Hall is 33 years, referring to the time of its completion and occupancy. The entire, complete area of the building can accommodate 500 persons. It is located approximately 35.7 km away from the West Valley Fault, an active earthquake fault and considered a seismic source type "A". Most of the structural components were observed with no signs of degradation like major cracks, spalling, misalignment, etc.

4.1.2. Valencia Hall

The Valencia Hall has existed for 41 years, as mentioned by the senior official, the year she joined the University was the year of its inauguration and occupancy. It can accommodate a maximum of 2900 persons, while it is located 35.7 km away from the West Valley Fault, an active earthquake Fault and considered as seismic source type "A". The structural components like beams, slabs, columns, trusses, walls, and bleachers have not shown major degradation. Flores Hall and Valencia Hall are adjacent to each other with three meters as distance.

4.2. Identified and Observable hazards in the Flores Hall and Valencia Hall through Rapid Visual Screening

4.2.1. Flores Hall

There was a crack in the column of the Infirmary located in the Extension area. The beams, slabs, and trusses were covered with tiles and ceiling boards/cladding, not exposed or visible. There is a diagonal crack observed at the perimeter wall of the Research Office while no sign of degradation on the main entrance stair but seen in the emergency stair some concrete spalling at the edge of the steps.

The architectural finishes of Flores Hall were observed to be dilapidated due to its age, the wallpaper, floor tiles, ceiling finishes, doors, windows, and paint finishes. The mechanical, electrical, and plumbing are still functional except for some observed improper electrical and communication lines layout, the drainage system of the ground floor in the

The extension area and the water backflow of the comfort rooms are also on the ground floor, and the worst rainwater drifts in the connection of the old and extension areas. In one of the offices, it was observed that the wall shelves were not properly installed. There are many furniture, fixtures, and equipment in all the offices. The offices are part of the hallway, so the width of the hallway became narrow.

4.2.2. Valencia Hall

The notable observation was the rainwater drifting from the concrete roofing/slab to the walls of the offices under the bleachers and some concrete spalling at the edge of the bleachers.

The architectural components like the paints are about to fade, cloth curtains have accumulated dust, the mechanical, electrical, and plumbing components are still functional, with few furniture, fixtures, and equipment

5. Conclusion

Based on the findings of the study, the researchers concluded that Rapid Visual Screening is an important tool in the preliminary structural and non-structural investigation of Flores Hall and Valencia Hall. Also, the data gathered during the Rapid Visual Screening will serve as inputs for the Non-Destructive Testing to determine the health and safety of the Flores Hall and Valencia Hall.

Recommendations

Based on the previous findings and recommendations, the study has drawn the following recommendations:

- There is a need to continue the monitoring of the structural health and safety of the Flores Hall and Valencia Hall through Non-Destructive Tests.
- The Building and Ground Management Office may prepare a Preventive Maintenance Management Plan more focused on the Structural and Non-structural components like Architectural, Mechanical, Electrical, Plumbing, and Sanitary. The observed degradation of non-structural components of Flores Hall and Valencia Hall may be included in this preventive maintenance management plan and be used as a reference for repair and requisition of construction materials to be included in the Program Project Management Plan. Once the second phase of this study is completed, the structural components may be included in the preventive maintenance management plan.
- All the plans of new projects should be digitized from the initial plans to as-built plans to avoid missing plans; inventory of all new plans should be done by the Project Management Office and Building and Ground Management Office.
- This study may be replicated in other buildings of the University in the main campus and external campuses.
- The University may create an Office/ Technical Committee who will conduct Rapid Visual Screening Inspection for all the buildings in the main campus and external campuses.

Compliance with ethical standards

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Disclosure of conflict of interest

My co-authors, Engr. Radger Teddy L. Manuel and Engr. Charlene May N. Rivera, declare that they have NO conflict of interest. We have an agreement as researchers that I am the team leader and they are the collaborators.

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