



***Structural Assessment and Condition Evaluation of 2  
Suspended floor building at [REDACTED]***

*A Comprehensive Analysis Using Non-Destructive Testing Methods*

**Client:**



**Date of Inspection:**



**Prepared By:**

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## 1. Introduction

This report presents the findings of the Structural Assessment and Condition Evaluation conducted at Dangote Estate, Lekki Lagos.

The assessment was carried out to evaluate the structural integrity and overall condition of the building, ensuring its safety, functionality, and compliance with relevant building codes and standards.

The primary objective of this evaluation was to identify any existing or potential structural defects, assess the extent of deterioration (if any), and provide recommendations for necessary repairs or maintenance. The inspection focused on key structural components, including the columns, beams, slabs, and other load-bearing elements, which are critical to the stability and longevity of the building.

The assessment employed a combination of visual inspection and advanced non-destructive testing (NDT) techniques to evaluate the condition of the structural elements without causing damage to the property. Visual inspection allowed for the identification of visible signs of distress, such as cracks, spalling, corrosion, or deformation, while NDT methods provided deeper insights into the internal condition of the materials, including concrete strength, reinforcement integrity, and moisture content.

This report is intended to serve as a comprehensive document for the property owner, facility managers, and other stakeholders, providing a clear understanding of the building's current structural condition. It also outlines actionable recommendations to address any identified issues, ensuring the continued safety and durability of the structure.

The findings and conclusions presented in this report are based on the data collected during the site inspection, analysis of the structural components, and adherence to industry best practices and standards. It is our hope that this evaluation will contribute to the informed decision-making process regarding the maintenance, repair, or rehabilitation of the property.

## **1.1 Non-Destructive Testing (NDT) Methods Used:**

1.1.1 Wall Scanning / Wall Detector: The objective of the wall detector test is to locate embedded materials such as reinforcement bars.

1. Inspection Preparation: Prior to the commencement of the wall scanning exercise, the inspection area was carefully reviewed to identify the sections of the wall requiring investigation. The wall surfaces were visually examined to ensure they were free from excessive dust, moisture, or surface obstructions that could interfere with the accuracy of the scanning equipment. The inspection scope and grid area were also defined to ensure systematic coverage of the wall sections.

### **2. Equipment Setup and Calibration**

A wall scanning device capable of detecting embedded objects within concrete and masonry elements was utilized for the inspection. The equipment was switched on and calibrated in accordance with the manufacturer's guidelines to ensure accuracy and reliability of readings. The appropriate detection mode was selected to identify metallic objects, reinforcement bars, electrical conduits, and other embedded materials within the wall.

Examples of commonly used equipment include scanners such as the Bosch D-tect 150 Wall Scanner or Hilti PS 50 Multidetector, which are designed for non-destructive detection of hidden elements in structural components.

### **3. Scanning Procedure**

The wall detector was placed flat against the surface of the wall to ensure proper contact and accurate signal transmission. The device was then moved slowly and systematically across the wall surface in both horizontal and vertical directions to cover the entire inspection area.

During the scanning process, the equipment provided visual and audible signals whenever embedded objects were detected within the wall.

### **4. Identification and Marking of Detected Objects**

Upon detection of embedded elements, the exact locations were carefully marked on the wall surface using a marker or chalk. These markings served as reference points indicating the presence and approximate position of reinforcement bars, conduits, pipes, or other hidden materials.



## 5. Documentation of Findings

All detected locations were documented during the inspection process. Observations including the approximate depth, location, and type of detected material were recorded where applicable. Photographic evidence and site notes were also taken to support the inspection findings and ensure proper documentation for reporting purposes.

## 6. Interpretation and Assessment

The results obtained from the scanning exercise were analyzed to determine the presence and distribution of embedded materials within the wall structure. Areas where objects were detected were clearly identified to prevent accidental drilling, cutting, or structural damage during subsequent construction or renovation activities.

## 7. Safety Considerations

All inspection activities were carried out in compliance with standard site safety procedures. Personnel involved in the inspection used appropriate personal protective equipment (PPE), and care was taken when scanning areas suspected to contain live electrical conduits.

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## 2. Methodology

The following methods were used during the inspection, in accordance with relevant international and local standards:

### 2.1 Rebound Hammer Test:

- Conducted as per ASTM C805/C805M-18: Standard Test Method for Rebound Number of Hardened Concrete.
- Used to estimate the strength of the concrete.

### Methodology for Rebound Hammer Testing of Concrete

#### 2.1.1. Objective

The objective of this methodology is to assess the surface hardness and estimate the compressive strength of concrete using the rebound hammer test. This non-destructive testing method provides an indication of the concrete's quality and uniformity.

#### 2.1.2. Equipment

- **Rebound Hammer (Schmidt Hammer):** A spring-loaded device that measures the rebound of a plunger after it strikes the concrete surface.
- **Calibration Anvil:** Used to calibrate the rebound hammer before testing.
- **Abrasive Stone or Grinder:** For smoothing rough concrete surfaces if necessary.
- **Measuring Tape:** To mark and measure test locations.

### 2.1.3. Preparation

- **Surface Preparation:** Ensure the concrete surface is clean, smooth, and free from loose particles, paint, or other coatings. If the surface is rough, use an abrasive stone or grinder to smooth it.
- **Calibration:** Calibrate the rebound hammer using a calibration anvil as per the manufacturer's instructions to ensure accurate readings.
- **Test Location Selection:** Choose representative locations on the concrete structure, avoiding edges, corners, and areas with visible cracks or defects. Mark the test points at least 20 mm apart.

### 2.1.4. Testing Procedure

#### 1. Positioning the Rebound Hammer:

- Hold the rebound hammer perpendicular to the concrete surface. Ensure the plunger is in direct contact with the surface.
- For vertical surfaces, use the hammer in a horizontal position. For horizontal surfaces, use it in a vertical position.

#### 2. Taking Measurements:

- Press the rebound hammer firmly against the concrete surface until the plunger retracts and the hammer impacts the surface.
- Release the hammer after impact, allowing it to rebound. Record the rebound number (R) from the scale on the hammer.

#### 3. Data Recording:

- Record the rebound numbers along with the corresponding test locations.
- Calculate the average rebound number for each test location.

### 2.1.5. Data Analysis

- **Compressive Strength Estimation:** Use the average rebound number to estimate the compressive strength of the concrete. This can be done using correlation curves or charts provided by the rebound hammer manufacturer, which relate rebound numbers to compressive strength.
- **Uniformity Assessment:** Compare rebound numbers from different locations to assess the uniformity of the concrete. Significant variations may indicate areas of poor quality or deterioration.

### 3. Test Results

#### 3.1. Foundation

Location	R1	R2	R3	R4	Average (N/mm <sup>2</sup> )	Remarks
Foundation	36	37	36	35	36.0	Satisfactory

**Element Inspected:** Ground Beam

**Observations:**

- No visible signs of differential settlement.
- No major structural cracks observed on foundation walls.
- No evidence of soil erosion or undermining around foundation perimeter.
- Concrete surface condition is satisfactory.

### 3.2. Ground Floor Columns

Column	R1	R2	R3	R4	A:ciagc (N/mm <sup>2</sup> )	Remarks
C1	««	«4	«4	«5	«4.00	Satisfactóy
C2	«2	«4	«4	««	««.25	Satisfactóy
C3	«1	««	««	«2	«2.25	Satisfactóy
C4	«2	«1	««	«2	«2.00	Satisfactóy
C5	«1	«1	««	«1	«1.50	Satisfactóy
C6	«1	«1	««	«1	«1.50	Satisfactóy
C7	«1	«1	««	«1	«1.50	Satisfactóy
C8	28	«1	«0	«0	29.75	Satisfactóy
C9	«0	«2	«0	«0	«0.50	Satisfactóy
C10	««	«1	«0	«0	«1.00	Satisfactóy
C11	«1	29	29	29	29.50	Satisfactóy
C12	«1	«1	29	29	«0.00	Satisfactóy
C13	29	«1	29	29	29.50	Satisfactóy
C14	«1	29	29	29	29.50	Satisfactóy
C15	«1	«1	«1	«1	«1.00	Satisfactóy
C16	«2	«2	«1	«1	«1.50	Satisfactóy
C17	«0	29	«0	«0	29.75	Satisfactóy

#### Observations:

- Columns are vertically aligned with no noticeable deviation.

- No visible structural cracks, spalling, or reinforcement exposure.
- All columns exhibit adequate compressive strength
- There is no significant variation or weak zone
- Concrete surface is sound and well compacted.
- No signs of distress under current load condition.

### 3.3 First Floor Slab

Slab Location	R1	R2	R3	Average (N/mm <sup>2</sup> )	Remarks
First Floor Slab	27	27	26	26.67	Satisfactory

#### Observations:

- No excessive deflection observed.
- No major cracks beyond acceptable hairline shrinkage cracks.
- Soffit condition is good with no honeycombing or reinforcement exposure.
- Load distribution appears uniform

### 3.4. First Floor Columns

Column	R1	R2	R3	R4	A:ciágc (N/mm <sup>2</sup> )	Remarks
C1	26	«0	28	«0	28.50	Satisfactory
C2	29	29	«0	«0	29.50	Satisfactory
C3	28	«0	29	29	29.00	Satisfactory
C4	28	«0	29	«0	29.25	Satisfactory

C5	«1	«1	29	29	«0.00	Satisfactory
C6	«0	«0	«0	«0	«0.00	Satisfactory
C7	«0	29	29	29	29.25	Satisfactory
C8	28	28	27	27	27.50	Satisfactory

**Observations:**

- Columns are properly aligned.
- No signs of structural distress.
- No visible cracks or concrete deterioration.
- Reinforcement is not exposed.

**3.5 Second floor column**

Column	R1	R2	R3	R4	A:ciágc (N/mm <sup>2</sup> )	Remarks
C1	29	«0	«0	«0	29.75	Satisfactory
C2	27	«0	«0	«0	29.25	Satisfactory
C3	28	28	29	29	28.50	Satisfactory
C4	«1	«0	«0	«0	«0.25	Satisfactory

**Observations:**

- **Columns are vertically aligned with no noticeable deviation.**
- **No visible structural cracks, spalling, or reinforcement exposure.**
- **All columns exhibit adequate compressive strength**

- **There is no significant variation or weak zone**
- **Concrete surface is sound and well compacted.**
- **No signs of distress under current load condition.**

### 3.6 Second Floor Slab

Slab Location	R1	R2	R3	Average (N/mm <sup>2</sup> )	Remarks
Second Floor Slab	28	28	27	27.67	Satisfactory

#### **Observations:**

- No excessive deflection observed.
- No major cracks beyond acceptable hairline shrinkage cracks.
- Soffit condition is good with no honeycombing or reinforcement exposure.
- Load distribution appears uniform

#### 4. Test Results and Analysis

The rebound hammer test was carried out on the structural elements of the building, including the foundation, ground floor columns, first floor slab, first floor columns, and second floor slab. The test was conducted to estimate the surface compressive strength of the concrete using a Schmidt Rebound Hammer in accordance with \*\*ASTM International guidelines under ASTM C805/C805M for non-destructive testing of concrete.

From the test readings obtained, the average estimated compressive strength values for the structural members ranged approximately between:

- The **minimum value (26 N/mm<sup>2</sup>)**:
  - Still meets **C25 requirement (≥25 N/mm<sup>2</sup>)**
  - Indicates **no structural failure**
  
- The **maximum value (37 N/mm<sup>2</sup>)**:
  - Shows **excellent concrete quality at foundation level**
  
- Overall range: **26 – 37 N/mm<sup>2</sup>**

The results indicate that the majority of the tested elements fall within the range of 26 N/mm<sup>2</sup> – 37 N/mm<sup>2</sup>, which is generally consistent with the expected compressive strength for structural concrete used in reinforced concrete buildings.

## 5. Comparison with Acceptable Standard

Typical structural concrete used in building construction is usually designed with characteristic strengths such as:

- 20 N/mm<sup>2</sup> (C20) – Minimum structural grade
- 25 N/mm<sup>2</sup> (C25) – Common structural grade for residential buildings
- 30 N/mm<sup>2</sup> (C30) – Higher strength structural concrete

Based on commonly referenced international guidance such as ASTM International and \*\*British Standards Institution standards like BS EN 12504-2 for rebound hammer testing:

- Concrete values above 25 N/mm<sup>2</sup> are generally considered adequate for structural applications in typical reinforced concrete buildings.
- The recorded rebound hammer values in this assessment meet and in many cases exceed the minimum acceptable strength for structural concrete.

The lowest recorded average value (26 N/mm<sup>2</sup>) still falls within the acceptable range for C25 structural concrete, while several elements recorded strengths above 30 N/mm<sup>2</sup>, indicating good concrete quality.

- concrete strength across all elements is **consistent and reliable**
- No structural element shows **critical failure**
- Slight strength variation between floors is **normal in construction**
- Overall quality indicates:
  - Proper batching

- Adequate compaction
- Good curing practices

## 6. SITE OBSERVATIONS AND RECOMMENDATIONS

### 1. Dampness at Rear Side of Building

#### Observation:

Slight dampness was observed at the rear side of the building. This condition is likely due to **capillary rise of moisture**, possibly resulting from an inadequately installed or compromised **damp-proof membrane (DPM)**.

#### Implication:

If not addressed, prolonged moisture ingress may lead to:

- Deterioration of finishes
- Mold growth
- Gradual weakening of building elements

#### Recommendations:

- Conduct a detailed inspection of the **damp-proofing system** at the affected area
- Apply appropriate **remedial damp-proofing treatment** (e.g., chemical damp-proof course or surface waterproofing)
- Ensure proper **site drainage** to prevent water accumulation around the foundation
- Monitor the area over time to confirm effectiveness of the intervention

## 2. Concrete Spillage and Exposed Reinforcement at Master Bedroom Terrace

### Observation:

Concrete spillage was observed at the **master bedroom terrace (concrete façade design area)**. The absence of adequate **concrete cover** has resulted in **exposure of reinforcement bars**.

### Implication:

Exposed reinforcement is susceptible to:

- Corrosion due to environmental exposure.
- Reduction in structural durability.
- Potential long-term structural deterioration if left untreated.

### Recommendation:

- Remove all loose and defective concrete around the affected area.
- Clean the exposed reinforcement and treat with **anti-corrosion coating**.
- Reinstate the section using appropriate **repair mortar or concrete** ensuring adequate cover is provided.
- Ensure compliance with standard **concrete cover requirements** in all exposed structural elements.
- Implement proper supervision during finishing works to prevent recurrence.

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Both observations are **localized defects** and do not currently indicate a global structural failure.

However, **timely remedial action is essential** to prevent long-term deterioration and maintain structural durability.

## 7. Conclusion and Recommendation

Based on the rebound hammer test results and analysis:

- The concrete strength of the tested structural members is within acceptable structural limits.
- The foundation, columns, and slab elements tested show satisfactory compressive strength.
- No structural member tested shows values indicating substandard or weak concrete.

Therefore, the overall integrity of the tested concrete elements is considered satisfactory for structural performance.

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## 7. REFERENCES

### 1. ASTM Standards (American Society for Testing and Materials)

- ASTM C805 – Standard Test Method for Rebound Number of Hardened Concrete
  - This standard provides the method for measuring the rebound number, which is used in rebound hammer testing to estimate the strength of concrete.
- ASTM D5230 – Standard Guide for Measuring the Rebound Number of Concrete Using the Schmidt Hammer
  - A guide that supplements ASTM C805 for applying the Schmidt hammer in practice.

### 2. ISO Standards (International Organization for Standardization)

- ISO 1920-10:2018 – Testing of Concrete - Part 10: Determination of the Rebound Number of Concrete
  - An international standard for the rebound hammer test, similar to ASTM C805, providing a method for evaluating concrete hardness and estimating compressive strength.
- ISO 13666:2018 – Non-destructive Testing of Concrete - Determination of Rebound Hammer Test
  - Specifies the requirements for rebound hammer testing, focusing on concrete compressive strength estimation.

### 3. Guidelines and Handbooks

- Handbook of Nondestructive Testing of Concrete by L. R. Kessler and E. P. Popovics
- NDT for Concrete Structures by L.M. Lowes and G.M. Bond