Over the past decades, there has been a tremendous improvement in the concrete placement technology in Uganda. The methods have moved from being manual to the use of concrete pumps. A concrete pump is capable of pumping high volumes of concrete per minute. This implies that for small volume slabs before the setting of concrete, the whole weight of the fresh concrete of the upper slab, formwork, and props is transferred to the lower supporting slab. During construction, slabs are stacked with materials like bricks, blocks, sand, and aggregates. Construction loads such as block loads and loads due to props, formwork, and freshly cast solid concrete slabs on the lower floor are usually greater than the imposed loads and are not catered for in design. A baseline survey carried out on 118 randomly selected sites in Kampala revealed that in 87% of the cases, supports are removed from a lower reinforced concrete slab, and then props are put on its top to support a yet to be cast slab on an upper floor. It also revealed that 80.6% of the slabs had construction loads such as bricks, blocks, sand, timber, and aggregates. Deflections were measured using dial gauges for construction loads owing to freshly cast slab and concrete blocks in a physical model of a multistory structure with dimensions of 4 m long, 2 m wide, 2 m high to 2nd level, and 2 m to 3rd level. Loads due to freshly cast concrete were 158% more than unfactored design live loads. The maximum deflection at center of the slab due to a freshly cast slab and blocks loaded instantaneously was 1.15 mm and 11.815 mm, respectively, compared to the immediate deflection equal to 0.103 mm due to a design-imposed load of 2 KN/m$^2$.

1. Introduction

Uncontrolled speedy construction of upper floors with stay in place formwork has been attributed as one of the major causes of failure of high-rise buildings in Uganda during the construction phase [1]. Shoring and reshoring processes of slabs in tall buildings lead to very high construction loads which are more than the self-weight of slabs [2]. These construction loads are also higher than design loads [3]. A construction load is that load that can be present due to execution activities but is not present when the execution activities are completed [4]. Construction loads should not be neglected in order to provide assurance of safety of buildings, and they include dead, live, equipment-impact, wind loads, the weight of workmen, equipment, and material storage [5].

The purpose of design is to provide safety of buildings against collapse at ultimate loads and an adequate amount of stiffness against excessive deflections at service loads. Although serviceability problems caused by excessive deflections are not catastrophic, they can necessitate expensive repairs to the nonstructural elements. Producing a satisfactory design, therefore, requires that the magnitude of deflections at service loads lies within permissible values [6].

Limited deflections in a floor which causes cracking/distortion in partitions could reasonably be considered as a defect but not failure, whereas excessive deflection resulting in serious damage to partitions, ceilings, and floor finishes could be classified as a failure [7].

Reinforced concrete buildings cover over 90% of all buildings constructed in Uganda [8]. Solid slabs are some of
the slab types used in Uganda which form part of building elements of a reinforced concrete structure.

Over the past decades, Uganda’s construction industry has moved from manual to motorized hoists to using concrete pumps. Concrete pumps are capable of placing approximately 1 m³/minute of concrete [9]. This implies that before the final setting time, the whole weight of the fresh concrete of the upper slab, formwork, and props is transferred to the lower supporting slab since the slab is not yet self-supporting. Excessively high construction loads due to fresh concrete, formwork, and materials on slabs are some of the leading causes of failures of 38% of buildings during the construction phase [10] leading to loss of lives and investments and subsequently an increased debt burden to future citizens in developing countries [11]. In Uganda, other causes of building failure are inadequate supervision, use of incompetent personnel, and the use of inadequate construction techniques [12].

A baseline survey of 118 buildings under construction revealed that during the building process, 87% of building sites in Kampala remove props below the slab after 28 days and these are placed on top of it to support a yet to be cast slab. Another survey revealed that in 124 sites, 80.6% of the sites had construction loads such as bricks, blocks, sand, timber, and aggregates. There was therefore need to study the load deflection relationship of solid slabs due to various construction loads.

As a convenient way of controlling deflections, some codes of practice specify limiting span to depth ratio. This is conservative because the effect of all factors affecting deflections is included in a single parameter, namely, depth [13]. Actual deflections may differ from estimated ones particularly if applied moments are close to the cracking moment [14].

Basic in situ load tests are based on deflection measurements, and these are normally made by mechanical dial gauges which must be clamped to an independent rigid support [15]. The measurement of deflection is also aided by the use of close-range photogrammetry method in destructive testing [16]; hydrostatic cell levelling [17]; precise levelling [18]; and linear variable displacement transducers (LVDTs) [19].

In the construction of a multistorey structure, construction loads may exceed the design loads by an appreciable amount. Thus, shoring must be provided to support these loads without excessive stresses or deflection. The calculation of the loads imposed on these shores as well as on the structure must be performed to determine the cycle time for the erection of the structure and for the design of the shoring properly. However, no single procedure for shoring and reshoring multistorey structures is recommended in the literature [20].

Most failure occurs in the shoring system in which many of the shores buckle due to overloading. The use of structural fuses as load limiters installed on temporary shoring systems [10] has been developed.

Concrete properties should also be accurately evaluated to predict the immediate and long-term deflection of the slabs [21]. The final deflection of a slab depends on the extent of initial cracking which, in turn, depends on the construction procedure, amount of early shrinkage, temperature gradients in the first few weeks after casting, degree of curing, the degree of restraint, and the quality of the concrete [22].

2. Materials and Methods

2.1. Research Approach. A systematic experimental program was designed to investigate the load deflection relationship of supporting slabs due to various construction loads.

2.2. Baseline Survey. A baseline survey was carried out on reinforced concrete multistorey construction sites around Kampala to inform the dimensions of the model chosen for the experimental program, materials, support conditions of upper slabs, and construction loads due to block loads. Observation checklists were used to collect data. Data were analysed using MS Excel 19 [23].

2.3. Material Tests. Tests were done on soil, aggregates, and concrete. Water tests were not necessary because it was drawn from tap water supplied by the national water body. Tests on cement and reinforcement were not carried out because certificates of conformity on the same were obtained from manufacturers.

2.3.1. Concrete Tests. A trial mix established a ratio of 1: 1.5: 3, with water cement ratio of 0.68, in order to provide the needed concrete strength of C20/25 using hand mixing and weight batching. 150 mm square moulds were used conforming to BS EN 12390-1-1 [24]. Sampling fresh concrete was done using BS EN 12350-1:2019 [25]. Vibration and curing of concrete were carried out according to BS EN12390-2 [26]. Slump tests were done according to BS EN 12350-2 [25]. Compression tests were done according to BS EN 12390-3 [27]. A diesel operated mechanical mixer with rotating pedals was used to mix concrete during construction.

2.3.2. Aggregate Tests. Sampling of aggregates was done using quartering method in accordance to BS 812-102:1984 [28]. Flakiness index was calculated in accordance with BS 812-105.1:1989 [29]. Water absorption and relative density were evaluated in accordance with BS 812-2:1995 [30]. Grading and assessment of fine content were done in accordance with BS 812-103.1-1985 [31].

(1) Soil Tests. Undisturbed soil samples were collected at 1.5 m depth, and direct shear tests were carried out in accordance with BS 1377-7:1990 [32] in order to calculate the bearing capacity according to Terzaghi.

2.3.3. Model Description. From the baseline survey, the minimum slab dimensions obtained from the sites were 2 m width, an average length of 4 m, and average of 3 m height. These dimensions informed the dimensions of the model.
chosen for experimental program. As a result, a physical model of a multistory structure was built, with dimensions of 4 m long, 2 m wide, and 2 m high to the second level and 2 m to the third level, as shown in Figure 1 below.

The model had three levels, ground floor, first floor, and second floor, as shown in the longitudinal section in Figure 2.

The foundation consisted of pad footings which were 1 m × 1 m × 0.2 m deep. 200 mm × 250 mm deep ground beams and 200 mm × 200 mm columns were provided at the ground floor level, 1 m above the foundation. The plan of the foundation and ground beams is shown in Figure 3.

The ground slab 250 mm thick consisted of precast slabs 200 mm thick and a 50 mm concrete topping of class C 20/25, with ground beams of 200 × 250 mm at the edges as shown in Figure 4 above.

The beams used as shown in, Figure 5 were of dimensions of 200 mm × 250 mm. T8 mm-150 mm center-to-center link reinforcement and 2T12 mm-2T12 mm top and bottom reinforcement anchored with hooks 1 meter into the column were used to reinforce them.

The columns used as shown in, Figure 6 were of dimensions 200 mm × 200 mm. They were reinforced with T8 mm-120 mm center to center links reinforcement and 4T12 mm longitudinal reinforcement.

The first and second floor slabs were 175 mm thick and comprised of a layer of sagging moment reinforcement, T12 mm at 200 center to center primary reinforcement with T12-300 center to center secondary reinforcement. At the supports, T12 mm at 200 center to center primary reinforcement with T12-300 center to center secondary reinforcement was provided as shown in Figure 7 below.

2.4. Construction Loads due to Freshly Cast Reinforced Concrete Slabs and Props. Just as it was discovered from construction procedures during a baseline survey carried out by the researcher in Kampala, props were removed from supporting the first floor slab after gaining strength at 28 days and were placed on top of it to support a yet to be cast slab on the second floor. As shown in Figures 8 and 9, of the 25 props supporting the upper floor on which concrete was to be cast, four (4) props were placed on top of load cells at strategic locations to monitor the load from the freshly cast slab for 28 days. Dial gauges were placed under the soffit of the first floor slab to monitor the deflection due to loads from the freshly cast slab. The load cell locations are shown as LC 1, LC 2, . . . LC 9. Dial gauges are shown as DG-1 up to DG-9.
The second floor was cast in ten (10) minutes using ready mix concrete. From the time of casting up to a period of 28 days, deflections were monitored, and corresponding loads calculated.

2.5. Construction Loads due to Blocks. Just as it was discovered from construction procedures during a baseline survey carried out by the researcher in Kampala, slabs are usually loaded with construction materials such as concrete blocks temporarily during building of partitions. Both first and second floor slabs therefore were loaded to determine their deflection time behaviour. The total number of blocks was 672. The same were loaded in a time period of 4 hours (Figures 10–12). The blocks were stacked to a height of 1.33 m, length of 3.6 m, and width of 1.8 m.
2.5.1. Tools Used for Data Collection on the Physical Model. Table 1 shows the tools that were used for data collection on the model.

2.5.2. Material Details Used for Building Model. These included sand, cement, aggregates, water, reinforcement, and timber which were all obtained from local sources, guided by results from observations during the baseline surveys. They are shown in Table 2.

2.6. Structural Analysis and Design. Structural analysis and design of the structure by manual calculations leading to sizing of elements, performing deflection checks and
Figure 10: Section through stacked blocks.

Figure 11: Typical first layer of blocks.

Figure 12: Typical tie layer 2 of blocks.
calculated according to BS EN 1992-1-1 [14], were done before model construction.

2.6.1. Elastic Deflection. According to ACI 318, elastic or immediate deflection was obtained using the following equation [33]:

\[
\text{deflection} = \frac{\omega l^4}{384EI},
\]

where \(\omega\) = uniformly distributed load; \(l\) = length; \(E\) = Young’s modulus of concrete; \(I\) = moment of inertia.

### 3. Results and Discussion

#### 3.1. Baseline Survey.
A baseline survey carried out on 118 randomly selected sites in Kampala revealed that in 87% of the cases, supports are removed from a lower reinforced concrete slab, and then props are put on its top to support a yet to be cast slab on an upper floor. A second baseline survey was also carried out on 124 randomly selected sites in Kampala. It also revealed that 80.6% of the slabs on sites surveyed had construction loads such as bricks, blocks, sand, timber, and aggregates as shown in Table 3.

From Table 3, it is seen that timber in various forms is the most commonly loaded material on slabs as it comprised 34% of the sites. The second most commonly loaded materials are bricks and blocks. These were found on 22.5% of the sites. 19.4% of the sites did not have construction loads. These were mainly sites in the city center (central business district). Here pumped concrete was mainly the norm.

#### 3.2. Material Tests

3.2.1. Compressive Strength Results. The compressive strength test for elements cast is shown in Table 4. At 28 days, concrete cube strengths above 25 MPa were achieved.

3.2.2. Workability/Slump Results. On average, true slump of 45–100 mm was achieved during trial and actual mixing for all elements except the second floor slab. A collapse slump of 150 mm was achieved for the pumped concrete cast on second floor slab.

3.2.3. Coarse and Fine Aggregate Tests. Coarse and fine aggregates were sieved according to test method BS 812-103.1:1985 [31] under the specifications of BS 882:1992 [34] (Figures 13 and 14).

Fine aggregates were well graded while coarse aggregates were predominantly uniformly graded single sized aggregates of size 20 mm, respectively, according to Figures 13 and 14.

3.2.4. Other Fine and Coarse Aggregate Tests. The fines percentage obtained was 0.273 for sand, and for coarse aggregates, it was 0.043. This was less than the maximum of 4% as per specification in BS 882:1992 [34]. Water absorption for coarse aggregates was 0.16. The relative density was 2.668 for coarse aggregates. The flakiness index for coarse aggregates was 28.7% < 40% according to specifications in BS 882:1992.

3.2.5. Soil Investigation Results. Cohesion factor \(C\) obtained was 10.8, and internal friction angle \(\varphi = 30^\circ\). Hence, the bearing capacity of the site soil determined from Terzaghi’s model gave a value of 292.47 kPa.

#### 3.3. Freshly Cast Slab Construction Loads

3.3.1. Load Deflection Time Relationship Curves due to Freshly Cast Slab. Table 5 shows data from readings recorded from the start of casting to the end of casting and during the period of loading. In Table 5, DG refers to dial gauge. It should be noted that the casting and finishing operations ended in under 10 minutes from the start of casting. Deflection increased by 12% for DG-9 in the first 37 minutes.
Table 6 shows that there was a reduction in load as setting occurs at the load cells located at the edges of the slab (LC2 and 3). The load on load cells at the center of the slabs LC1 and 4 remained constant over a period of 37 minutes.

Figure 15 shows the deflection experienced due to loads of fresh concrete on lower slab. This was monitored by dial gauges DG8, DG6, DG7, DG6, D65, DG4, DG3, DG2, and DG1 in locations shown in Figure 9. Generally, it is seen that the deflection decreases as the concrete hardens.

Points shown in Figure 16 represent the following:
- Point A: start of casting.
- Point B: end of casting.
- Point C: final setting of concrete.
- Point D: 10th day of drying of concrete after casting.
- Point E: 18th day of drying of concrete after casting.
- Point F: 19th day of drying of concrete after casting.
- Point G: 23rd day of drying of concrete after casting.
- Point H: 28th day of drying after casting.

Thus, Figure 16 shows that the deflection increased sharply at an instant of casting from 0 mm (point A) to 1.01 mm (point B). Point B is reached after 10 minutes of casting.

Deflection further increased from 1.01 mm (point B) to 1.159 mm (point C). Point C which is 9 hours 23 minutes after casting is assumed to be the final setting time of concrete.

The deflection thereafter remained constant from point C to point D (1.145 mm). Point D is the 10th day after casting.

From point D (10th day), the deflection reduced drastically to 0.475 mm (point H). Point H is at 28 days after casting.

3.3.2. Load Time Curves for Freshly Cast RC Slab and Props.
There was a reduction in load as setting of concrete occurred indicated by the load cells, LC2 and 3 located at the edges of the slab according to Table 7. The decrease in load cell loads due to setting is minimal. This decrease was 0.6% for LC2 and 0.1% for LC3 from the start of casting. The loads on load cells at the center of the slabs LC1 and 4 increased minimally by 0.54% and 0.1%, respectively, over a period of 37 minutes from the start of casting.

3.3.3. Load-Time Relationship for Freshly Cast Slab Loads.
Figure 17 shows that the trend of load reduction is the same for all load cells. The reduction in load over 28-day period is found to be 28% for LC4, 36% for LC3, 44% for LC1, and 52% for LC2.
Figure 13: Grading results of coarse aggregate.

Figure 14: Coarse aggregate grading.

Table 5: Deflection and time values on dial gauges 9, 8, and 5.

<table>
<thead>
<tr>
<th>Time interval (minutes)</th>
<th>Cumulative time interval (minutes)</th>
<th>DG-9</th>
<th>DG-8</th>
<th>DG-5</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0.659</td>
<td>0.675</td>
<td>1.011</td>
<td>S.O.C</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td>0.714</td>
<td>0.67</td>
<td>1.011</td>
<td>E.O.C</td>
</tr>
<tr>
<td>15</td>
<td>25</td>
<td>0.714</td>
<td>0.67</td>
<td>1.011</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>31</td>
<td>0.714</td>
<td>0.67</td>
<td>1.01</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>37</td>
<td>0.739</td>
<td>0.67</td>
<td>1.01</td>
<td></td>
</tr>
</tbody>
</table>

S.O.C: start of casting; E.O.C: end of casting (application of full load); DG-X: dial gauge number.

Table 6: Excerpt of loads recorded on load cells 1 to 4.

<table>
<thead>
<tr>
<th>Time interval (minutes)</th>
<th>Cumulative time interval (minutes)</th>
<th>Load on load cells 1 to 4 (kg)</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>24.29 19.89 81.14 233.39 254.8</td>
<td>B.C</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td>167.76 128.08 233.39 254.8</td>
<td>S.O.C</td>
</tr>
<tr>
<td>15</td>
<td>25</td>
<td>167.92 127.73 233.23 254.78</td>
<td>E.O.C</td>
</tr>
<tr>
<td>6</td>
<td>31</td>
<td>168.08 127.63 233.22 254.78</td>
<td>Setting</td>
</tr>
<tr>
<td>6</td>
<td>37</td>
<td>168.42 127.44 233.19 254.87</td>
<td>Setting</td>
</tr>
</tbody>
</table>

B.C: before casting; S.O.C: start of casting; E.O.C: end of casting (application of full load); DG-X: dial gauge number.
Figure 18 shows that there was a sharp rise in load recorded from 0.79 kN to up to 2.55 kN at the start of casting, point A to point B. Point A represents the weight of formwork, props, and reinforcement which is equal to 0.79 kN. Point B was recorded after 10 minutes of casting. The load reached its peak of 2.58 kN (point C) and then reduced continually as concrete hardened up to 1.83 kN.
The load was reduced by 29.1% from point C to point D. Point D was achieved after 28 days. In between the 28 days as curing was being done there were some rises and falls attributed to curing of the slab.

(1) Load Deflection Curves. Figure 19 shows the combined load time curves for loads due to freshly cast reinforced concrete slab. All the graphs show that there was sharp rise in load and deflection. Constant load accompanied by continuous deflection resulted, thereafter, a sharp fall in load at constant deflection. Finally, a decrease in deflection and load resulted.

Figure 20 shows that the deflection increased sharply at an instant of casting from 0 mm to 1.01 mm (point A to point B, respectively) during 10 minutes of casting. It further increased from 1.01 mm (point B) to 1.159 mm (point C) after setting, 9 hours and 23 minutes after casting, due to loads of reinforced concrete, formwork, and props.

It thereafter remained fairly constant until the 10th day (point D). Point DE is reduction in load recorded on the 10th day. Point F is the 14th day after drying. At that point, deflection was 0.7 mm. As concrete dried further, the load reduced by 7.3% from point E to point G. The final deflection was 0.475 mm after 28 days (point H). This graph shows that weight recorded after 10 days was low. This implies that the columns and beams had started to take up some of the load. At that time, the slab has achieved workable strength 3 days more than the usual 7 days at which concrete strength is normally tested. It thus remains a point of concern why concrete compressive working strength is not tested after 10 days.

According to Table 8, the deflection due to freshly cast RC slab and props was higher than the design elastic deflection due to live loads.

3.4. Loads from Blocks (Instantly Loaded Construction Loads)

3.4.1. Deflection Time Curves for Construction Loads due to Blocks. Hollow and solid blocks were stacked on the first floor slab and deflection was monitored. They were stacked in a time interval of 4 hours. They had similar weights averaging 17.38 kg. They were stacked to a height of 1.330 m. This was based on the height derived from the typical height of stacked construction loads observed during the baseline.
Figure 18: Typical load time curve for supporting slab due to loads contributed by freshly cast reinforced concrete slab and props (from casting to 28 days) (typical load cell 4 (LC4) and dial gauge position 5 (DG5)).

Figure 19: Load deflection curve for 28-day supporting slab due to loads by reinforced concrete slab (starting from casting to 28 days) (load cell 4 (LC4) and dial gauge position 5 (DG5)), LC3-DG6, and LC2-DG7.
survey of which 81.8% block loads varied between 1 and 1.8 m.

The curve on Figure 21 shows that deflection increased during loading from 0 mm (point A) to 8.9 mm (point B). The deflection then increased by 32.75% from 8.9 mm (point B) to 11.815 mm (point C). Point C is after 11 days.

During unloading, the deflection then decreased by 53.45% from 11.815 mm to 5.55 mm (point D). It can be observed that after unloading, the deflection remained at 5.5 mm and did not return to zero which implies that the slab was stressed into the inelastic range.

From Table 9, the deflection obtained from experiment 11.815 mm was higher than the limit (span/250 mm) and the immediate deflection due to design loads.

The total number of blocks added was 672, and the deflection was measured after every 20 blocks.

According to Figure 22, the load increased from 0 to 11.9 kN/m² at the start of stacking to the finish (point A to point B). This corresponded to deflection increase from 0 to 8.14 mm in time frame of 4 hours.

Loading remained constant from point B to point C, but the deflection increased from 8.14 mm to 11.7 mm for a period of 11 days. This shows that the deflection continued to increase even when loading had stopped. This implies that the slab had been loaded into the inelastic range.

During unloading (point C to point D), the deflection decreased from 11.7 mm to 5.55 mm and loading reduced from 11.9 kN to 0 KN.

3.5. Discussion. Deflection due to construction loads should not exceed long-term deflection limit of span/500 or span/250mm. Since a deflection of 8 mm was the limit of span/250 mm, it can be supposed that 5.33 mm deflection (achieved by taking a factor of safety of 1.5 which is multiplied by the live load when calculating the ultimate design) should not be exceeded which corresponds to a load of 9.2 kN/m² as indicated in Figure 22.

Imposed loads due to blocks (672 in total) stacked on the first floor slab had a load of

---

**Table 8: Deflection comparison between manual deflection calculations and experimental deflection due to freshly cast slab loads.**

<table>
<thead>
<tr>
<th>S/N</th>
<th>Experiment/calculation</th>
<th>Deflection (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Load deflection time curves due to freshly cast reinforced concrete slab and props.</td>
<td>1.159</td>
</tr>
<tr>
<td>2</td>
<td>Manual deflection calculation: immediate elastic deflection due to design live loads.</td>
<td>0.103</td>
</tr>
</tbody>
</table>
The freshly cast slab had a design self-weight load of

\[
25 \times 0.175 = 4.375 \text{kN/m}^2. \tag{3}
\]

From Figure 9, the maximum area support occupied by a prop is \(0.5 \times 1 = 0.5 \text{ m}^2\). Therefore, the weight of slab over an area of \(0.5 \text{ m}^2\) carried by the prop is 2.188 kN. The peak load through the prop recorded from the experiment was 2.58 kN. This means that the weight of formwork was equal to 2.58 – 2.188 = 0.1392 kN.

The design-imposed action \(Q_k\) was assumed to be 2.0 kN/mm². However, an imposed action of 14.32 kN/mm² is experienced due to loaded blocks and an imposed action of 4.4 kN/mm² is experienced due to freshly cast concrete on upper floor. This is impacted on the lower floor as point loads of 2.58 kN. Therefore, the design should cater for imposed action due to construction materials and point loads due to props or props should be maintained until construction is complete which is uneconomic alternative.

### 3.6. Conclusion

#### 3.6.1. Deflection

The manual deflections from calculations was 0.103 mm due to design-imposed live load.

Experimentally, a deflection of 11.9 mm in the mid span was obtained due to block loads, while a deflection of 1.159 mm was obtained due to loads due to a freshly cast reinforced concrete slab and props.

According to EN 1992-1-1, the permissible deflection was equal to \(16 \text{ mm} = \text{span}/250\) during construction and \(8 \text{ mm} = \text{span}/500\) after construction. Therefore, all deflections from experiments due to construction loads contributed by concrete blocks (11.815 mm) and freshly cast slab loads (1.159 mm) and those due to design-imposed load equal to 0.103 mm were less than the highest allowable deflection of \(\text{span}/250\) equal to 16 mm. Deflection results from loads due to blocks (11.815 mm) were above the allowable deflection of \(\text{span}/500\) equal to 8 mm.

#### 3.6.2. Construction Loads

For loads due to freshly cast slab, the area carried by the props was \(0.5 \text{ m}^2\). The design-imposed live loads according to BS EN 1991-1-1 were 2 kN/m².
peak load through the prop over an area of 0.5 $m^2$ experimentally recorded was 2.58 kN.

For loads due to blocks, imposed loads due to blocks were 14.32 kN/$m^2$. The design-imposed live loads according to BS EN 1991-1-1 were 2 kN/$m^2$ and the ultimate design load to be carried by the slab was 14.77 kN/$m^2$. Thus, the imposed construction load due to blocks of 14.32 kN/$m^2$ was higher than design-imposed loads of 2 kN/$m^2$.

The actual load experienced due to weight of blocks was

$$G_k + Q_k = 8.595 + 14.32 = 22.92 \text{ kN/m}^2.$$  \hspace{1cm} (4)

This was 55.2% higher than the ultimate design load.

3.7. Recommendations. No slab should be occupied or added on top of another unless back propping is done especially in the middle of the supporting slab.

If back propping is not done, construction loads from materials like blocks should not be supported on the slab to avoid short and long-term effects like cracking and creep as observed above.

Data Availability

The data used to support the findings of this study are included within this article.

Conflicts of Interest

The authors declare that there are conflicts of interest regarding the publication of this paper.

Acknowledgments

The authors gratefully acknowledge the financial support provided by the Research Grants Adhoc Committee of Kyambogo University (3rd call for proposals).

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