# EXPEREMENTAL INVESTIGATION ON MECHANICAL PROPERTIES OF NO FINE CONCRETE BRICKS

S.Kannan
Assisatant Professor,
RVS College Of Engineering and Technology,
Dindigul- 5
s.kannan494@gmail.com

S.Tamil Vasanthan
ME- Structural Engineering,
RVS College of Engineering and Technology,
Dindigul-5
S.tamilvasanthan@gmail.com

**ABSTRACT**

In this study, no-fine concrete were made into several number of cubes, and being tested for its high compressive strength and study the effectiveness of fine aggregate on the compressive strength of no-fine concrete were investigated concernly. The purpose of this project is to analyze the feasibility of producing highly sustainable no-fine concrete mixtures and evaluating the effect of fine aggregate on their properties. No-fine concrete is produced by using ordinary Portland cement, coarse aggregates, and water. This concrete is tested for its properties, such as compressive strength, waterabsorption, etc. The performance of no-fines concrete was compared with a concrete sample that is comparable to the material used for the construction of conventional concrete blocks such as clay bricks and fly ash bricks. These were complimented by hardened concrete tests including the following: compressive strength of blocks, walls, piers etc. Major advantage of concrete blocks is that their strength can be engineered as per requirement. The market for building block is growing at a rapid rate, especially in the areas where burnt bricks are not easily available or of poor quality. Lightweight concretes can either be lightweight aggregate concrete, foamed concrete or Autoclaved Aerated Concrete (AAC). Such lightweight concrete blocks are often used in mason's house construction, because of their less density and self-weight, it helps for faster construction.

**INTRODUCTION**

Blocks are important components in residential buildings. Even though bricks made of soil have been widely used so far, there is very good scope for using blocks made of cement, sand and coarse aggregates because bricks are not available at all places to the desired requirements. A concrete block is primarily used as a building material in the construction of walls. A concrete block is one of the several precast concrete products used in construction. Major advantage of concrete blocks is that their strength can be engineered as per requirement, thus making them relatively stronger than masonry with bricks walls by around 15-20%. The market for building block is growing at a rapid rate, especially in the areas where burnt bricks are not easily available or of poor quality. Unfortunately, rigorous scientific studies have not been made on the strength, durability and economy of concrete building blocks. Lightweight concretes can either be lightweight aggregate concrete, foamed concrete or autoclaved aerated concrete (AAC). Such lightweight concrete blocks are often used in mason's house construction, because of their less density and self-weight, it helps for faster construction.

**No-Fines Concrete**

No-Fines Concrete is a method of producing light concrete by omitting the fines from conventional concrete. No-fines concrete as the term implies, is a kind of concrete from which the fine aggregate fraction has been omitted. This concrete is made up of only coarse aggregate, cement and water. Very often only single sized coarse aggregate, of size passing through 20 mm retained on 10 mm is used. No-finesconcrete is becoming popular because of some of the advantages it possesses over the conventional concrete.

**Mix-Proportion of No-Fines Concrete**

No-fines concrete is generally made with the aggregate/cement ratio from 1:6 Aggregates used are normally of size passing through 20 mm and retained on 10 mm. Unlike the conventional concrete, in which strength is primarily controlled by the water/cement ratio, the strength of no-fines concrete, is dependent on the water/cement ratio, aggregate cement ratio and unit weight of concrete.

If too low water/cement ratio is adopted, the paste will be so dry that aggregates do not get properly smeared with paste which results in insufficient adhesion between the particles. On the other hand, if the water/cement ratio is too high, the paste flows to the bottom of the concrete, particularly when vibrated and fills up the voids between the aggregates at the bottom and makes that portion dense. No standard method is available, like slump test or compacting factor test for measuring the consistency of no-fines concrete. Perhaps a good, experienced visual examination and trial and error method may be the best guide for deciding optimum water/cement ratio.

No-fines concrete, when conventional aggregates are used, may show a density of about 1600 to 1900 kg/m$^3$, but when no-fines concrete is made by using light weight aggregate, the density may come to about 360 kg/m$^3$. No-fines concrete does not pose any serious problem for compaction. Simple rodding is sufficient for full compaction. The compressive strength of no-fines concrete varies between 1.4 MPa to about 14 MPa.

**Objectives**

- To identify the strength of no-fines concrete specimen.
- To identify the most economical mix for blocks.
- To study the durability of these concrete blocks.

**Advantages of No-Fines Concrete Block**

- Reduction in dead loads making savings in foundations and reinforcement.
- Improved thermal properties.
- Improved fire resistance.
- Savings in transporting and handling precast units on site.
- Reduction in formwork and propping.
- Shrinkage of this concrete is lower than the normal concrete and its thermal expansion is about 0.6 to 0.8 of normal concrete

**Uses**

1. To construct walls and other structural members.
2. They are also used to construct load bearing structures.
3. No-fines concrete blocks are used in construction of low-cost buildings.

**Scope**

1. All necessary tests will be carried out to ascertain the strength of these no-fines concrete block.
2. For a suitable strength and satisfactory workability, of no-fines concrete will be found out.

**Application of light weight concrete blocks**

- ✓ Cast in place for unit of low cost terrace houses, high-rise buildings.
- ✓ Light weight block for high – rise building
- ✓ Panels and partition walls of various dimension either pre-cast or poured in place
- ✓ All types of insulation work, including cavity walls
- ✓ Roofing and ceiling panels
- ✓ Sound proofing applications
- ✓ Pre-cast industrial and domestic building panels, both internal and external. Foundation for roads and sidewalks,
- ✓ Subsurface for sports arenas
- ✓ Void filling and infill section between beams of suspended floors.

| S.No | Is Sieve No.(mm) | Wt of Material Retained (kg)` | % of Wt Retained | Cumulative % of Wt Retained | % Finer |
|---|---|---|---|---|---|
| 1 | 40 | 0 | 0 | 0 | 100 |
| 2 | 20 | 0 | 0 | 0 | 100 |
| 3 | 12.5 | 0.95 | 95 | 95 | 5 |
| 4 | 10 | 0 | 0 | 95 | 5 |
| 5 | 4.75 | 0.05 | 5 | 100 | 0 |
| 6 | Pan | 0 | 0 | 100 | 0 |

**Casting of No Fines Bricks**

- From the investigation, the most economical mix with high strength identified was 1:6 mix ratios with 12 mm aggregate and 0.45% water content.
- In No Fines bricks no fine aggregate are used which reduce the weight of the bricks
- In these project no fines bricks of size 230x110x70 mm are used for construction of pier and walls
- In this No Fines Concrete Bricks Curing with 15 days
- Weight of Block 2.8 Kg (Density- 1600 kg/$m^3$)


**Casting of No Fines Bricks**

**Construction of Walls and Piers**

| S. No | Material | Walls | Piers |
|---|---|---|---|
| 1 | No Fines Bricks | 2 | 2 |
| 2 | Fly Ash Bricks | 2 | 2 |
| 3 | Bricks | 2 | 2 |

**No-Fines Brick Walls & Piers:**

- Walls size is 3' x 1'6" and Pier size is 1' x 1' x 1'6
- Walls should be construct two numbers and it should be tested 7 & 14 days curing

**No Fines Brick Walls & Piers**

**Clay Brick Walls & Piers:**

- Walls size is 3' x 1'6" and Pier size is 1' x 1' x 1'6
- Walls should be construct two numbers and it should be tested 7 & 14 days curing


**Brick Walls & Piers**

**Fly Ash Walls & Piers:**

- Walls size is 3' x 1'6" and Pier size is 1' x 1' x 1'6"
- Walls should be construct two numbers and it should be tested 7 & 14 days curing


**Fly Ash Walls & Piers**

**TESTING OF SPECIMEN**

**Compression Test on Clay Brick, Fly Ash Brick &No Fines Brick**

**Calculation:**

Compressive Strength = Load / Area N/$mm^2$



| S. No | Load (kN) | Compressive Strength Fly ash brick (N/$mm^{2)}$ |
|---|---|---|
| 1 | 320 | 12.88 |
| 2 | 310 | 12.47 |
| 3 | 310 | 12.47 |

| S. No | Load ( kN) | Compressive Strength Clay Brick (N/$mm^{2)}$ |
|---|---|---|
| 1 | 120 | 5.71 |
| 2 | 110 | 5.24 |
| 3 | 120 | 5.71 |

| S. No | Load (kN) | Compressive Strength No Fine Bricks(N/$mm^{2)}$ |
|---|---|---|
| 1 | 410 | 16.20 |
| 2 | 420 | 16.61 |
| 3 | 410 | 16.20 |

Compressive Strength of the No Fines Bricks =16.33N/$mm^2$.
Compressive Strength of the Fly Ash Bricks = 12.61 N/$mm^2$
Compressive Strength of the Clay Bricks = 5.55 N/$mm^2$

**Water absorption test on clay bricks, fly ash bricks and no fines bricks:**

**Calculation:**

% of water absorption = (W2-W1) / W1x100

| Sl. No | Dry weight of No Fine brick (W1) kg | Immersed weight of brick (W2) kg | % of Water Absorption |
|---|---|---|---|
| 1 | 3.60 | 3.65 | 1.38 |
| 2 | 3.59 | 3.64 | 1.39 |
| 3 | 3.61 | 3.66 | 1.40 |

| Sl. No | Dry weight of brick Fly ash (W1) kg | Immersed weight of brick (W2) kg | % of Water Absorption |
|---|---|---|---|
| 1 | 2.87 | 3.22 | 12.19 |
| 2 | 2.91 | 3.26 | 12.09 |
| 3 | 2.94 | 3.36 | 12.18 |

| Sl. No | Dry weight of brick Clay Brick (W1) kg | Immersed weight of brick (W2) kg | % of Water Absorption |
|---|---|---|---|
| 1 | 3.48 | 3.57 | 2.58 |
| 2 | 3.50 | 3.58 | 2.28 |
| 3 | 3.49 | 3.57 | 2.30 |

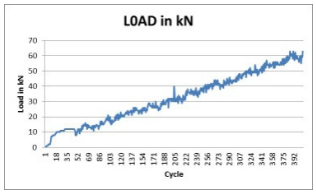
Average water absorption of the No Fines Bricks = 1.39%
Average water absorption of the Fly Ash Bricks = 2.38%
Average water absorption of the Bricks = 12.15

**TEST OF BRICK WALLS & PIERS**

- The load test is done for the constructed piers and walls at the 7&14 days.
- Load should be to applying UDL throughout the length of walls & piers in loading frame

**Test Results of Brick Wall in 7 Days Curing:**

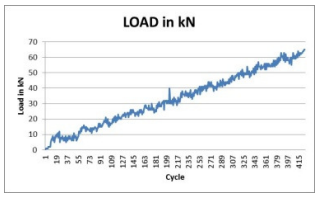
| S.No | Load (kN) | S.No | Load (kN) |
|---|---|---|---|
| **1** | 0 | **8** | 35 |
| **2** | 5 | **9** | 40 |
| **3** | 10 | **10** | 45 |
| **4** | 15 | | |
| **5** | 20 | | |
| **6** | 25 | | |
| **7** | 30 | | |




The ultimate load carrying capacity of the 7 Days
brick wall is 63 kN.

**Test Results of Brick Wall in 14 Days Curing:**

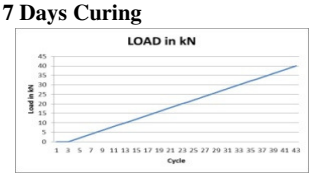
| S.No | Load (kN) | S.No | Load (kN) |
|---|---|---|---|
| **1** | 0 | **8** | 35 |
| **2** | 5 | **9** | 40 |
| **3** | 10 | **10** | 45 |
| **4** | 15 | **11** | 50 |
| **5** | 20 | **12** | 55 |
| **6** | 25 | **13** | 60 |
| **7** | 30 | **14** | 65 |




The ultimate load carrying capacity of the 14 Days brick wall
is 65 kN.

**Test Results of Brick Pier in 7 Days Curing**

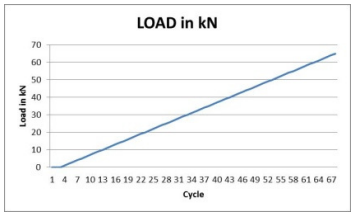
| S.No | Load (kN) | S.No | Load (kN) |
|---|---|---|---|
| **1** | 0 | **6** | 20 |
| **2** | 1 | **7** | 25 |
| **3** | 5 | **8** | 30 |
| **4** | 10 | **9** | 35 |
| **5** | 15 | **10** | 40 |




The ultimate load carrying capacity of the 7 Days Brick pier is 40 kN.

**Test Results of Brick Pier in 14 Days Curing**

| Sl.No | Load (kN) | S.No | Load (kN) |
|---|---|---|---|
| **1** | 0 | **8** | 35 |
| **2** | 5 | **9** | 40 |
| **3** | 10 | **10** | 45 |
| **4** | 15 | **11** | 50 |
| **5** | 20 | **12** | 55 |
| **6** | 25 | **13** | 60 |
| **7** | 30 | **14** | 65 |




The ultimate load carrying capacity of the 14 Days Brick pier is 65 kN

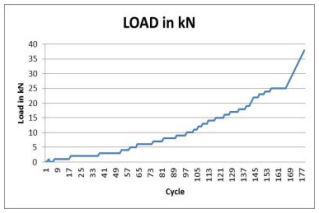
**TEST OF FLY ASH BRICK WALLS & PIERS**

The load test is done for the constructed piers and walls at the 7&14 days. Load should be to applying UDL throughout the length of walls & piers in loading frame

**Test of Fly Ash Brick Walls & Piers**

**Test Results of Fly Ash Brick Wall in 7 Days Curing:**

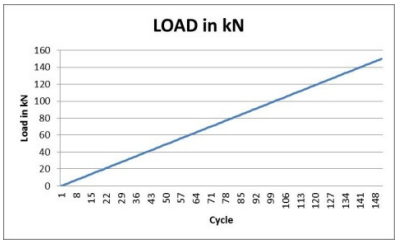
| S.No | Load (kN) | S.No | Load (kN) |
|---|---|---|---|
| **1** | 0 | **8** | 30 |
| **2** | 1 | **9** | 35 |
| **3** | 5 | **10** | 38 |
| **4** | 10 | 11 | 42 |
| **5** | 15 | 12 | 46 |
| **6** | 20 | **13** | 48 |
| **7** | 25 | **14** | 52 |




The ultimate load carrying capacity of the 7 Days Fly Ash Brick Wall is 38 kN.

**Test Results of Fly Ash Brick Wall in 14 Days Curing**

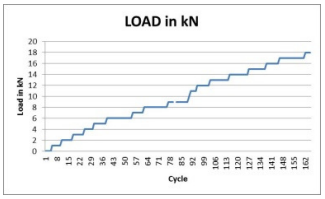
| S.No | Load (kN) | S.No | Load (kN) |
|---|---|---|---|
| **1** | 0 | **9** | 80 |
| **2** | 10 | **10** | 90 |
| **3** | 20 | **11** | 100 |
| **4** | 30 | **12** | 110 |
| **5** | 40 | | |
| **6** | 50 | | |
| **7** | 60 | | |
| **8** | 70 | | |




The ultimate load carrying capacity of the 14 Days Fly Ash Brick Wall is 110 kN.

**Test Results of Fly Ash Pier in 7 Days Curing:**

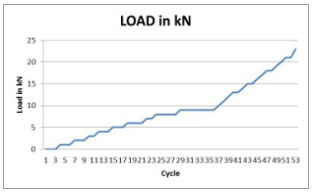
| S.No | Load (kN) | S.No | Load (kN) |
|---|---|---|---|
| **1** | 0 | **9** | 26 |
| **2** | 1 | **10** | 30 |
| **3** | 3 | **11** | 32 |
| **4** | 6 | **12** | 35 |
| **5** | 12 | **13** | 38 |
| **6** | 16 | **14** | 42 |
| **7** | 20 | **15** | 45 |
| **8** | 23 | **16** | 48 |




The ultimate load carrying capacity of the 7 Days Fly Ash Brick Pier is 48 kN.

**Test Results of Fly Ash Pier in 14 Days Curing**

| S.No | Load (kN) | S.No | Load (kN) |
|---|---|---|---|
| **1** | 0 | **10** | 38 |
| **2** | 1 | **11** | 42 |
| **3** | 5 | **12** | 45 |
| **4** | 8 | **13** | 48 |
| **5** | 16 | **14** | 52 |
| **6** | 20 | **15** | 56 |
| **7** | 23 | **16** | 58 |
| **8** | 28 | **17** | 64 |
| **9** | 35 | **18** | 72 |



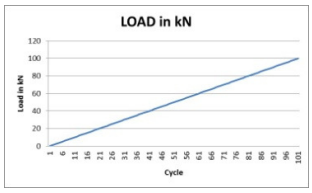

The ultimate load carrying capacity of the 14 Days Fly Ash Brick Pier is 72kN.

**TEST OF NO FINES BRICK WALLS & PIERS**

- The load test is done for the constructed piers and walls at the 7&14 days
- Load should be to applying UDL throughout the length of walls & piers in loading frame

**Test Results of No Fines Brick Wall in 7 Days Curing**

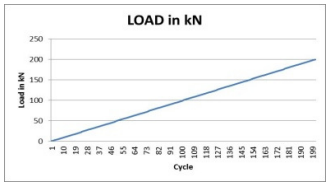
| S.No | Load (kN) | S.No | Load (kN) |
|---|---|---|---|
| **1** | 0 | **7** | 42 |
| **2** | 1 | **8** | 48 |
| **3** | 8 | **9** | 53 |
| **4** | 14 | **10** | 62 |
| **5** | 20 | **11** | 69 |
| **6** | 31 | **12** | 74 |




The ultimate load carrying capacity of the 7 Days No Fines Brick Wall is 74 kN.

**Test Results of No Fines Brick Wall in 14 Days Curing**

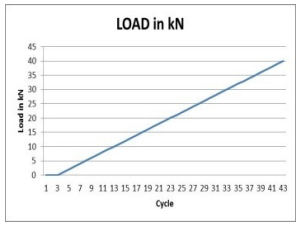
| S.No | Load (kN) | S.No | Load (kN) |
|---|---|---|---|
| **1** | 0 | **7** | 123 |
| **2** | 23 | **8** | 131 |
| **3** | 45 | **9** | 140 |
| **4** | 66 | 10 | 147 |
| **5** | 88 | 11 | 154 |
| **6** | 108 | 12 | 160 |




The ultimate load carrying capacity of the 14 Days No Fines Brick Wall is 160 kN.

**Test Results of No Fines Brick Pier in 7 Days Curing**

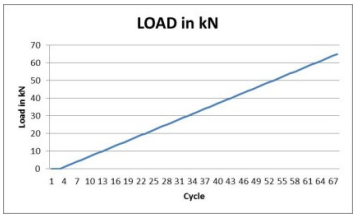
| S.No | Load (kN) | S.No | Load (kN) |
|---|---|---|---|
| **1** | 0 | **9** | 28 |
| **2** | 1 | **10** | 32 |
| **3** | 4 | **11** | 36 |
| **4** | 6 | **12** | 38 |
| **5** | 12 | **13** | 42 |
| **6** | 16 | **14** | 46 |
| **7** | 20 | **15** | 52 |
| **8** | 25 | **16** | 60 |




The ultimate load carrying capacity of the 7 Days No Fines Brick Pier is 60 kN

**Test Results of No Fines Brick Pier in 14 Days Curing**

| S.No | Load (kN) | S.No | Load (kN) |
|---|---|---|---|
| **1** | 0 | **10** | 35 |
| **2** | 1 | **11** | 37 |
| **3** | 4 | **12** | 42 |
| **4** | 7 | **13** | 45 |
| **5** | 16 | **14** | 49 |
| **6** | 19 | **15** | 53 |
| **7** | 23 | **16** | 69 |
| **8** | 29 | **17** | 84 |




The ultimate load carrying capacity of the 14 Days No Fines Brick Pier is 83 kN

**CONCLUSION**

- No fines bricks are used for construction of piers and walls The compressive strength and water absorption shows a higher strength while compared to conventional bricks
- The axial compression loading of the walls and piers constructed by No Fines Bricks are higher than the conventional bricks
- No fines concrete brick wall takes 74 kN compressive load in 7 days curing. It is 30 kN load more than brick wall and 22 kN more load than fly ash wall
- No fines concrete brick wall takes 160 kN compressive load in 14 days curing. It is 95 kN load more than brick wall and 50 kN more load than fly ash wall
- No fines concrete brick pier and brick pier takes 60 kN compressive load in 7 days curing. It is 20 kN more than brick wall and 12 kN more load than fly ash pier
- No fines concrete brick pier and brick pier takes 93 kN compressive load in 14 days curing. It is 28 kN more than brick wall and 21 kN more load than fly ash pier
- No fines concrete bricks takes more compressive load than other bricks
- The cost has been increased for no fines bricks while compared to other conventional bricks

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