# Analysis of assessment of rigid pavement constructed using self-compacting concrete with fly ash and bricks dust as replacement for fine aggregates

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## ABSTRACT

Assessment of rigid pavement of self compacting concrete is very old. Special type of applications such as underwater or bridge concreting have always required concrete, which can be placed without any need for compaction. In such circumstances vibration is simply difficult. Earlier self compacting concretes depends on very high content of cement paste, once super plasticizers became easily available in market, they were added in the concrete mixers. The mixers required special and well controlled placing methods in order to avoid segregation of concrete, and high content of cement paste made them to shrinkage. The overall costs are very high and application remained so limited. As compared to normally vibrated concrete (NVC), assessment of self compacting concrete (SSC) possesses increase in qualities and improves productivity and work conditions due to elimination of compaction in concrete. Self compacting concrete (SSC) generally has higher powder content then than normal vibrated concrete (NVC) and thus it is important to replace some of its cement by additions to get an economical and durable concrete. Japan is using self compacting concrete in bridge and other construction projects which takes place in water, building and tunnel construction since early 1990. In the last seven years, a number of self compacting concrete bridges have been constructed in Europe. In the united states usage of SSC in highways bridges construction is very finite at this time. However, the USA precast concrete industry is starting to apply the technology to architectural concrete. SSC has high potential for larger structural applications in highway bridge construction. The use of concrete without vibrating the highway bridge construction is old. In these days efforts are made to balance the mechanical properties of self compacting concrete sample. The standard which is used based on the 7 days, 28 days and 56 days respectively for compressive, splitting tensile and flexure strength.

## INTRODUCTION

Self compacting concrete is the concrete in which without any effect of extra compaction energy, flow slowly under the effect of gravity, as well as totally fills the reinforcing space and the formwork. It is very important for the properties which are at very high flow ability and good sedimentation stability. These properties can be taken by the use of increasing flour grain (flour corn type) by stabilizing additives or their combination in combining with highly effectively flow agents. Most of the people don't know about it at least do not like it too much but, concrete is in any form everywhere. If

you don't live at center of desert or sea, please just turn your head around the desert or sea and you will discover this fact of concrete. There is no doubt that concrete is of special importance in the buildings and constructions and bridges. Among the other building and construction and material i.e. (steel, brick asphalat, timber, bituminous etc.). According to the cement sustainability startup, the use of concrete is expected to be equal to twenty five billions tons every year which means above 3.8 per person per year in the world.

## Objectives of the study

- The height noise when construction sites and works should be low.
- The problem associated with vibration are eliminated.
- It needs less labour for completing work.
- Projects competed on fast mode.
- It improves the standards and also help in reducing time.
- The strength can be achieved without any need of trembling and less amount of screening is needed.
- Which results that helps in saving the overall cost.

## Need for the proposed study

As the usage of self and rigid compressing concrete and the more engineering properties of the cost of various structures which decrease the values of economically and its limitation of the cost of supplying. This helps in improving the mixing of contents and the controlling the quality of cement and its producers. In such high quality and important material helps in getting the high constructions in lowest time this lead to have low applications of the compressing concrete. Controlled over small area of the where this is commonly used and it became very efficient and well trusted.

METHODOLOGY

INTRODUCTION

This methodology is adopted for this study on the control and concrete made with replacement of Fly ash & Bricks dust with fine aggregates in self compacting concrete are discussed. The parameters such as Compressive strength, split of tensile strength and flexural strength are discussed and comparisons between the various mixes are represented**.**

In order to study the effects on fresh concrete properties when Fly ash & Bricks dust is added into the concrete as fine aggregate replacement, the rigid compacting concrete SCC containing different proportions of Fly ash & Brick dust were tested for Slump flow, V-funnel, U-Box, L-box. The results of fresh properties of all Self-Compacting Fly ash & Brick dust concretes are included in table. The Table shows the properties of such as slump flow, V-funnel flow times, L-box, U- box. In terms of slump flow, all SCCs exhibited satisfactory slump flows in the range of 590–740 mm, which is an indication of a good deformability.

As per researchs, time ranging from 6 to 12 seconds is considered adequate for a rigid compacting concrete SCC. The V-funnel flow times was in the range of 9 to 13 seconds.

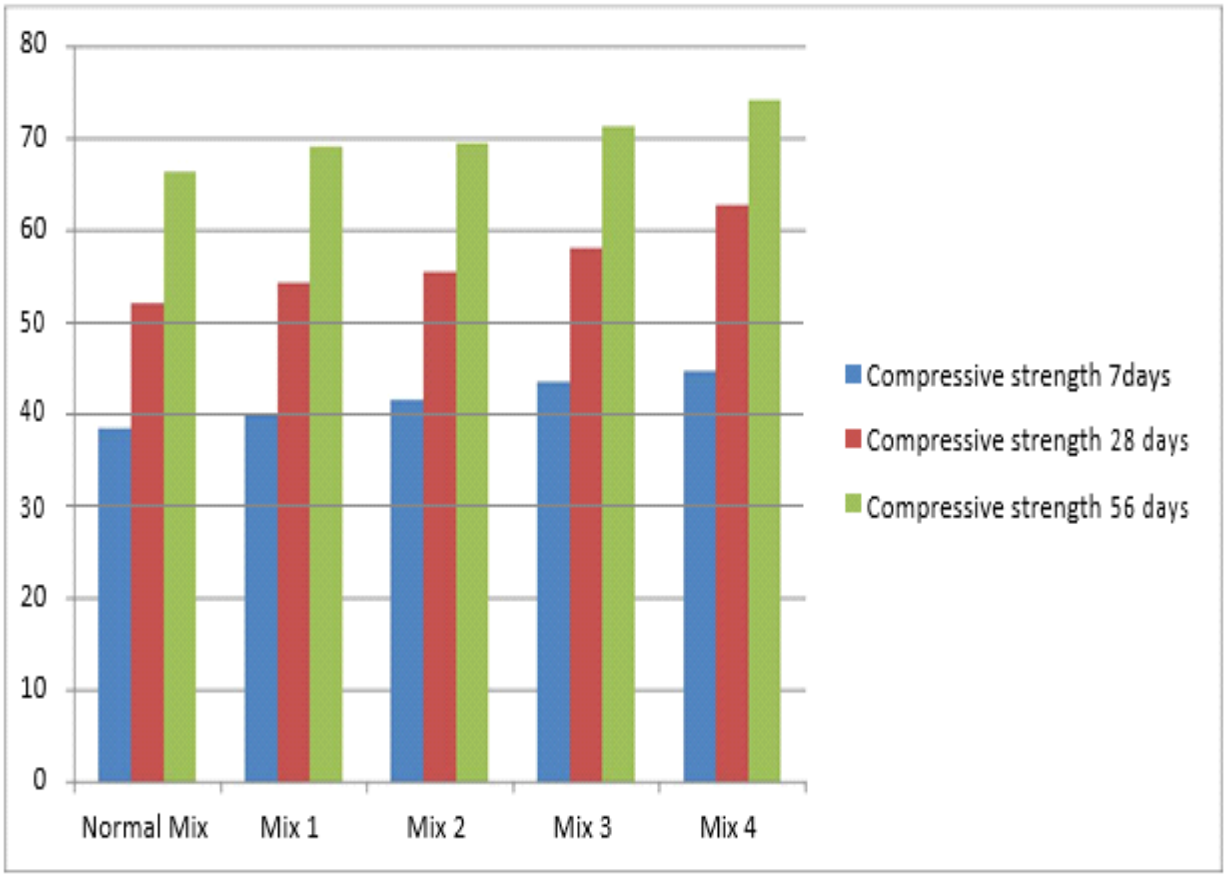
| Mixture ID | Slump (mm) | V-funnel (seconds) | L-Box (H2/H1) | U-box(H1-H2) |
|---|---|---|---|---|
| Normal mix | 688 | 8 | 0.9 | 31 |
| Mix 1 | 590 | 13 | - | - |
| Mix 2 | 705 | 11 | - | 35 |
| Mix 3 | 740 | 13 | 0.9 | 35 |
| Mix 4 | 720 | 9 | 1.0 | - |

Table of fresh concrete properties

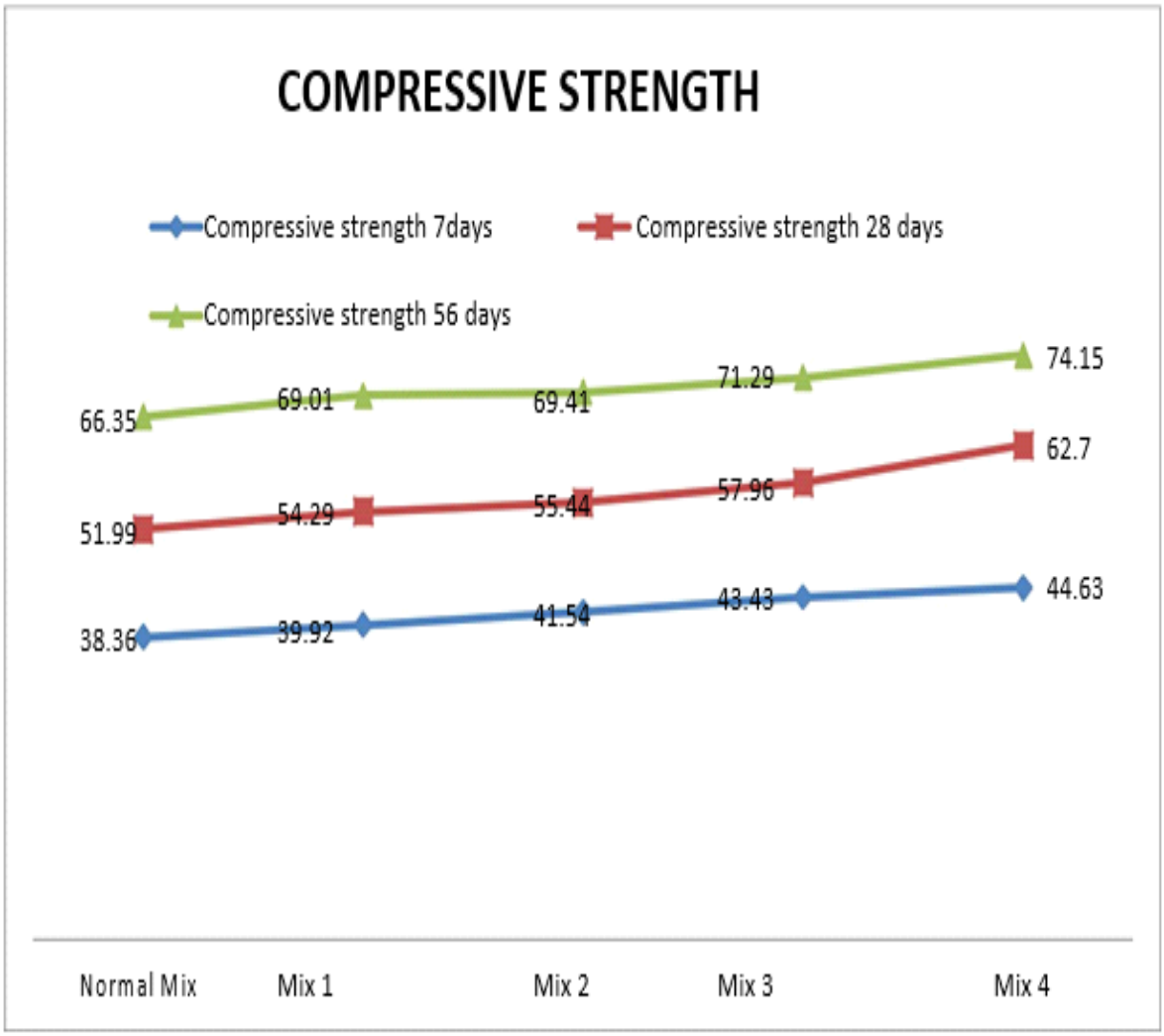
As per researchs, time ranging from 6 to 12 seconds is considered adequate for a rigid compacting concrete SCC. The V-funnel flow times was in the range of 9 to 13 seconds. Test results of this investigation gives details that all SCC mixes meet the requirements of allowable flow time. Maximum size of coarse aggregate was kept as 16 mm in order to save blocking effect in the L-box. The gap between re-bars in L-box test was 35 mm. The L-box ratio H2/H1 for the mixes was above 0.8 which is as per EFNARC standards. U-box difference in height of concrete in two compartments was in the range of 5 to 40 mm. All the Fresh properties of concrete values were in good agreement to that of the values given by European guidelines. After 24 hours of casting, the contents were removed from the moulds and immediately dipped in clean fresh water. The specimens were cured for 7 days, 28 days and 56 days respectively. Depending on the requirement of age of curing. The fresh water tanks used for the curing of the apparatus was emptied and cleaned once in every fifteen days and were filled once again. All the specimens under immersion were always kept well under water and it was seen that at least about 15 cm of water was above the top of the contents.

**compressive strength of SCC mix**

| MIX | Compressive Strength ($N/mm^2$) | | | Average ($N/mm^2$) | Compressive | Strength |
|---|---|---|---|---|---|---|
| | 7 days | 28 days | 56 days | 7 days | 28 days | 56 days |
| Normal mix | 38.97 | 51.29 | 67.34 | 38.37 | 51.99 | 66.35 |
| | 37.80 | 52.15 | 65.23 | | | |
| | 38.35 | 52.66 | 66.49 | | | |
| Mix 1 | 39.99 | 53.98 | 68.85 | 39.92 | 54.29 | 69.01 |
| | 39.68 | 54.12 | 69.90 | | | |
| | 40.13 | 54.78 | 68.33 | | | |
| Mix 2 | 41.21 | 55.65 | 69.89 | 41.55 | 55.44 | 69.41 |
| | 41.20 | 54.89 | 69.02 | | | |
| | 42.23 | 55.78 | 69.34 | | | |
| Mix 3 | 43.12 | 56.78 | 71.67 | 43.45 | 57.96 | 71.20 |
| | 43.85 | 58.67 | 70.97 | | | |
| | 43.34 | 58.45 | 71.23 | | | |
| Mix 4 | 44.89 | 61.78 | 73.20 | 44.65 | 62.75 | 74.15 |
| | 44.45 | 62.89 | 74.02 | | | |
| | 44.56 | 63.45 | 75.23 | | | |




Compressive strength bar chart




Compressive strength graph chart

In order to study the effect on compressive strength when the Fly ash & Brick dust is added into self compacting concrete as fine aggregates replacement, the cube containings different proportions of Fly ash surkhi & Brick dust were prepared and kept for curing for 7, 28 and 56 days. The test was conducted on ASTM of capacity 3000 KN. From the results it is concluded that the 56 days strength of all the mixes is invariably higher than corresponding 7 days and 28 days strength, this is due to continuous hydration of cement with concrete.

## Conclusions:

It has been verified, by using the slump flow and U-tube tests, that rigid compacting concrete (SCC) achieved consistency and self compactability under its own weights, without any external vibration or compaction. Also because of the special admixtures used, self compacting concrete SCC has achieved a density between 2400 and 2500 kg/m$^3$, which was greater than that of normal concrete 2370-2321 kg/m$^3$.Rigid compacting concrete

can be determined in such a way, by adding chemical and mineral admixtures, so that it's splitting tensile, flexural strength and compressive strengths are higher than those of normal vibrated concretes.

- The properties such as slump flow, V funnel flow times, L box, U box. In terms of slump flow, all SCCs exhibited satisfactory slump flows in the range of 590–745 mm, which is an indication of a good deformability in this concrete.

- The compressive strength increases with an Increase in the percentage of the Fly ash & Brick dust in it. An increase of about 37% strength at 7 days 15% strength at 28 days and 8% at 56 days was observed with the increase of Fly ash & Brick dust specimens from 5% (SCC MIX1) to 12% (SCC MIX4).

- It was observed that the percentage increase in compressive strength was more predominant at very early ages.

- The strength which was later increased at later ages also but not so quickly because the pozzolanic reactions of the fly ash is faster at early ages and the brick dust acts as a filler also along with pozzolanic activity against the fine aggregates which acts as a filler product only.

- The split tensile strengths of self and rigid compacting concrete SCC after 7 days are comparable to those determined after 28 days for NC. This was possible because of the use of Fly ash & Brick dust as a fine aggregate replacement, which usually tend to increase the early strength of concrete.

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