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BLENDED CEMENT CONCRETE (Cement is blended with the materials of GGBS & FLY ASH)

G.S.Sai Saran *, K. Surya Teja, T.Venkat Das
*B.tech Civil Engineering, KLUniversity, Vaddeswaran, Guntur, Andhrapradesh INDIA
B.tech Civil Engineering, KLUniversity, Vaddeswaran, Guntur, Andhrapradesh INDIA
Assistant Professor, Dept. of Civil Engineering, KLUniversity, Vaddeswaran, Guntur, Andhrapradesh INDIA

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ABSTRACT
In this paper we are going to summarize about the mix properties and standards of strength of the mix in which the cement is partially replaced with the blending material like fly ash and GGBS. According to the papers refereed the mainly concentrated about environmental improvement and durability even with the reduction of the cement in mix. In this we are going to find the compression strength and flexural strength for the blended cement concrete casted and cured for7 days and 28 days of 27 number of Cubes and 27 number of Beams.
Thus to make a less utility of cement to reduce the pollutants released during manufacturing, it gives high strength without effecting the environment and as to make better cost and strength results than normal mix and finally we concluded with compare of results from experiment performed.

INTRODUCTION
Concrete is a composite material made primarily out of water, aggregate, and cement. Frequently, added substances and fortifications incorporated into the blend to accomplish the sought physical properties of the completed material. At the point when these materials are combined, they frame a liquid mass that is effectively formed into shape. After some time, the concrete structures as a hard framework which binds rest of the materials together into a durable granite-like material with numerous uses.

Famous concrete structures incorporate the Hoover Dam, the Panama Canal and the Roman Pantheon. The soonest extensive scale clients of concrete technology were the antiquated Romans, and concrete was generally utilized as a part of the Roman Empire. The Colosseum in Rome was assembled to a great extent of concrete, and the concrete vault of the Pantheon is the world's largest unreinforced concrete arch.

After the Roman Empire caved in, utilization of concrete got to be uncommon until the innovation was re-spearheaded in the mid-eighteenth century. Today, concrete is the most broadly utilized man-made material (measured by tonnage).

Cement
A cement is a folio, a substance that sets and solidifies and can tie different materials together. "Cement" can be followed back to the Roman expression creation caementicium, used to portray brick work taking after cutting edge concrete that was produced using pulverized rock with copied lime as fastener.

Cement utilized as a part of development can be described as being either pressure driven or non-pressure driven, contingent on the capacity of the bond to set in the vicinity of water (see water driven and non-water powered lime mortar).

Non-pressure driven bond won't set in wet conditions or submerged; rather, it sets as it dries and responds with carbon dioxide noticeable all around. It can be assaulted by some forceful chemicals in the wake of setting.

Pressure driven bonds (e.g., Portland concrete) set and get to be cement because of a concoction response between the dry fixings and water. The substance response results in mineral hydrates that are not extremely water-dissolvable as are very tough in water and safe from synthetic assault. This permits setting in wet condition or submerged and further shields the solidified material from substance assault. The substance process for water driven bond found by old Romans utilized volcanic slag (enacted aluminum silicates [citation needed]) with lime (calcium oxide).

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Fly ash

Fly Ash, otherwise called vent ash, flue ash, is one of the buildups created in ignition, and includes the fine particles that ascent with the flue gasses. Ash which does not rise is termed base ash. In a modern connection, fly ash normally alludes to ash created amid ignition of coal. Fly ash remains is for the most part caught by electrostatic precipitators or other molecule filtration hardware before the flue gasses achieve the smokestacks of coal-terminated force plants, and together with base slag expelled from the base of the furnace is for this situation mutually known as coal ash or coal ash. Contingent on the source and cosmetics of the coal being burned, the segments of fly ash differ extensively, however all fly ash incorporates significant measures of silicon dioxide (SiO_2) (both amorphous and crystalline) and calcium oxide (CaO), both being endemic fixings in numerous coal-bearing rock strata. Constituents rely on the particular coal bed makeup, yet may incorporate one or a greater amount of the accompanying components or substances found in follow amounts (up to hundreds ppm): arsenic, beryllium, boron, cadmium, chromium,hexavalenchromium, cobalt,lead, manganese, mercury, molybdenum, selenium, strontium, thallium, and vanadium, alongside dioxins and PAH mixes.

Previously, fly ash remains was by and large discharged into the environment, yet contamination control gear commanded in late decades now require that it be caught preceding discharge. In the US, fly ash is for the most part put away at coal force plants or set in landfills. Around 43% is reused frequently utilized as a pozzolan to create hydraulic cements or hydraulic mortar or an incomplete replacement for Portland cement in concrete generation. Pozzolans guarantee the setting of concrete and mortar and furnish concrete with more protection from wet conditions and substance assault. Some have communicated wellbeing worries about this. Sometimes, for example, the smoldering of concrete waste to make power ("resource recovery" offices a.k.a. waste-to-energy facilities), the fly ash may contain larger amounts of contaminants than the base ash and blending the fly and bottom ash together brings the relative levels of contaminants wit.

Ground-granulated blast furnace slag (GGBS or GGBFS)

Ground-granulated blast furnace slag (GGBS or GGBFS) is gotten by extinguishing liquid iron slag (a by-result of iron and steel-production) from an blast furnace in water or steam, to deliver a lustrous, granular item that is then dried and ground into a fine ashing the reach to qualify as non-perilous waste in a given state, though, unmixed, the fly ash would be within the extent to qualify as risky waste. The chemical composition of a slag differs impressively relying upon the arrangement of the raw materials in the iron production process. Silicate and aluminate contaminations from the mineral and coke are combined in the blast furnace with a flux which brings down the consistency of the slag. On account of pig iron creation the flux comprises for the most part of a blend of limegranite and forsterite or sometimes dolomite. In the blast furnace the slag drifts on top of the iron and is emptied for detachment. Moderate cooling of slag melts results in a unreactive crystalline material comprising of a collection of Ca-Al-Mg silicates. To acquire a decent slag reactivity or hydraulicity, the slag dissolve should be quickly cooled or extinguished beneath 800 °C keeping in mind the end goal to keep the crystallization of marinate and melilite. To cool and section the slag a granulation procedure can be connected in which liquid slag is subjected to fly floods of water or air underweight. On the other hand, in the pelletization handle the fluid slag is incompletely cooled with water and in this way anticipated into the air by a pivoting drum. With a specific end goal to get a suitable reactivity, the got pieces are ground to achieve the same fineness as cement. The primary segments of blast furnace slag are CaO (30-half), SiO_2 (28-38%), Al_2O_3 (8-24%), and MgO (1-18%). When all is said in done expanding the CaO substance of the slag results in raised slag basicity and an increment in compressive quality. The MgO and Al_2O_3 substance demonstrate the same pattern up to individually 10-12% and 14%, past which no further change can be gotten. A few compositional proportions or somewhere in the vicinity called water powered files have been utilized to relate slag organization with pressure driven action; the last being for the most part communicated as the folio quality. The glass substance of slags suitable for mixing with Portland cement commonly shifts between 90-100% and relies on upon the cooling strategy and the temperature at which cooling is started. The glass structure of the extinguished glass to a great extent relies on upon the extents of system shaping components, for example, Si and Al over system modifiers, for example, Ca, Mg and to a lesser degree Al.

GGBS is utilized to make strong concrete structures in mix with standard Portland cement and other pozzolanic materials. GGBS has been generally utilized as a part of Europe, and progressively in the United States and in Asia

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(especially in Japan and Singapore) for its prevalence in concrete durability, developing the lifespan of structures from fifty years to a hundred years. Two noteworthy employments of GGBS are in the creation of value enhanced slag cement, to be specific Portland Blast furnace concrete (PBFC) and high-slag blast furnace cement (HSBFC), with GGBS substance extending commonly from 30 to 70%; and in the generation of prepared blended or site-grouped tough cement. Cement made with GGBS cement sets more gradually than cement made with conventional Portland concrete, contingent upon the measure of GGBS in the cementations material, additionally keeps on picking up quality over a more drawn out period underway conditions. This outcomes in lower warmth of hydration and lower temperature rises, and makes keeping away from joints less demanding, however might likewise influence development plans where speedy setting is required.

Fig 1: sand, aggregate, water, cement

METHODOLOGY

- First the method of mixing is to be studied from the previous project by other makers.
- Hence by knowing the mix design of M25
- Thus all the replacing materials like fly ash, GGBS instead of small amount of cement.
- To that the ratios of replacing are to be determined and the mixture proportion of cement aggregate: course aggregate is finally calculated.
- For this proportion the cubes are to be casted and cure for 7 days and 28 days; to determine compression strength.
- And also cylinders also to be casted and cured for 7 days and 28 days; to determine the split tensile strength.
- Therefore our requirement of determining the compression strength and tensile strength is done as it is to be more than normal mix of M25 the our requirement is reached.
- This procedure is to be followed for all different ratios of replacement of cement and water.
- All these values is to be tabulated clearly to make an understanding of all the proportions of adding the materials.

MATERIALS USED

In this project the materials used for M25 grade mix design is

1. OPC (ordinary Portland cement 53grade)
2. Aggregate - 20mm.

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Test data

1. Specific Gravity of cement – 3.15
2. Specific Gravity of coarse aggregate -74
3. Specific Gravity of fine aggregate – 63
4 Specific Gravity of fly ash – 2.2
5. Target strength: - 33.25 N/mm^2
6. w/c ratio: - 0.45

Quantity for 1 cube

Table 1: quantity of materials required for casting of one cube.

Mix id:	GGBS (kg)	Fine aggregate (kg)	Coarse aggregate (kg)	Fly ash (kg)	Water (lit)	Cement (kg)
Ratio 1	0	2.408	4.158	0	0.63	1.39
Ratio 2	0.21	2.408	4.158	0.21	0.63	0.980
Ratio 3	0.245	2.408	4.158	0.245	0.63	0.910
Ratio 4	0.280	2.408	4.158	0.280	0.63	0.840

Mix proportion of M25 ratio is C: FA: CA = 1: 1.72: 2.97 at water/cement = 0.45.At ratio1 = 0% of equal replacement of GGBS and Fly ash with the weight of cement ratio2 = 30%; ratio3 = 35%; ratio4 = 40%.

Quantity for 1 beam

Table 2: quantity of materials required for casting of one beam.

Mix id:	GGBS (kg)	Fine aggregate (kg)	Coarse aggregate (kg)	Fly ash (kg)	Water (lit)	Cement (kg)
Ratio 1	0	3.62	6.23	0	0.945	2.1
Ratio 2	0.315	3.62	6.23	0.315	0.945	1.47
Ratio 3	0.367	3.62	6.23	0.367	0.945	1.37
Ratio 4	0.420	3.62	6.23	0.420	0.945	1.26

Mix proportion of M25 ratio is C: FA: CA = 1: 1.72: 2.97 at water/cement = 0.45.At ratio1 = 0% of equal replacement of GGBS and Fly ash with the weight of cement ratio2 = 30% ; ratio3 = 35%; ratio4 = 40%.

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RESULTS

Compressive strength for 7 days

Table 3: compressive strength results for three trails of cubes cured for 7days.

Mix designation	Compressive strength for 7 days			Average compressive strength
	Trail1 N/mm^2	Trail2 N/mm^2	Trail3 N/mm^2	N/mm^2
FA [0%] + GGBS [0%]	24.59	23.98	24.85	24.47
FA [15%] + GGBS [15%]	25.64	24.21	25.77	25.20
FA [17.5%] + GGBS [17.5%]	22.23	20.056	21.8	21.364
FA [20%] + GGBS [20%]	15.69	13.516	15.26	14.82

Bar graph

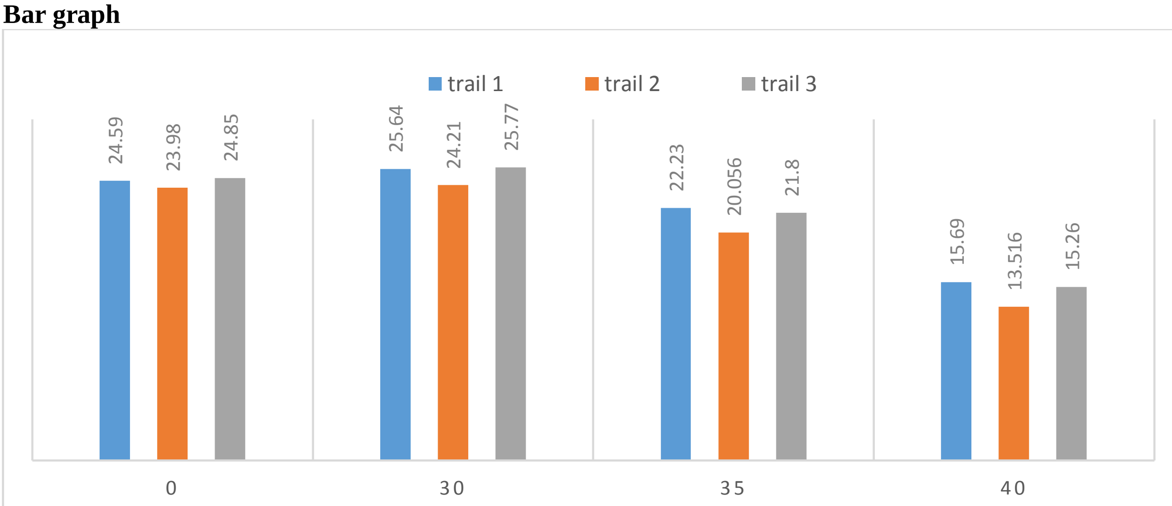

Fig 2: strength comparison for three trails of 7days cured cubes

Compressive strength for 28 days

Table 4: compressive strength results for three trails of cubes cured for 28days.

Mix designation	Compressive strength for 28 days			Average compressive strength
	T1 N/mm^2	T2 N/mm^2	T3 N/mm^2	N/mm^2
FA [0%] + GGBS [0%]	26.90	24.77	25.59	25.75
FA[15%]+GGBS[15%]	26.392	27.956	26.136	26.82
FA[17.5%]+GGBS[17.5%]	23.98	22.67	23.544	23.39
FA[20%]+GGBS[20%]	19.184	20.928	22.236	20.78

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Bar graph

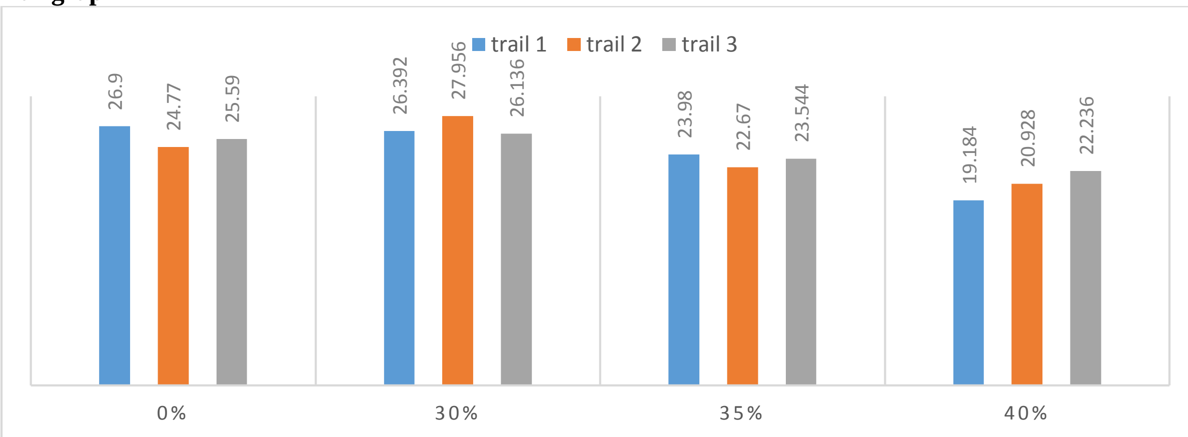

Fig 3: strength comparison for three trails of 28days cured cubes

Flexural strength for 7 days

Table 5: Flexural strength results for three trails of beams cured for 7days.

Mix designation	FLEXURAL strength for 7 days			Average FLEXURAL strength
	T1 n/mm^2	T2 n/mm^2	T3 n/mm^2	n/mm^2
FA [0%] + GGBS [0%]	1.47	1.47	0.98	1.308
FA [15%] + GGBS [15%]	3.43	3.43	3.924	3.59
FA [17.5%] +GGBS[17.5%]	0.49	0.49	0.981	0.65
FA [20%] + GGBS [20%]	0.49	0.49	0	0.32

Bar graph

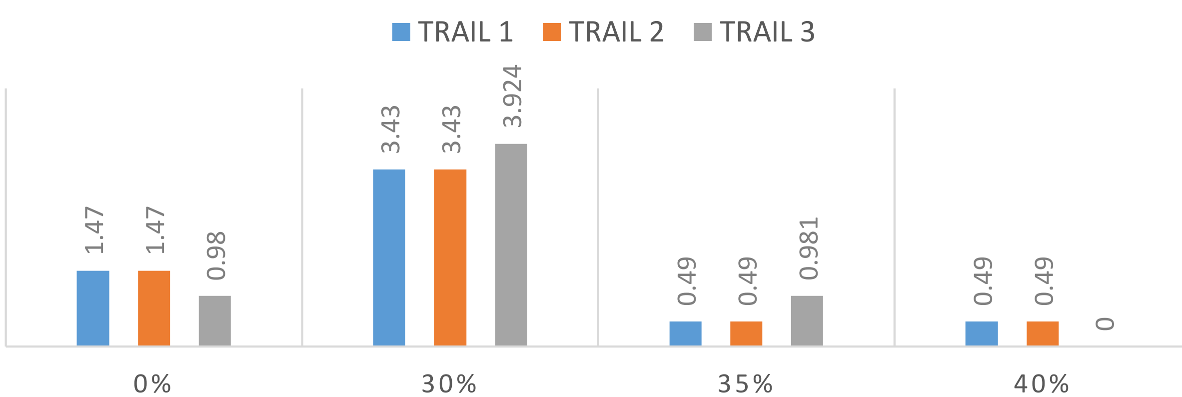

Fig 4: strength comparison for three trails of 7days cured beams

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Flexural strength for 28days

Table 6: Flexural strength results for three trails of beams cured for 28days.

Mix designation	FLEXURAL strength for 28 days			Average FLEXURAL strength
	T1 n/mm^2	T2 n/mm^2	T3 n/mm^2	n/mm^2
FA [0%] + GGBS [0%]	2.45	2.45	2.943	2.614
FA [15%] + GGBS [15%]	5.88	4.41	5.39	5.228
FA[17.5%]+GGBS [17.5%]	1.962	1.471	1.962	1.798
FA [20%] + GGBS [20%]	0.49	0.49	0.981	0.653

Bar graph

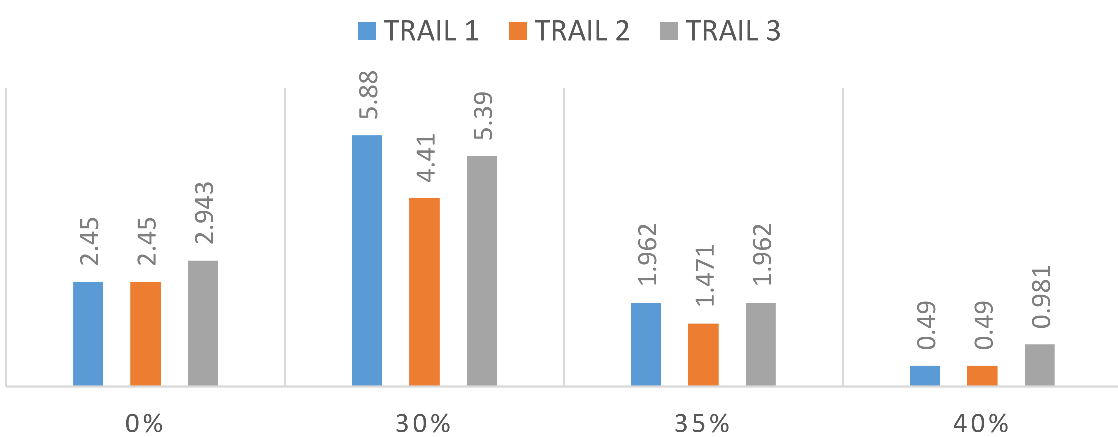

Fig 5: strength comparison for three trails of 28days cured beams

CONCLUSION

- From this test we observed that by replacing the cement content by fly ash and GGBS by 30%, 35% and 40% the values of compressive strength are the best than the normal raw mixture of M25 and when the replacement is 30% of equal ratios from cement, its value is higher than the normal mixture.
- In the same for the flexural strength test of equal percentage of replacements of fly ash and GGBS in cement weight only the higher value obtained for 30% and for other replacement values decreased compared to nominal mix in the flexural strength test of M25 grade.

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REFERENCES

[1] "K.V.Pratap, M.Bhasker, P.S.S.R.Teja" triple blending of cement concrete with fly ash and ground granulated blast furnace slag IJEAR Vol. 4, Issue Spl-2, Jan - June 2014 .

[2] "A.H .L. Swaroop, K .Venkateswararao, Prof P .Kodandaramarao" Durability Studies on Concrete with Fly Ash & GGBS, IJERA ISSN: 2248-9622 www.ijera.com Vol. 3, Issue 4, Jul-Aug 2013, pp.285-289.

[3] "Yatin H Patel, P.J.Patel, Prof. Jignesh M Patel, Dr. H S Patel.", Study on durability of high performance concrete with alccofine and fly ash , IJAERS/Vol. II/ Issue III/April-June,2013/154-157.

[4] " K. Suvarna Latha, M V Seshagiri Rao, Srinivasa Reddy", Estimation of GGBS and HVFA strength efficiencies in concrete with age, IJEAT ISSN: 2249 – 8958, Volume-2, Issue-2, December 2012

[5] "Chillari Suresh , Ashok Reddy B", Study of mechanical properties of concrete with double blending of fly ash and ggbs , IJRSAE Volume 2 , Issue 8, PP: 241 - 249 , OCT-DEC- 2014.

[6] "Dr.T. Felix Kala" Effect of Granite Powder on Strength Properties of Concrete, Issn(e): 2278-4721, Issn(p):2319-6483, Dr.T. Felix Kala , Issue 12 (May 2013), Pp 36-50

[7] "Ravindranatha, N. Kannan, Likhit M. L" EFFECT OF BACTERIA ON PARTIALREPLACEMENT OF CONCRETE WITH FLY-ASH AND GGBS, eISSN: 2319- 1163 pISSN: 2321-7308

[8] "Jay D Patel, AJ Sheth" HIGH PERFORMANCE CONCRETE USING QUATERNARY BLEND (IJIRAE-2014)

[9] "Abhish M S, Kamalakara G K, Srikanth M Naik" Study on Blended Cement Composites with 53 Grade OPC Composite for Marine Condition/Environment, (IJERT),ISSN: 2278-0181, IJERTV4IS030592 www.ijert.org, Vol. 4 Issue 03, March-2015

[10] " A.A. Ramezanianpour, S. Atarodi, M. sami", Durability of concretes containing ground granulated blast furnace GGBS against sulfate attack, Third International conference on Sustainable Construction Materials and Technologies -2009; 54(2/3):163–84. http://www.claisse.info/Proceedings.htm

[11] "J. A. Peter, M. Neelamegam, J.K. dattatreya, N.P.Rajamane and S.Gopalakrishnan". Utilisation of flyash as cement replacement material to produce high performance concrete

[12] "A.H .L. Swaroop, K .Venkateswararao, prof P .Kodandaramarao" fly ash

[13] "A.A. Ramezanianpour, S. Atarodi, M.Sami". Durability of concretes containing ground granulated blast furnace GGBS against sulfate attack.

[14] "K.V.Pratap, M.Bhasker, P.S.S.R.Teja" triple blending of cement concrete with fly ash and ground granulated blast furnace slag

[15] "K. Suvarna latha, M.V.Seshagiri rao, Srinivasa reddy". Estimation of GGBS and HVFA strength efficiencies in concrete with age

[16] "Kejin Wang and ZhiGe" evaluating properties of blended cements for concrete pavements.

[17] IS383:1970[zone of sand]

[18] IS456:2000[water content]

[19] IS10262:2009[mix design]

[20] Text Book: Concrete Technology By M.S.Shetty