

A Review Paper on Re-vibration of Fly Ash Concrete

N.A. Mane¹, A.S. Manjarekar², C.S. Patil³

¹M.Tech, Sanjay Ghodawat University, Kolhapur

²Assistant professor, Dept. of civil Engineering, Sanjay Ghodawat University, Kolhapur

³Assistant professor, Dept. of civil Engineering, Sanjay Ghodawat University, Kolhapur, Maharashtra, India

Abstract - - Cement which is a binding material binds with other materials together. And it can be hard automatically. Fly ash is used as supplementary cementations material as replacement of cement. Fly ash reduces costs and environmental pollution. The use of Fly ash in concrete it gained popularity. It is more durable and efficient. Fly ash is very good option for variety of concrete. But in concrete mixes there is lack of understanding of the process of compacting concrete by vibration some problems may arise when delaying the casting of concrete. The experimental study has been taken to investigate the effect of re-vibration of fly ash concrete. For concrete 43 grade of ordinary Portland cement, with water/cement ratio is 0.45 and with more number of re-vibration time lag intervals between $\frac{1}{2}$ hr and 2 hr. The tests conducted on concrete specimens are compressive strength, surface hardness, water permeability, chloride permeability. The modulus of elasticity is also studied.

Key Words: Re-vibration, Fly Ash, Concrete, Workability, Compressive strength

Introduction

Concrete is the most used construction material in the world. Concrete has high strength, durability, versatility and economy. Concrete resist all types of loads. The quality of concrete is considered by its strength. There are, properties to be considered as low permeability, low shrinkage, creep, porosity, density, fire resistance, impact resistance etc. Cement is main binding material in concrete. The use of fly ash as cementitious material. Fly ash is used as replacement of cement in concrete. Fly ash generated from of coal combustion process. Fly ash is most commonly material which is waste byproduct of electricity generating thermal power plants. A pozzolan is a siliceous compound which is act as a cementitious material. Fly ash is a best known and most commonly used material. Fly ash is immediate economic benefit occur because cement is replaced with less expansive by product. Fly ash not only reduced the cement consumptions but also eliminate the disposal cost. The use of fly ash in a concrete it reduces water demand, bleeding and head evolution. Concrete is expand due to heat of hydration, fly ash is reduces expansion and cracking in concrete. Fly ash is reducing concrete bleeding and improves workability. Fly ash improves compressive strength than conventional concrete for long term. The partial replacement of fly ash in cement has improved environmentally, economic and technical benefits. The concrete has reduced amount of waste material, cleaner environment, and reduced energy

requirement. The effect of vibration of concrete is improved strength of concrete. Vibration has been proved to be the best mean by which concrete particles are drawn into the concrete mass. The same concept of re-vibration is used for vibrating of concrete. The re-vibration is used for vibrating of concrete. Re-vibration method is applied to fresh concrete is vibration again at intervals after initial vibration of concrete placed. It is found as effective means for improving concrete durability.

Importance of re-vibration

Re-vibration provides strength to the concrete. It provides hardness to the surface of the concrete. In concrete aggregates are present in different sizes. Gaps are filled with fine aggregate. And the air voids get removed by water to make concrete consolidated properly. Re-vibration after an early age when the concrete is properly placed then it gains maximum strength. Within the initial setting time caused an increased hardened density. For successful vibration, re-vibration techniques is widely used to correct compaction of concrete structure.

Re-vibration process

Vibration done after some time the concrete has been placed and consolidated is known as re-vibration. Re-vibration is properly done, it is beneficial. When concrete is poured, it might have many air voids, which can weaken the concrete structure. Concrete vibrators remove the air bubbles by vibrate the concrete. Re-vibration is delayed vibration process which has been already placed and compacted concrete. It may be successive layer of concrete, when vibration in the upper layer of fresh concrete partially hardened. Many researchers mentioned that if partially set concrete distributed it causes loss of strength in concrete. But in the case of exposed concrete and provided the concrete becomes in plastic condition under vibration, re-vibration is not harmful and may be its beneficial. IF for a long period vibration is repeated quality of concrete improved due to rearrangement of coarse aggregate particles and remove entrapped air and water from aggregate thus concrete produces stronger and watertight concrete. Entrapped air bubbles in fresh concrete are needed to explore. Re-vibration process maximum air bubbles are removed.

Types of Vibrators

1. Internal Vibrator: Internal vibrator is also known as needle vibrator, also it is power unit. At the end of vibrator long tube is attached where head is attached to vibrator. For providing the power petrol engine, compressed air or an electric engine is used. Long tube is rotates an eccentric weight which is inside the vibrating head. The frequency of vibrator is 700 cycles per minute. For proper compaction of concrete vibrating head is inserted in concrete.



Fig. Internal Vibrator

2. Form Vibrator: Form vibrator is also known as external vibrator. The vibrator is fixed on the vertical and horizontal in both the direction with suitable spacing. Spacing should not exceed 90 cm in each direction. Where the internal vibrator cannot be possible, form vibrator is used for compaction. For case of thin and congested sections such as tunnel lining and arches form vibrator is used.



Fig. Form Vibrator

3. Surface Vibrator: Surface vibrator is also named as pan vibrator and screed vibrator. This type of vibrator used for slabs and pavements. Surface vibrator should be vibrating the surface of concrete. Surface vibrator is effective when the depth of concrete is 20cm. When depth of concrete is more than 20cm surface vibrator is used with internal vibrator.

Fine aggregate: Fine aggregate size is less than 4.75mm. For know the quality of concrete various test such as specific gravity, sieve analysis has been conducted on fine aggregate.

Coarse aggregate: The size of aggregate is more than 4.75mm then the aggregate called as coarse aggregate. Coarse aggregates locally available of size 10mm and 20mm and maximum size of coarse aggregate not greater than $\frac{1}{4}$ th of member size.

Fly Ash: Fly ash is the material, burning of bituminous coal which is called as Class F type fly ash. Pozzolanic properties, the glassy silica and alumina of Class F fly ash requires a cementing agent, such as Portland cement, quicklime, or hydrated lime mixed with water to react and produce cementitious compounds.

Admixture: Armix plast 111 admixture is used. This admixture is brown colour liquid and it specially made for to increase workability or for produce excellent quality concrete with good density and less permeability. For use of this admixture it directly added in concrete during mixing process. This added in quantity of 100-125ml for per 1 cement bag. Benefits of admixture use are increase workability, improve strength and quality, help to reduce bleeding and segregation also reduce cum plasticizing concrete admixture.

Water: Water is most important ingredient used in concrete mix which helps to mix concrete properly, also it lubricates the mix. The quantity of water is most important parameter in concrete. Portable water is used for mixing of concrete and curing the specimen.

Process of production

Batching: Weigh batching is accurate method of measuring the material. Weigh batching is simplest, flexible method. In large concrete plant they have used automatic weighing machine. In large work sites, bucket type of weighing machine is used.

Mixing: For Proper concrete mixing care should be taken at the time of concrete mixing because concrete is homogeneous and uniform material. For large concrete work and for reinforced concreting mixing should be carried out by mixing equipment.

When drum is used for concrete mix concrete falls in inclined chute and gets discharged out. Concrete mixers are generally run at a speed of 15 to 20 revolutions per minute for concrete mixing. For well designed 25 to 30 revolutions are required for proper mixing of concrete.

Preparation and Casting: Concrete mixture is made for M40 grade concrete. The compressive strength M 40 grade of concrete is 27 Mpa and 40 Mpa . The other concrete mixtures were made by replacing cement with 25%, 35% of class F fly ash with time lag of half hour intervals. Water-cement ratio is same for all specimens.150mm x 150mm x

150mm size of cubes are used for testing of specimens. Specimens are prepared by considering IS516-1959.

Re-vibration: Re-vibration of concrete is the application or process of vibration of concrete after the placing of concrete. The technique behind using and operating concrete vibrators is very important in achieving optimum results. Vibration and re-vibration are carried out in a similar manner expect that vibration is done while casting and re-vibration is done after a time lag from casting. Re-vibration of concrete would disturb the hardening process affecting the quality of the construction. Specimens are re-vibrated after the initial vibration. Concrete cubes are vibrated after ½ hr, 1 hr, 1 ½ hr, 2 hr for 30 seconds.



Fig. Re-vibration of Concrete

Curing: The specimens removed from the moulds after 20-24 hrs of casted time. The specimens are cured in curing tank. Curing is done for 7 days and 28 days. After the curing period specimens used for testing purpose.

Advantages of Re-vibration of concrete

1. Changes should not require for preparation of fly ash concrete as compared to normal concrete.
2. Reduces environmental pollution.
3. Have good acid resistance.
4. Reduces the consumption of cement overall.
5. Water absorption is less.

Disadvantages of fly ash concrete

1. Re-vibration process is complete at early age of concrete.
2. The life of high volume fly ash concrete structure is less than conventional concrete.

Conclusions

1. The replacement of cement in concrete by fly ash, it gives an opportunity to manufacture environmental friendly concrete.
2. Re-vibration of fly ash concrete helps to improve compressive strength and chloride resistance, decreased permeability and improved workability.
3. The concrete gained maximum compressive strength with maximum concrete density.
4. Re-vibration of fly ash concrete is increase the surface hardness of concrete.
5. The maximum compressive strength is carried out after the 2 hr re-vibration.

References

1. Shinhyu Kang, Zane Lloyd, Taehwan Kim, M. Tyler Ley (2020) Predicting the compressive strength of fly ash concrete with the Particle Model. *Cement And Concrete Research* 137(2020)106218
2. Charith Herath, Chamila Gunasekara, David W. Law, Sujeeva Setunge Performance of high volume fly ash concrete incorporating additives: A systematic literature review. *Construction and Building Materials* 258 (2020) 120606
3. Ashish KumerSaha (2017) Effect of class F fly ash on the durability properties of concrete. *Sustainable Environment Research* 28(2018) 25-31
4. H.B. Koh, DYeoh, S Shahidan (2017) Effect of re-vibration on the compressive strength and surface hardness of concrete. *Material Science and Engineering*.
5. Alaa M.(2017) Rashad A brief on high-volume Class F fly ash as cement replacement – A guide for Civil Engineer. *International Journal of Sustainable Built Environment* (2015) 4, 278–306
6. IS 383:2016 Course and Fine Aggregate for concrete- Specification (Third revision). Bureau of Indian standard, New Delhi, Jan 2016.
7. Abdulhalim KaraGin and Murat Doruyol(2014) An experimental study on strength and durability of fly ash in concrete mix. *Advances in Materials Science and Engineering* Volume 2014, Article ID 417514
8. P. Nath, P. Sarker (2011) Effect of Fly Ash on the durability properties of high strength concrete. *Procedia Engineering* 14 (2011) 1149–1156
9. M. Ahmruzzaman Utilization the Use of Fly Ash in Concrete. *Progress in Energy and Combustion Science* 36 (2010) 327–363
10. M.V. Krishna Rao, P. Ratish Kumar, N.V.R.C Bala Bhaskar (2008) Effect of Re-vibration compressive strength of concrete *Asian Journal of civil engineering* vol.9, No.3
11. Prinya Chindaprasirt, Chai Jaturapitakkul, TheerawatSinsiri (2004) Effect of fly ash fineness on Compressive strength and pore size of blended cement paste. *Cement and Concrete Composites* 27(2005) 425-428

12. Rafat Siddique (2003) Performance characteristics of high-volume Class F fly ash concrete. Cement and concrete Research 34(2004)487-493
13. Gamal E. Khaleel.(1995) Effect of re-vibration on concrete quality. Magazine 17(7) 119-131
14. Moayed Noori Al- Khalaf, Miss Hana AbidYousif (1985) Effect of re-vibration on the stability and compactibility of concrete. Cement and concrete research vol.15 pp. 842-848,1985
15. M. M. Kassim Effects of re-vibration on early age retarded concrete. High Performance Structure and Materials VI 85