

SESSION 2013-14

**“AN EXPERIMENTAL INVESTIGATION FOR THE USE
OF BLAST FURNACE SLAG FOR IMPROVING
MECHANICAL PROPERTY OF CONCRETE”**

Submitted to

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

in partial fulfillment of the requirement for the degree of

MASTER OF TECHNOLOGY

In

STRUCTURAL ENGINEERING

Submitted By

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ABSTRACT

Due to growing environmental awareness, as well as stricter regulations on managing industrial waste, the world is increasingly turning to researching properties of industrial waste and finding solutions on using its valuable component parts so that those might be used as secondary raw material in other industrial branches.

Although iron slag is still today considered waste and is categorized in industrial waste catalogues in most countries in the world, it is most definitely not waste, neither by its physical and chemical properties nor according to data on its use as valuable material for different purposes. Moreover, since the earliest times of the discovery and development of processes of iron and other metals production, slag as by-product is used for satisfying diverse human needs, from the production of medicines and agro-technical agents to production of cement and construction elements. Iron making slag are by products of the iron making processes. To date, these types of slag have been widely used in cement and as aggregate for civil works.

An experimental investigation carried out to evaluate effects of replacing aggregates (fine) with that of Slag which is an industrial waste by-product on concrete strength properties. The basic objective of this study was to identify alternative source of good quality aggregates which is depleting very fast due to the fast pace of construction activities in India. Use of slag a waste industrial byproduct of iron and steel production provides great opportunity to utilize it as an alternative to normally available aggregates. In this study, Concrete of M25 grades were considered for a W/C ratio of 0.5 for the replacements of 0 , 20, 40,60,80 % Of fine aggregate. Whole study was done in replacement of natural fine aggregate with granular slag. The investigation revealed improvement in compressive strength ,split tensile and flexure strength.

Keywords –Granulated blast furnace slag, coarse and fine aggregate, compressive ,tensile and flexural strength.

CHAPTER 8

Conclusion

8.1 GENERAL

The strength of concrete mixtures have been computed in the present work by replacing 20%, 40% ,60 % and 80% GBFS with the sand. On the basis of present work, following conclusions are drawn.

- 1) Use GBFS in Concrete increases the degree of workability remarkably when Compare with conventional concrete result
- 2) The gain in 7 days compressive strength of GBFS concrete was found good when compaired with conventional concrete results
- 3) The gain in 14 days compressive strength of GBFS concrete was found good when compaired with conventional concrete.
- 4) The gain in 28 days compressive strength of GBFS concrete was found good when compaired with conventional concrete but results differ when 80 % GBFS was used as fine aggregate. In 60 % replacement compressive strength improved by 22.52 % and reduced upto 19.5 % at 80 % replacement.
- 5) Use of GBFS in volume upto 60 % gives good split tensile strength when compaired with conventional concrete results. The strength improved by 4.61 % at 60 % replacement and reduced upto 8.16 % at 80 % replacement.
- 6) Flexural strength of GBFS concrete was found good when compared with conventional concrete , but results differ when 80 % GBFS used. The strength improved by 22.04% at 60 % replacement and reduced upto 33.07 % at 80 % replacement.

Hence, concluded that 60 % partial replacement of sand by slag is giving the highest result for compressive strength, tensile strength and flexural strength, hence it could be recommended that slag aggregate could be effectively utilized at fine aggregate in concrete application as partial replacement of fine aggregate.

Dissertation Report
On
**An experimental investigation of partial replacement
of cement by various percentage of phosphogypsum and flyash in
cement concrete**

*This progress report is submitted to Rashtrasant Tukadoji Maharaj Nagpur University in
partial fulfillment of the requirement for the degree of Master of Technology in Structural
Engineering (Full-Time)*



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ABSTRACT

Million tons of fly ash (FA) and phospho-gypsum (PG) are produced every year. The utilization of these industrial by-product materials is important in terms of environmental and economical issues are concerned. Modern concrete is no longer a composite made up of only with cement, fine aggregate, coarse and water. It is now common to use admixture (chemical and minerals), pozzolanas for modifying different properties of concrete in fresh and hardened state. As the IS 456:2000 [1] opens the new avenue to the cement industry to use the variety of admixture and pozzolanas such as fly ash, silica flume, rice husk, highly reactive metakaoline and ground granulated blast furnace slag. This was accomplished by preparing cement concrete with Ordinary Portland Cement of 53 grade, coarse aggregate, natural fine aggregate and water. This project present the salient feature of the use of Phosphogypsum (PG) – Flyash (FA) as a partial replacement for cement Concrete and discuss the improvement effected in the properties of concrete. The objective of this study is to evaluate the technical possibilities of incorporating FA and PG in production of concrete. Study was conducted on grade of cement concrete mix M25. In this project Phosphogypsum and flyash is used as mineral admixture with trial combination of partial replacement of cement by 5% PG - 20% FA , 10% PG - 20% FA , 15% PG - 20% FA, 5% PG - 25% FA. The compressive, tensile and flexural strength are studied by casting and testing specimens for 7, 14 and 28 days.

Keywords: Phosphogypsum (PG), flyash(FA), admixture, cement, compressive Strength, tensile Strength, flexural Strength.

8.2. CONCLUSION :-

An industrial waste like phosphogypsum and Fly ash impairs the strength development of calcined products and hence it can be used in construction industry for preparation of concrete replacing some quantity of cement, which is a valuable ingredient of concrete to achieve economy.

From the experimental programme, the following conclusions are drawn:-

1. The degree of workability increases considerably with the use of PG & FA in concrete when compared with conventional concrete result.
2. The gain in 7 days compressive strength of PG & FA concrete was found good when compared with conventional concrete results.
3. The gain in 14 days compressive strength of PG & FA concrete was found good when compared with conventional concrete, but results differ when PG is used in excess of 10%.
4. The gain in 28 days compressive strength of PG & FA concrete was found good when compared with conventional concrete, but results differ when PG is used in excess of 10%.
5. Use of PG in volume up to 10% and FA in volume up to 25% gives good split tensile strength when compared with conventional concrete results.
6. Use of PG in volume up to 10% and FA in volume up to 20% gives good tensile strength and the values are also close to IS specification for split tensile strength.
7. Flexural strength of PG and FA concrete was found good when compared with conventional concrete but results differ when PG is used in excess of 10%.
8. Utilization of PG and FA and its application are used for the development of the construction industry, Material sciences.
9. It is a possible alternative solution for the safe disposal of Phosphogypsum and Flyash.

**“OPTIMIZATION & DESIGN OF HIGH RISE BUILDING
WITH DIFFERENT STRUCTURAL FRAMING SYSTEMS
SUBJECTED TO SEISMIC LOADS”**

Submitted to

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ABSTRACT

Due to excessive displacements of tall buildings occasioned by lateral loads, lateral load resisting systems are usually provided to curtail the load effect. The resistance may be offered by Frame Action, Shear Walls, or combined Walls and Frames (also known as Dual System).

In this study, 3D structural modeling base software STAAD-PRO V8i was used to generate and analyze three-dimensional building models for the assessment of the relative effectiveness of the various lateral load resisting systems. Five models were used, one for moment resisting frame & 04 models each for the lateral load resisting systems. The basic concept is to study the arrangement of shear walls & bare frames within the building system to optimize overall lateral displacements & inter-story drifts.

Each model consisted of G +10 story frame structure having total height of 33.0 m. Each building model was subjected to three-dimensional analysis for the determination of both the lateral displacements at story top and inter-story drifts.

The results of the work showed that the dual system was the most efficient lateral-load resisting system based on deflection criterion, as they yielded the least values for lateral displacements and inter-story drifts. The moment frame was the least stiff of the resisting systems, yielding the highest values of both the lateral displacement and the inter-story drift.

Conclusion

The present research involves the development of a new method and analysis of shear wall framing system and a new model to compare the safety of the structure and cost effectiveness structure for a lateral loading system for a tall & high rise structures. In this project the behavior of different framing systems comprising of dual system structures was studied under seismic loads. The lateral loads, dead loads, live load are taken for design of structure as per IS standards for Darbhanga region or Zone V. This SMRF system is cost effective and resisting to tall and high rise structures.

Structural engineers, in particular will be able to select cost effective framing system which will also results in safety of structure in highly earthquake prone areas. Based on the results obtained from analysis of all frames various observations are made as follows.

1. Providing shear walls at appropriate locations substantially reduces the displacements due to high intensity earthquake and other lateral loads. Shear walls are more effective when located along exterior perimeter of the building – such a layout increases resistance of the building to twisting.
2. The base shear in frame V is the greatest as compared to other frames whereas moment frame shows least among all. The total self weight of other frames is less as compared to frame V & hence base shear value is more for this frame.
3. The story drift for all models satisfy the permissible limit $0.004 \cdot h$ where h is the story height, as per IS 1893. Due to higher stiffness as compared to other frames, frame-V displaced lesser than other frames. In comparison frame V is 48 % stiffer than other frames & hence its percentage reduction in displacement is 30 % more than other frames.
4. Among the building frames studied, for bare frame the greatest inter story drift occurred at the bottom third of the height of building (i.e... maximum at floor levels 02 & 03), whereas, for all dual system frames the drift is greatest for the story's located within the middle of the building height (i.e... maximum at floor levels 05 & 06).

**“COMPARATIVE STUDY OF S.M.R.F. BUILDING
OVER O.M.R.F. BUILDING WITH SEISMIC AND
WIND EFFECT”**

Submitted to

*Rastrasant Tukadoji Maharaj Nagpur University in partial fulfilment
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ABSTRACT

Seismic evaluation provides a general idea about the building performance during an earthquake. The criteria of evaluation of building depend on materials, strength and ductility of structural components and detailing of reinforcement. I have considered Special Moment Resisting Frame (Ductile Detailing) and Ordinary Moment Resisting Frame as structural frame and Comparison are made for seismic load & wind load. The study involved modelling of G+13,G+12,G+10,G+7 structures. Analyses have been carried out in STAAD pro software. The analysis were studied and compared. It is thus conclude that OMRF Structures are to be designed for relatively higher equivalent forces than that of SMRF Structures. Use of IS 1893 (part 1):2002 is very effective for detailing the structure and economical. Study of performance of SMRF structure in Earthquake is good as compared to OMRF structure.

Chapter 9

CONCLUSION

The analysis has been carried out on various load combination, at all the Seismic Zones

- The loading combination 1.5 EQ + 1.5 DL and 0.9 DL - 1.5 EQ are found to be critical in case of column of OMRF and SMRF.
- The Bending Moment on OMRF structure are comparatively higher than that of SMRF structure
- The load combination 1.2(DL+LL+WLZ-) is found critical in case of Wind analysis.
- The load combination (1.5 EQ + 1.5 DL) is critical in Seismic Analysis.
- For load combination (1.5 EQ + 1.5 DL) = %Difference for Maximum Bending Moment for Zone = II is 25.00 %
- For load combination (1.5 EQ + 1.5 DL) = % Difference for Maximum Bending Moment for Zone = III is 32.87 %
- For load combination (1.5 EQ + 1.5 DL) = % Difference for Maximum Bending Moment for Zone = IV is 39.76 %
- For load combination (1.5 EQ + 1.5 DL) = % Difference for Maximum Bending Moment for Zone = V is 45.94 %

PROJECT REPORT

On

WATER ANALYSIS OF KOLAR RIVER

In partial fulfillment of the requirements for the award of Degree of Bachelor of Engineering in Civil Engineering

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ABSTRACT

Pollution is an undesirable change which has detrimental effect on the organism that are depending on the environment. These changes can be temporary or permanent depending on the extent to which pollution has taken place. Pollution has crept in all three constituents of the atmosphere viz., air, water and soil. Adsorption techniques for the treatment of liquid industrial waste are surface phenomenon where a suitable adsorbent is taken and the given effluent is kept in contact or without stirring. The organic and inorganic load of the effluent gets adsorbed on to the adsorbent. Adsorbent studies are very much useful in the evaluating the treatment effluent in terms of toxicity reduction. The present study was undertaken with the objective to study the characteristic of the water of the Kolar River. The variation in physico-chemical characteristic were observed and monitored every season i.e. rainy, winter and summer. Mean values of temperature, pH, electrical conductivity, chlorides, sulphates, dissolved oxygen, oil and grease, BOD, COD were observed.

After all the analysis of the results the physico-chemical parameters were compared with the desirable limit. The parameters those were exceeding the desirable limit were suggested with the remedial measures.

CHAPTER 5 CONCLUSION

5.1 Conclusion

In conclusion it can be stated that the different studied physico-chemical parameters such as pH, electrical conductivity, BOD, COD, DO etc. there is variations in values of the parameters if compared with standard values. So it is highly necessary to treat the effluent with proper procedure before using it for drainage or domestic application.

The sample collected from three different points is alkaline in nature. The sample is slightly acidic in nature in the summer season since the effluent released in the river nearby MIDC area doesn't get diluted in the water.

The water near MIDC area contains maximum amount of oil and grease as compared to other points since the industries in MIDC directly discharge the effluents in water body without any treatment. The construction of bridge is in progress near Kille Kolar area which results in the use of machineries in Kolar River from which the oil and grease leak out.

The electrical conductivity is very high at Kille Kolar as the by-products of power plant are released in the river. The timber wood along with dead bodies is burned near the banks of the river of which the ashes are discharged in river. Infact, the fly ash emitted by a power plant a by-product from burning coal for electricity carries into the surrounding environment 100 times more radiation than a nuclear power plant producing the same amount of energy.

All the sampling stations contain some amount of BOD which is restricts the use of water for drinking purposes. The presence of religious place nearby Kille Kolar area results in discharge of organic matters like flowers, vegetables, shrubs etc. in the river.

The dissolved oxygen in the summer season is on lower side this can create threat to the aquatic life. The main reason of lower dissolved oxygen level is that the stream flows are usually lower, and thus the total quantity of oxygen available is also lower. In addition to this the chemicals like oil, grease etc. are discharged in to river which decreases the dissolved oxygen in the river. Also dissolved oxygen content decreases are the BOD increases.