



## Souvenir

### Exhibitors' Directory Constro 2016

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Chairman, Constro' 16

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Convenor, Souvenir Committee

Published by



#### Pune Construction Engineering Research Foundation

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Manufacturing Ideas!

Vinayak Jagtap

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**Constro 2016 - Inauguration**  
**Hon. Chief Guest - Ar. Professor Uday Gadkari**

Professor and Director of Institute of Design Education and Architectural Studies (IDEAS) Nagpur, **Ar. Professor Uday Gadkari** is also currently the **President of Council of Architecture (COA)**, India. It is a statutory body by Government of India, regulating Education and Profession of Architecture in India. He obtained his degree in Bachelor of Architecture in 1981 and subsequently, degree in Master of City Planning in 1984.

He has been a teacher in Architecture & Planning for over 30 years. He is associated with the administrative side of academics also as the **Chairman of Board of Studies in Architecture** for 3 years and Member, Academic Council and senate of University also for 3 years. He also has been a part of 15 National Conferences of Architecture as a Convener or as a Secretary while he was a keynote speaker in more than 18 national and regional conferences. He has also written and presented numerous papers in various conferences. He has guided and advised more than 25 students at under-graduate level, 8 at post-graduate level and 1 for Ph. D research project.

Prior to becoming the President of COA, Professor Gadkari was an Executive Member of COA for 9 years. He led a delegation of Indian architects to London. He has been active as Secretary of State Association of Schools of Architecture and Member, Central Advisory Board on Education, Govt. of India.

He brought about reforms in academic governance of architectural schools in India by streamlining the governance in office administration. He dealt with matters of professional concerns at National level. He was responsible for Planning & Implementation of **Capacity building and Skill Development Programs** for students, teachers and young professionals. He designed and implemented various competitions & competitive exams at National level.

As a practising professional, Professor Gadkari has dealt with several Residential, Commercial, Institutional as well as Sports Infrastructure projects. He is a fellow of Indian Association of Architects and life member of the Indian Institute of Architects and a member of the Indian Building Congress.



## From Constro 2016 Chairman's Desk

Dear Friends,

Constro 2016 will present those emerging technologies which will play an important role towards the movement of creating a Smart City. The process of development also creates a conducive environment for employment opportunities, particularly in the Construction Industry. Skill development fuels a great advantage in the efficiency of output. Effective use of tools and equipment play a vital role to improve the productivity of Skilled Labour. Constro 2016 will present all these important aspects by featuring a special pavilion to showcase products and techniques related to its focused themes. **The fair will consist of 6 pavilions, 250 stalls and special focus on featuring the tools and materials connected with Skill Development.**

Constro 2016 will provide a unique opportunity for construction businesses, both large and small, to showcase their products & services, analyze competitors' strengths and weakness, offer access to emerging technologies and network with domestic & international groups to scale new heights of success.

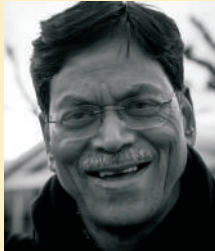
Going by past record and increasing interest amongst stake-holders we are expecting more than **10,000 business delegates** to attend the event, which has now reached international standards and ambience. Constro 2016 has the support of about **40 organisations** that are partnering with PCERF to put together this event. As always we have harnessed various stake-holders of the industry such as architects, engineers, builders, manufacturers, management consultants, institutions, students and more.

Through the year, we organized a series of seminars wherein experts from all over gave their viewpoint on building a 'Smart City'. We have hosted competitive events for industry and institutions, like **Constro Vidyarthi Awards**, which fits very well with our motto; '*Education through Exhibition*'. The initiative **PCERF-Kumar Beharay Construction Safety Awards** got a wonderful response from the industry this year, and we will now be conducting the same annually, instead of bi-annually along with Constro. Emerging technologies and innovations have always played a big part in this event. Amongst the many other firsts, Constro 2016 will also see the launch of a mobile app, which will benefit not just the visitors, but also the participants. This is another way of promoting the 'Smart City' plan.

We are also closely working with the Pune Municipal Corporation (PMC) on various projects for the city. The PMC has been a great pillar of support since the very first Constro in 1985.

Constro 2016 promises to be significantly better. We are sure that everyone who is a part of it and who visits it will benefit greatly out of this event.

**Neelkanth S. Joshi**  
Chairman, Constro 2016



## President's Message

Dear Fellow members,  
On the occasion of launch of the souvenir I extend warm greetings to all of you.

On behalf of PCERF, I would like to thank everyone for your support for the Constro exhibition. In last three decades through Constro, we have been able to fulfil objective of PCERF of bringing people of various skills together. The collective strength of these people has also now been helping us in creation of knowledge bank, which support our various activities related to skill development, research and development, and continuing education programmes.

Since the introduction of government's policies of **"Smart Cities"**, Construction Industry has opened up a lot of opportunities for new businesses. This is of course expecting Industry to upgrade its skills and technology base. PCERF'S role as a resource organisation in training, research and development activities, has proved very effective and successful. Not only more number of aspirants are wanting to take the advantage of these programmes but, CIDC has also recognised and approved PCERF as an official representative for the western region in conducting these programmes. In the coming years this situation is going to open a lot of new opportunities for PCERF for strengthening training and knowledge development activities. We also need support from all our members and partner organisations, in expanding this team, and supporting this mission of knowledge and skills creation.

I look forward for your continued support for the future activities and wish everyone a constructive response through the Constro Exhibition.

**Shrikant Nivasarkar**  
President, PCERF



## From PCERF Secretary's Desk

Dear Friends,

It gives me great pleasure to address the readers of the Souvenir which is being published on the occasion of Constro 2016. Constro as an exhibition has evolved over a period of time from 1985, when the first Constro was organised on the BJ Medical Grounds, Pune.

Constro was one initiative taken up by PCERF after it was founded in 1983, when various construction professionals came together for the benefit of the Construction Sector. Over the years, research had been undertaken sporadically and not in a regular planned method. Some focused efforts over past one year have yielded results towards ensuring the **commencement and continuation of research, development and training**.

This has been possible because of associations undertaken with academic institutions like VIIT Pune and CIDC, New Delhi. As of now, two research projects are already underway under the academic as well as professional guidance. The end result of this research is certainly going to benefit the construction sector and ultimately, the society at large!

Similarly, **refresher courses** offered by PCERF have been appreciated not only by the industry, but they have also been **endorsed by CIDC**, for the value addition that they offer to the trainees – who are again working professionals from the industry.

Keeping in mind the fast changing pace of development in the construction sector, the principles and beliefs of PCERF – that of **working together** – show their continued relevance today! I appeal to all the professional organisations and associations to come together and join hands with PCERF. The specialised knowledge and knowhow that each organisation and association would have acquired over a period of time may be disseminated using the platform of PCERF over the entire spectrum of personnel associated with the construction sector. The role of PCERF is that of a catalyst that will benefit all concerned and as mentioned before, the general public at large and hence our country!

**Sanjay Vaichal**

Secretary, PCERF



## Convener's Message Souvenir Committee

I am grateful to the Organising Committee of Constro 2016, for believing in my abilities and entrusting me with the responsibility of the Souvenir by making me the Convener of the Souvenir Committee. The scope and the design and presentation style was discussed in detail. It was decided that the Souvenir shall play the dual role of an **Exhibitors' Directory as well as a Technical Volume** that will have a long shelf-life as a reference book.

This resulted in a search for exploring the various aspects relating to the twin themes of Constro 2016 – Smart Cities and Skill Development – with the help of a number of articles. While some articles have a specific reference to Pune city, others are more general. **Pune Metro Project** and a part of the Pune Municipal Corporation's Vision with respect to the Aundh-Baner-Balewadi (ABB) area, explain a few Smart City aspects about Pune. Generic articles about what constitutes “Smartness” in a city, its historical background as well as the moot question as to how to make Cities Smart today are discussed in some other articles.

The lavishness of Indian art and craft have been seen in historical structures, be it a fort or a temple. With the advent of technology, some of these skills are either in danger of being lost, or are losing their sheen. Some articles explore these aspects of Skill Development. **Heritage conservation and application of technology should be consciously seen as complementary, rather than competitive to each other.**

We, at Constro 2016, hope and believe that this Souvenir shall be useful to you. At this juncture, I would like to thank our well-wisher, **Shri. RB Suryavanshi** for supporting our effort in the creation of the Technical Papers' Section. Also, I thank all the authors of the articles who spent their valuable time and effort for contributing to this Souvenir, with a special mention of Ar. Shekhar Garud. I am grateful to all the advertisers who have chosen the medium of the Souvenir to display their products, services and most importantly, their good wishes towards Constro and PCERF.

I would like to mention the exceptional work done by student volunteer Shaunak Dabadghav who worked untiringly and cheerfully in practically all the spheres of this Souvenir to ensure that it reaches its fruition successfully. I would also like to thank Indrajeet Malave for utilising his contacts which led to invaluable contribution. The inputs offered by Vinayak Jagtap went beyond the formal scope of printing; I thank him for his whole-hearted support. I thank all the volunteers, staff and personnel associated with Constro and PCERF for all their help. And last, but not the least, I thank Shri Neelkanth Joshi for his unstinting support in this endeavour – the Constro 2016 Souvenir.

**Ar. Mrinalini Sane**

Editor,

Convener, Souvenir Committee

## We will miss you, Baney Sir!



Our beloved Shri K.P. Baney, left for heavenly abode on 8th November, 2015. An evergreen personality who had been involved with PCERF as a Founder Member, had also been the President of PCERF from 2005 - 2010. He had Chaired Constro in its early days. He had been involved with numerous organisations like BAI, CREDAI and AESA. His nature of bringing together people and bonding with them was the reason that these organisations flourished under his leadership and continued to look at his vision for further guidance.

A dedicated and sincere member of the construction sector, he was an out-of-box thinker. His helpful nature and generosity have been experienced by various persons who have been associated with him – be it a fellow engineer, an employee, a friend, a consultant or a student!

One intriguing aspect that distinguished him was his unique sense of humour. He used this sense of humour to deflate a tense situation and create harmony. His punctuality and commitment to his word was well-known to all.

We at PCERF, extend our heartfelt condolences to his family on his sad demise. The members of the construction fraternity shall always cherish his memories and follow his teachings.



**Pune Construction  
Engineering Research Foundation,  
PCERF**





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**Pune Construction  
Engineering  
Research Foundation,  
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## Pune Construction Engineering Research Foundation, PCERF

### About PCERF

Pune Construction Engineering Research Foundation is an NGO established in 1983. Eminent Civil Engineers, Architects, Designers, Consultants and Builders came together and decided to serve Construction Sector by solving day to day problems and creating awareness about new technological developments and their ground applications. **For over 25 years now, PCERF is working to improve quality, knowledge, technology, research and development in the Construction Sector** by organising workshops, seminars, conferences and refresher courses for the gamut of personnel associated with Construction - the grass root level of skilled, semi-skilled and unskilled workers, students, technical consultants, contractors and entrepreneurs. In addition, competitions and publications are also undertaken from time to time.

**Over the years, PCERF has built close bonds with various Engineering and Architecture Colleges**, Technological and Professional Associations, Local Government Departments, National and International organisations. It had created a harmonious environment for useful collaboration between the academia and research organisations with the industry. An excellent team of dedicated professionals is the real strength of PCERF, with which the organisation is stepping forward to serve the end user of the Construction Industry and hence, to serve our nation, India.

**An interesting initiative of PCERF is Constro** – exclusive International Fair on Construction Machinery, Materials, Methods and Projects. Constro 2016, the 14<sup>th</sup> Constro, India's largest international Fair will be held from 14<sup>th</sup> to 17<sup>th</sup> January, 2016 at the Agricultural College Grounds, Pune. Constro 2014, the previous Constro has matched the International Standards in terms of facilities offered and overall business and social ambience. As per the past experience, it is expected that top decision makers and consultants will attend Constro 2016. Since it is a business fair, traders and distributors of Construction Machinery, Products and Equipment, Interior and Architectural Products will also be present at the 4 day mega show. The organisers are confident that Constro 2016 will unleash multiple opportunities to participants as a result of shared knowhow during the event.

An initiative to inculcate and further the relationship between the Industry and the Academia is the **Constro Vidyarthi Award**. This Competition has attracted over 19 entries from architecture colleges from both undergraduate as well as post-graduate level; whereas, the entries from civil engineering colleges is more than double – 39 entries again at the UG and the PG level. These student projects shall be adjudged by a panel of eminent jury members and the winner shall be declared during Constro 2016.

Continuing with the **research activity** and educational institutes, PCERF is offering financial support to selected research projects undertaken at the academic institutes to encourage the interactive participation and hence develop a symbiotic relationship that will nurture and enhance the talent found at the college level to help in transformation of the industry.

**Training and refresher courses** offered by PCERF have now gained an additional credential – the recognition given to these courses by CIDC – Construction Industry Development Council! One programme under the aegis of CIDC has already been conducted and many more are in the offing. The response from the industry has been extremely encouraging.

PCERF expects to take up many more such initiatives that will be in line with the philosophy of PCERF – for the construction, by the construction and of the construction sector.



## About CONSTRO 2016

For the past three decades, since 1985, PCERF has been organising its flagship event, a biannual trade fair named 'Constro Exhibition', which is **currently credited amongst the largest events in the infrastructure & civil engineering industry in India**. Constro has been unique because it has been a showcase of innovative processes and tools through different themes. It is a shining example of collaborative effort wherein professionals from the industry and different organizations join forces to put together this trade fair that attracts lakhs of people. With an aim of 'Education through Exhibition', every Constro has been a platform for sharing knowledge.

## The Themes of CONSTRO 2016:

### A. Emerging Technologies for Smart Cities

As world urbanization continues to grow and the total population expected to double by 2050, there exists an increased demand for intelligent, sustainable environments that reduces environmental impact and offer citizens a high quality life. Today urban cities are referred to as the engines of economic growth, therefore there is an urgent need for the cities to get smarter to handle this large-scale urbanization and finding new ways to manage complexity, increase efficiency, reduce expenses, and improve quality of life. This would mean that it will have to provide a very high quality of life to its citizens comprising, Good quality but affordable housing, Cost efficient physical infrastructure such as 24 x 7 Water supply, Sanitation, 24 x 7 Electric supply, Clean air, Quality education, Skill development, Health care, Security and safety, Entertainment, Sports, Robust and high speed inter connectivity, Fast & efficient urban mobility, etc.

A Smart City constitutes of four pillars. The centre of attention for each pillars is the citizen. In other words a Smart City works towards ensuring the best for its citizens, regardless of social status, age, income levels, gender, etc.

#### Drivers of Smart City

- Smart Power & Smart Energy
- Smart Water Supply
- Sewage System
- Smart Transport & Mobility
- Smart Connectivity
- Smart Buildings
- Smart Disaster Management
- Smart Living & Social Infra
- Security & Safety
- Skill Development
- Smart Environmental Sustainability
- Job Creation

#### SPECIAL PAVILIONS AT CONSTRO 2016:

- Hall of Building Materials
- Hall of Interiors
- Hall of Electronics & Electricals
- Hall of Emerging Technologies for Smart Cities
- Experience Center

**We have published 3 Constro newsletters along with 9 E-newsletters.**

### B. Skill Development

The process of development creates an conducive environment for employment opportunities, particularly in the Construction Industry. Skill development fuels a great advantage in the efficiency of output. Effective use of tools and equipments play a vital role to improve the productivity of Skilled Labour. The theme 'Skill Development' focuses on products, practices related to Skill Development. Constro 2016 will feature these hand tools, equipments through a special pavilion and also plans to conduct workshops for Plumbers, Carpenters, Masonry, etc. in order to create the awareness as a future activity.



Pune Construction Engineering Research Foundation,  
PCERF



## Vidyarthi Competition – 2016

### PCERF-Padmashree B. G. Shirke Vidyarthi Award

VIDYARTHI COMPETITION - 2016 is scheduled during Constro 2016.

#### The Competition

This University Level Competition for Architecture / Civil Engineering Students for Best Innovative Construction Practices organized by PCERF in CONSTRO-2016 is the first endeavor to motivate the students for inculcating the research culture in young generation. The competition is planned to motivate the students from the field of Architecture and Civil Engineering. This Competition aims at enkindling the thoughts and skills of the students to come up with efficient ways of thinking about various facets of construction practices such as flexibility in design, economic and ecological benefits, speed of construction, cost effectiveness, life cycle cost benefit etc. and many more.

PCERF is pursuing the task of organizing an interesting and challenging competition during CONSTRO for inculcating research aptitude and attitude in budding engineers and architects and evaluating the same for the students who have graduated in recent past. This is a major interface event created between the users and customers on one side and the providers and manufacturers on the other side. This is a biennial event to be held for the students of Architecture / Civil Engineering studying in the Colleges / Institutes of Savitribai Phule Pune University (SPPU) with a view to recognize, appreciate and finally reward the talents of young Architects / Civil Engineers.

#### Aim

To provide the platform to work in unison with all the stakeholders (viz. Students, Academic Institute/ University and Industry) in the construction Industry so as to evolve ways & means for more efficient use of construction practices and provide optimum value to the customer.

#### Objectives

The following are the objectives of the competition.

1. To motivate the students toward developing an attitude of R&D in emerging technologies
2. To enkindle the thoughts and skills of the students to come up with innovative and efficient ways of thinking
3. To develop Industry-Institute relations
4. To obtain viable and workable solutions for the identified problems that are faced by the construction industry



## Methodology

The following methodology is proposed prior to the selection

1. The problems to be identified by the Industry as per the current need
2. Based on the need, topic to be given to the students by March/April of the year
3. The expression of the interest by the students to be invited from various institutes
4. The problem to be assigned to the students by June month
5. Industry mentor to be allotted to the student group
6. The progress to be reviewed by the industry at two stages

## Selected award winner

1. Research funding will be given to the winner students and the institute
2. This funding will be utilized by the student under the supervision of his parent institute and PCERF
3. The industry involved will be reviewing the progress and get desired / possible solution

## Conclusion

We at PCERF understand that a research based construction industry is more profitable, productive, sustainable and professional. The efforts towards Vidyarthi Competition are expected to bring researchers from the academia and the industry on one platform for overall improvement in quality and standard of infrastructure in the construction industry for the benefit of all stakeholders – the primary constituent being, of course, the general public!

## Status of Vidyarthi Competition 2016

Due to the short time frame from the inception of the idea of Vidyarthi Competition to the event of Constro 2016, it was not possible to follow the methodology as proposed. However, it was considered that the opportunity offered by the Constro 2016 event should be utilized to spread awareness of this new initiative. As a result, this competition was announced and entries from academic institutes were invited. These entries were in the form of those projects that were already submitted by the final year students at UG and PG level as a part of their academic course curriculum. About 36 entries were received from 9 architecture and engineering colleges for UG level projects while 21 entries have been received from 5 architecture and engineering colleges for PG level. A panel of eminent jury members will adjudge the winners.







Pune Construction Engineering Research Foundation,  
PCERF



## Research and Development Activities of PCERF

By Col G Hussain (Retd ), Director technical PCERF



In pursuit of PCERF vision and objective, the Executive committee took certain concrete steps in Jun 2014. It started with a brainstorming session on 30 June 14. It was decided to form a committee comprising of following members to assist and provide guide lines for R & D program and to create a full time post of technical director :-

- a) Mr. Naren Kothari, VP PCERF
- b) Mr. Sanjay Vaichal, Hon. Sec. PCERF
- c) Mr. Neelkanth S Joshi, Ex. Member PCERF

This committee discussed with Prof. Subhash Bonde and made the following recommendations:-

- To form a group of experts from different fields of civil engineering to identify the topics for research
- To finalize the goals and objectives and focus on material technology and composite material
- To interact with various engineering colleges and identify the BE and ME level projects
- PCERF to facilitate research projects and arrange for logistics required for R & D projects

The technical committee called various meetings of experts and representatives of engineering colleges.

They recommended a few projects offered by VIIT College of Engineering to be under taken for research as follows:

- Development of Maturity Meter for estimation of concrete strength
- Standardisation of cement mortar for river sand replacement using stone dust, ground granulated blast furnace slag, marble powder & use of nano material
- Development of design guidelines for ferrocrete panels and its applications for walls and road surface
- Development of plastering machine for indigenous need

The first two projects are progressing well and the research team led by Prof. Dr. Milinda A. Mahajan, Prof. Dr. Rajesh B. Ghongade, Prof. Shruti L. Gore, Prof. Archana Tanawade and Prof. Archana Ratnaparkhi has come out with the Abstract of the projects. These abstracts of the projects are produced for the readers

### Project 1

## Estimation of Concrete Strength by Maturity Meter

**Civil Engineering Department:** Gore S. L., Tanawade A. G., Dhonde H. B. and Mahajan M. A.

**E & Tc Engineering Department:** Ratnaparkhi A. K. and Ghongade R. B.

Vishwakarma Institute of Information Technology, Pune

### Abstract

Traditionally, the acceptance for new construction has been limited to judging the acceptability of the concrete delivered to the project on the basis of slump, air content, and compressive strength. In common practices, compressive strength of the concrete is evaluated using the destructive tests (on Cube/Cylinder) which is time consuming, cumbersome and labour intensive. The Maturity Method, proposed in this proposal is a non-destructive and proven method for estimating the strength of newly placed concrete.

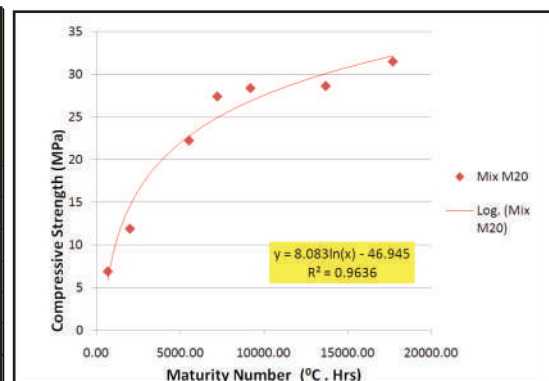
The Maturity Method is a technique to estimate in-place strength by accounting for the effects of temperature and time on strength development. This system improves the estimation of strength of concrete structures and accelerates the work flow in large constructions. This capability, among others, enables quality control engineers to determine the appropriate time to remove forms and begin new construction. Also we can open the pavements for traffic. In Precast it would prove a boon which may ultimately increase the production of the elements as "Turn-Around Time" is potentially reduced in prefab plants with the use of Maturity Method.

The research aims at developing a practical and economically viable mobile phone based Maturity Meter technology along with its Calibration and Validation protocol for the industry. The researchers plan to implement a unique concept of "Web Based Module" to generate maturity curves that can predict the concrete strength in real-time. The data would be stored in SD card placed in Maturity Meter. Also GSM module will send messages on registered cell phone and the site engineer would be able to decide about removal of forms. It will lower the production cost by optimizing the mix design around in place strength targets. Reduce or eliminate dependence on highly variable test samples for determining early-age concrete strength.

The sample calculation for M20 Mix carried out in August 2015 at NYATI site is given in Table: 1 and Fig. 1.

| Day | Date   | Time     | Maturity Index (hours*degree C) (datum temp: 0 deg C) M20 S1 | Maturity Index (hours*degree C) (datum temp: 0 deg C) M20 S2 | Maturity Number (Hrs-Degcel.) | Strength (Mpa) |
|-----|--------|----------|--------------------------------------------------------------|--------------------------------------------------------------|-------------------------------|----------------|
| 1   | 11-Aug | 15:30:38 | 678.67                                                       | 687.71                                                       | 683.19                        | 6.85           |
| 3   | 13/8   | 15:50:36 | 2001.25                                                      | 2006.13                                                      | 2003.69                       | 11.87          |
| 7   | 17/8   | 16:33:34 | 4613.31                                                      | 4596.17                                                      | 5538.38                       | 22.23          |
| 11  | 21/8   | 15:00:30 | 7248.31                                                      | 7209.66                                                      | 7228.98                       | 27.42          |
| 14  | 24/8   | 16:13:33 | 9235.76                                                      | 9183.59                                                      | 9209.67                       | 28.4           |
| 21  | 31/8   | 19:00:37 | 13753.05                                                     | 13665.99                                                     | 13709.52                      | 28.65          |
| 28  | 07-Sep | 19:40:37 | 18441.35                                                     | 18314.17                                                     | 18377.76                      | 31.52          |

**Table 1: Sample calculations for Maturity Number**



**Figure : Calibration Curve**

## Project 2

### Standardization of Cement Mortar for River Sand Replacement using Stone Dust, Ground Granulated Blast Furnace Slag, Marble Powder & Use of Nano-Materials

**Civil Engineering Department:** Gore S. L., Tanawade A. G., Dhonde H. B. and Mahajan M. A.  
Vishwakarma Institute of Information Technology, Pune

#### Abstract

The Government has introduced limitations on the mining of natural sand from rivers in an effort to protect the natural environment. This has escalated the cost of river sand. The substitute to this has been used as secondary filler viz. crushed sand.

The river sand is being replaced by crushed sand and a secondary filler material (viz. Stone Dust, Ground Granulated Blast Furnace Slag and Marble Powder). This replaced mortar is widely used in the construction industry but limited only for non-structural wall construction as a bonding layer between bricks /blocks. The application of such mortar for plaster work has many technical limitations. The objective of this work is to study the effect of adding waste material to the cement mortar on enhancing its mechanical properties and durability.

The experimental investigation is carried out to investigate the properties of the mortar in fresh and hardened state. The compressive strength, split tensile strength and flexure strength are studied. The selected optimum mortar mix is used at NYATI site (refer Fig. 2).

#### Summary

The following are the observation of the ongoing study.

1. 100 % crushed sand with 20% GGBS gives compressive strength  $35.14 \text{ N/mm}^2$
2. Optimum amount of colloidal nano silica is near about 3%
3. Replacement of river sand is possible and final study will prove the optimum and effective mix design for the mortar mix



*Before plastering*



*After plastering*



*Making surface smooth with sponge*



*Finished Plastering on RCC wall*

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