

## Ferrocement – constructions in Phuket



Escore Company's Ferrocement tank is a type of reinforced concrete material with main components of concrete, steel bar and wire mesh. It is highly strong, durable and anti-rust that it can support high compression and tension. It is not easily decayed or broken. There is innovation of ferrocement forming with Skeleton steel and wire mesh throughout the internal surface of concrete for reinforcement.

Ferrocement tank passes certification from leading institutions and government agencies. It is also certified at fellow engineer level in terms of compression, tension, water absorption and sulfate resistance.

**Big Buddha:** Phraphutthamingmongkhol-akenagakhiri Buddha, "Happiness on Top of Nagakerd Mountain" Contemporary art. Seated Buddha statue in Subduing Mara. Fundaments: 50 ferroconcrete piers as deep as 12 meters. Width: 25.45 m. Height: 45 m. Reinforced concrete structure adorned with white jade marble, Suriyakanta, from Myanmar (Burma). The weight of the white jade marble is approximately 135 tons per 2,500 sq.m. The statue was established on the top of Mount Nagakerd, Subdistrict Karon, Phuket Province.

The name "Phraphutthamingmongkhol-akenagakhiri" was later granted and appointed as the Buddha statue -a treasure of Muang Phuket by Somdech Phra Yanasangvara, The Supreme Patriarch of Thailand on October 28, 2008. This was accepted with reverence by Mr. Suporn Wanichakul, the president of the corporation creating the Buddha statue...





## P. Moosa studies ferrocement structures in Pune

Moosa recently visited Pune and Satara. In his technical visit he studied the precast factory production of ferrocement items. He said people in Kerala still not believe that ferrocement is stronger. Steel and cement make it unaffordable. As such the use of FIBAR like new materials which can replace steel bars has to be used. Moosa thinks about the affordable buildings for poor persons. He visited Pune Ferrocement office, where Er Girish Sangle had a nice meeting and discussions.

## DOME House planned in Aurangabad, India



A dome shaped house having diameter 48 feet is being planned in Aurangabad. The dome will be unique as it will be covered by lawns.



## Symbiosis Skill University to start ferrocement subject

Skill Universities are now interested to make their students exposed to the easy technologies. Ferrocement is such a technology which can be used to earn bread by the unemployed youth. Recently Symbiosis Skill University officials discussed the subject with Mr Girish Sangle, Project Co ordinator. A detailed proposal is being prepared for the University.





Athens' Stavros Niarchos Foundation Cultural Centre  
Athens, Greece



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Athens, Greece

## Sanpui Ferrocement Artist

Mr Sanpui is a ferrocement artist. He worked in Aurangabad and Pune, Maharashtra for many years. His specialty is the organic and natural shapes to be constructed using ferrocement. For bigger works he has shifted to Kolkata for few months. The imitation of the nature is so perfect that he is being invited by many architects in different states in India.



## Letter from Mr Sávio Nunes Bonifácio, USPQ, BRAZIL

Dear Prof. Balakrishna Divekar,

I hope to see you in good health with your family and friends.

As I also hope that the Ferrocemento structures will grow in your country, beautiful India. Extend our compliments to all Ferrocemento Society members, in particular Mr. Rajendra Pawar, our speaker at the Ferro12 Symposium.

Our ferrocemento projects for Water Treatment Plants, Reservoir and Waste Water Treatment Plants at Companhia de Saneamento de Minas Gerais - COPASA MG, use tanks with volumes of up to 500,000 liters. They are tanks built on site with reinforcement in welded steel screens and application of mortar with the vibrating box, technology developed from the work of Prof. Hugo Wainstok. Unfortunately, we still do not work with prefabricated structures, although we have upcoming projects for housing construction in this way.

We are currently working on the recovery of Waste Water Treatment Plant (WWTP) which after 18 years of operation with flow rates of 30 L/s with 80% efficiency in removing the organic BOD load, the top slab was broken. The wall below the water level is resistant and obtained average results of 41 MPa in the sclerometry test. The work begins with the cleaning and removal of sludge, demolition and reconstruction of the roof slab according to the original design. For the coating slab in contact with gases, the following researched: polyurea / polyurethane systems; or by adding a crystalline antimicrobial mixture to the reconstitution mortar followed by an inner layer of antacid gepolymer coating; or fiberglass-reinforced vinyl ester resin (PRFV) applied to the ferrocemento substrate. The cost of recovery with PRFV measured at the site for two UASB reactors was US \$ 151,810, approximately 60% of the cost of implementing a new WWTP (Source: COPASA, 2020).

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Figura 1 - View of the reconstructed upper slab reactors



Figura 2 - The two recovered UASB reactors



# Jalvardhini builds ferrocement tanks in rural area

Ulhas Paranjape



## Zilla Parishad, Raigad (INDIA)

Lecture was organized at Z.P. Raigad at Alibag on 29 th December 2020. The construction of 10,000 Liter closed Ferrocement water Tank was also done at YMC -Panvel , Dist Raigad. Chief Executive Officer of Raigad Zilla parishad Dr. Patil had organised a meeting of NGO and CSR Representative to discuss about Water & Waste Management In Dist Alibag on 29th December 2020 at Alibag. The CEO had earlier Visited Farm of Shri Parshuram Agivale & their he saw Ferrocement Tank . So he requested us to present our work & experience on 29th at Alibag. I talked on Water conservation & use of Ferrocement Technology.

Work of 10,000 liter Closed Ferrocement Tank at Bandan Wadi, For YMC was completed with the help of their Karyakarta Shri Santosh Thakur at Bandhan Wadi, Taluka Panvel Dist Raigad We provided only Technical Support. Two volunteers from Gnyan Prabhodini-Pune & Shri Tushar Nirguda from Seva Vardhini Pune visited Site during construction. Work was visited by Karjat Panchyat Samiti Engineer Shri Ingle visited the site on 29th and Panvel Taluka Krushi Adhikari Shri Chaudhari visited on 31st Dec. Er.Kiran Rajurkar also visited site on 2 days & explained 7 students of Diploma in Basic Rural Technology organised by YMC with Vigyan Ashram-Pabal. Shri Haresh Shah , Mrs Rita Shridhar & others of YMC also visited this site.



## Water Tank at Umaratt

On 21st January 2021 the work of 14 feet diameter and 4 Feet in height Ferrocement Tank was started at "Umaratt" Taluka Sangmeshwar Dist Ratnagiri. 6 students from Gharada Institute Technology -- Khed & 15 students from Rajendra Mane Polytechnic Devrukh along with their staff members come to have hands on experience at "Umaratt". Students took part in construction along with Mason and Villagers.

In the evening Alkatai organized a visit of NGO from Devrukh working on "Jalswarajya Scheme ". They visited the site to see and get information about Ferrocement Tank. On 22 nd January Principal Bhopale and his staff from Rajendra Mane & Prof Parulekar other staff also took part in applying Cement Mortar to Skeleton of Ferrocement Tank. Work was completed on 24<sup>th</sup> January, with Participatory approach. The villagers constructed the plinth, provided Sand, labor and cock & coupling. Remaining material was given by Jalvardhini Pratishthan.



Peruvian hotel is so different that it looks like the scene of

## “Castelo Rá-Tim-Bum”: the interior is incredible

Located in the Peruvian city of Urubamba, in the Cusco region, the Wifala Harmony Hotel has an organic architecture that offers guests a unique experience of comfort and even magic, as it looks like a movie set.



### Comunidad Tierra Claudio Caveri



In 1958 the architect Claudio Caveri founded this project in which Christianity and utopian socialism converged.

This community, in which Caveri took refuge until his death, was built almost entirely with his own hands. The buildings are one-story with irregular shapes, curves, folds and ferrocement roofs, which completely break with the straight lines, often used in architecture. Each of these constructions - built with cement and iron - is connected, forming a whole.

## Underwater Museum of Art Florida

It is a seven-foot face called HOPE. It is an underwater environmental sculpture that will look upwards toward the surface waters off Santa Rosa Beach, Fla.



“I titled it HOPE because it is looking upward to the top of the ocean at the light filtering down,” he said. “With climate change there are a lot of places and people that are going to be flooded out in the near future. But, there is hope if we get our act together and really work on this, we can at least mitigate the worst effects of it – probably not all of it, but we can definitely make it better for everyone if we work together and hash it out.”

The site is in the Underwater Museum of Art Florida, through the Cultural Arts Alliance of Walton County and South Walton Artificial Reef Association. It is the first such museum in the continental U.S.

It is a permanent sculpture park located in the waters of the Gulf of Mexico off Grayton Beach State Park, within a mile of the shore at a depth of 57 feet.

For this project, he chose the **Ferrocement technique**, with an underlying of welded steel rebar, chicken wire to create a mesh and four layers of sculpted cement to cover the form. The technique, used in boat-building, is somewhat unique.

“I read books on boat-building to learn the technique. It is really only feasible if you have low labor costs,” Burger said. “I am paying myself, so I can afford to spend my time.”



# Ferrocement.. best option for precast industry

By- Er Milind Kulkarni, MKCE, Mumbai

It is observed that both in traditional and modern constructions, natural resources are used directly as well as indirectly. For example in stone, brick and mud constructions in rural areas quarried stone is used and the mud in the form of clay /clay blocks is used. All of this leads to depletion of natural resources. Also most importantly the top soil which is the most important layer for agriculture gets sacrificed. Very few people except the farmers understand the real importance of loss of top soil.

In case of modern constructions of course huge consumption of natural stone such as basalt, for aggregates, river sands, cements and steel is used for the basic frame work of the structures. There is huge depletion of these natural resources which are not renewable.

The cost to benefit ratio, or the price we pay and are going to pay in the future for development is much skewed and highly dangerous.

The cement, steel, tiles, aluminum, paints, interiors also consume a large amount of energy to be manufactured. This high embodied energy is also a huge negative aspect of all these materials without which nothing nowadays can be constructed.

In such a scenario which is commonly seen and spread across the entire construction industry, “Ferrocement Technology” based construction comes as a wisp of fresh air and gives some hope and respite from the onslaught of rampant depletion of natural resources

## **Eco-friendly construction:**

Ferrocement technology reduces the depletion of natural resources to quite some extent. It's a great green initiative. Calculations done on live examples have also proven, a lower carbon foot print and sustainable green credit ratings.

Firstly it does not have aggregate, and bricks as an ingredient at all. Secondly it has weld meshes and chicken meshes as the main reinforcement, which requires lesser energy for manufacture. Cements containing high fly ash content, or GGBS can also be used



Ferrocement House in Noida



Ferrocement House in Satara Maharashtra

The total steel usage is very limited and used as skeletal steel which offsets the need for formwork and Precious Timber and again structural steel used for formwork of modern RCC structures is majorly eliminated

And most importantly as the thickness of the Ferrocement being very low, consumption of cement, sand, (even manufactured sand can be used!!) gets reduced. Today with the advent of Geopolymers in construction it is possible to have Ferro Geopolymer based construction. It has the greatest advantage of replacing cement and sand by 100%.

Fly Ash which is an environmental burden and a challenge for the safe disposal can be used and activated using simple chemicals and made to behave like cement! It only requires sunlight (which is abundant in this country for almost 9 months of the year!) and a temperature of about 30 to 35°C for curing and most importantly completely eliminates the need for water for curing, the most precious thing on this earth today. Ferro-geopolymers could be the game changer technology for the future.

Further from the material properties point of view most importantly the behavior of Ferrocement as a phase, homogenous composite as against concrete which acts a heterogeneous composite makes ferrocement far more superior than RCC.

Its ability to take both tensile and compressive stresses almost equally very low crack widths, resistance to shrinkage and drying cracking, makes it a technology of choice for structural designers.

Further with the reduced self-weight, foundations can be smaller and kept on weaker soils having medium to poor bearing strength. The earth quake loads get considerably reduced though wind loads could be a matter that needs to be addressed but can be resolved by adding eco-friendly dead cost effective dead weights.

### Magical Technology:

Ferrocement is nothing but a combination of cement, sand, weld mesh, chicken mesh pressed and filled with mortar. Skeletal steel in the form of 6mm/8mm bars are used for achieving form and shape to eliminate the use of formwork.

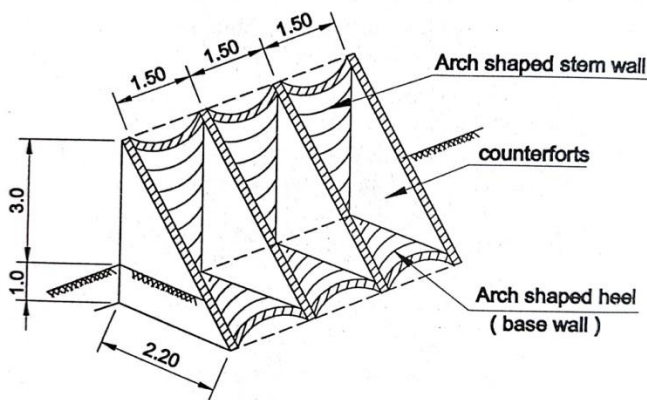
“A little change in the type and pattern of the reinforcement, the use of fine wire meshes instead of large diameter bars, and press filling mortar either by hand, machines, or precasting makes it a wonder material!!!”

This is how Dr Prof Divekar a pioneer, visionary, has explained it simply after living with it in body, mind and soul for the past more than 40 years and having designed and constructed a large number of structures successfully

Normally while constructing we use bricks, steel, metal, stone, timber etc, and sheets for roofing. But now we have to reduce quantity or eliminate them. Then without these, how to build a house?

Do you know what chicken mesh is? Yes, it is a hexagonal wire woven GI mesh it's flexible and can be stretched while fixing it to skeletal steel.

A weld mesh is a square grid of small diameter bars pre welded in a factory. It is more rigid. The skeletal steel is nothing but a skeleton of 6/8mm diameter steel bar by welding to the required shape and size. Then we fix the weld mesh and finally stretch this chicken mesh on both sides of the skeleton steel



In the second part we prepare a thick cement mortar. That is mixing of 1 part cement and 2 parts of fine sand and small quantity of water. We take this thick mortar and press fill it in the chicken-mesh layers. After the press and fill a final finishing and levelling is done using a plate trowel for aesthetics.

By pressing it becomes stiff. No wastage is seen. After some days you see this is just like a wooden plank, very slim and still very tough. Curing is required just like concrete.

The applications of this technology in the construction industry is enormous and wide ranging from very small to large structures both cast in situ and precast. Security Cabins, compound walls, small buildings, domes, pyramids, water tanks, treatment plants,,

repairs, waterproofing, permanent forms, check dams, silos, roads, pathways, pontoons, blast fences, and a lot lot more... !!!

### Low cost precast ZATPAT HOUSE:

Er Jayant Murudkar from Satara MIDC has manufactured a ZATPAT house. These are assembled on site from ferrocement components. This Zatpat house is assembled in a day. The precast ferrocement wall panels are standardized as 3.5 x 2.5 meter and the thickness is 25 mm. The roofing panels are 4 x 0.6 meter size with same thickness. The panels are ribbed panels so they have greater strength even though light.





The Zatpat house is becoming popular in Maharashtra as it can provide immediate shelters to rehabilitate the affected families. The houses can be dismantled and reused anywhere. The assembling process is very simple and villagers can easily do this.

Mr Murudkar has set up a factory to produce these ferrocement components. He has installed a machine which can manufacture the panels of size 0.6 meter by 3 meter weighing about 100 kg only. Precast Wall Panel of Size 3.5 X 2.5 meter weighs 750 Kilograms only. Thickness of 25 mm is available. 100 mm thick wall panel is manufactured using thermocol as an insulation filler.

Zatpat house is very affordable. If the plan dimensions of the room are 4.5 m by 3.5 meter and height is 2.5 meter then the cost of the house is only Rs 1,71,000. This includes excavation, foundation concrete, masonry, door and window, one bathroom and one toilet externally attached to the room. So the rate of this Zatpat precast house is Rs 1010 per sq foot.

(detailed video: <https://www.youtube.com/watch?v=bIsOE3X4Ros>)

### **Versatile Ferrocement:**

Ferrocement has been in use for the last 30 years across the country. Everybody is aware of it, but many do not know the details of the technology and costing. It is a simple, straight and easy to build. It is a futuristic material

and is an easy solution for many of the problems which concrete even today cannot resolve!!

Typical Domes of Shikhar on Ramakrishna temple built in Pune are precast thin petals of ferrocement and its classical example of the potential of ferrocement when designed and constructed properly!! So let us decide to understand in a bit more detail and adopt this magical innovation called as ferrocement technology.

In America, Mexico, England, France, Germany, Indonesia, it is being used extensively for multiple applications. In India also now we can plan anything like, your home, ware houses, cattle sheds, toilet blocks, water tanks and insist your architect and engineer, that you want ferrocement and nothing else. So, let us use ferrocement and save our earth. Let us be friendly with environment.

Sarthak Seva Sangh, Ambale, Tal. Purandar, Dist. Pune

## **FTC students make Chajja and water tank**



Ferrocement Society joined hands with Sarthak Seva Sangh and they started the FTC at Village Ambale, where the Sarthak has their hostel of boys and girls. The children are from disturbed family and they do not have parents. So the children of age above 17 could learn the ferrocement, plastering, welding etc. They have now constructed a water tank and building chhajjas using ferrocement technology. Dr Kudiya has made available moulds for making different articles in ferrocement. Er Jayant Murudkar has given helping hand to this FTC.

## Nashik Ferrocement Center builds water tanks

Seva Sankalp Samitee of Guruji Regnalaya, Nashik, an NGO is engaged in village Zampawadi extension works. This NGO planned to construct a water storage tank of 5000 litres capacity. Construction of a ferrocement tank was approved by their management. With the technical help of Jalvardhini Mumbai, a list of materials, design and drawings were provided to the NGO.

The village Zampawadi is located in the interior tribal area of Trimbakeshwar and is about 90 km from Nashik. It is accessible by road. The materials required were brought at site by the Samitee. In the meanwhile a square plinth of 8.5' x 8.5' and 4' height was constructed in stone masonry. The tank construction was planned on 31<sup>st</sup> Jan, 1<sup>st</sup> Feb and 2<sup>nd</sup> Feb. 2021. A team from Jalvardhini comprising Er. Ulhas Paranjape and Mr. Vijay Khare and a team from Nashik comprising Dr. Mahendra Nakil and Mr. Chaugule reached Zampawadi in the morning. The masons, volunteers (men and women) almost more than 20 numbers joined this task.

Er. Paranjape guided the work with sequential order. Mr Khare executed the work with the help of personnel available at site. The welded mesh and chicken mesh was unfolded first. The welded mesh in single layer and chicken mesh in double layer were tightened to each other using binding wire and also using chicken mesh wire.

The circle was marked on plinth wall with 7.5' diameter. The structure of chicken mesh and weld mesh tightened together was placed along the circumference of 7.5' circle. The four number C shaped steel bars, 8 mm dia were used for maintaining the circular shape of tank. The L shaped steel bars and circular bars at 12" c/c were are used as skeletal steel. The steel bars were fixed using binding wire. On the inner side additional chicken mesh to cover skeletal steel was provided. The outlet pipe and wash pipe were laid.

The cement mortar (1:3) was applied to weld mesh, skeleton structure from outside. The w/C ratio was maintained in such a way that the mortar could be pressed in the gaps of the meshes. All the volunteers/ workers enjoyed this application. The waterproofing agent was used as admixture. At the bottom of the tank 2 inch layer of concrete was laid and leveled. On next day plastering was done. On the third day the inside surface including bottom surface cement slurry was applied and a smooth surface was prepared.

From 4<sup>th</sup> day onwards the curing process was initiated through watering on gunny bags, well covered from all sides. This continued till 14 days. On each day water level was increased by 4 inches in the tank from 8<sup>th</sup> day onwards.

The tank was fully constructed using local laborers and mason on participatory basis. 5000 litres capacity tank will serve 14 families in this village area. (more photos on page 12)

### Ferrocement Awards

## Late V D Joshi Award for artisans

Pune: Pradeep Jadhav, a ferrocement worker was given the Late V D Joshi Award. 14<sup>th</sup> February is the birth anniversary of Late Joshi. The award is given every year to the selected applicants, who have worked as welders, masons, bar benders etc in ferrocement constructions.



The award winner Pradeep Jadhav was trained 4 years ago. He built nearly 25 ferrocement water tanks in rural area. Besides he has trained many villagers to build ferrocement tanks. Jadhav works with a NGO, Dnyan Prabodhini, Pune. Mr Vivek Giridhari said, his NGO needs support of designs for big size water tanks. Er Chandramohan, President said he is standardizing the ferrocement water tanks designs. Within few days society will publish the designs.

Er Girish Sangle, Project Coordinator, introduced the guests about the function. He also explained the functions and objectives of the Ferrocement Society and the nature and selection of the award winners. Er Vijay Shitole explained the need of the skilled workers for the ferrocement works. He said he has to restrict the number of ferrocement works only due to shortage of

the skilled labours. He stressed the need of training.

Er Padmanabh Lele, Hon Secretary explained his experiences about skilled workers. He said such awards will boost the morale of the workers. Er Rajendra Pawar, in his concluding speech told about Government support. He explained Khadakpurna Pump house ferrocement roof and Punand Project ferrocement canal lining experiences. The economy achieved and the results achieved were appreciated by the public. He said Indian Ferrocement works have been ranked on top in the World.

Er R K Nitturkar and Subhash Patil were also present for the function. The program was organized on 14<sup>th</sup> February 2021 in the Swarmayee Gurukul hall in Pune.



## NEW MEMBERS WELCOME

LM238 : Patel Haresh Khemabhai, Gujarath

LM 239 : Ar. Kalwane Piyush Uttam, Pune

LM 240 : Ponkumar Subrahmanyam, Titucirapalli, TN

LM 241: Patil Krishnat Narayan, Satara

## FERROCEMENT FOUNTAIN in SALEM

**Excellent work by Dr. Shoba Rajkumar**



The fountain structure is constructed using ferrocement for the students of the Department of Civil Engineering, Government College of Engineering, Salem to showcase the applications of ferrocement technology to the students, construction industry and the public. The dumbbell shape was selected for elegance of the ferrocement fountain structure. The foundation was constructed with a base course using M10 grade concrete mix. The side walls were constructed with skeletal steel rods of 8mm diameter running in both vertical and horizontal direction along with weld mesh and chicken mesh tied to it. Counterforts of ferrocement were placed at suitable intervals all along the tank wall on the outer side. As it is water retaining structure plastering was done with rich cement mortar of 1:2 cement sand ratio and 0.41 water cement ratio making it a stiff mix. The wall thickness of the tank was designed as 50 mm. Plastering was done on both inner and outer side of the reinforcement arrangement in the wall. The curved shape of the wall was easily attained due to small wall thickness.

The cost of labour for the construction which worked out to INR 2.2 Lakhs (excluding materials) was entirely borne by the Design Engineer and Constructor, Dr. D.Shoba Rajkumar, Professor of Civil Engineering, Government College of Engineering, Salem. This work was initiated, done, and completed successfully by her out of the passion she has got for ferrocement technology. During the initial stage of construction she has guided a batch of undergraduate students in 2018, R.Sivamakrishnan, V.Sivashankar, M.Vijaykumar and V.Vijay for doing their project on "Design and Construction of ferrocement Swimming pool". The students showed great interest in learning the technology.

A small ferrocement arch bridge is also constructed in front of the fountain structure for approach. The structure was

inaugurated by Dr. C. Vasanthanayaki, Principal, Government College of Engineering, Salem on 26<sup>th</sup> January, 2021. It was a great big show with the fountain in operation to all the faculty members of the College.

**Dr. Shoba said,**  
**"I dedicate the design and construction of this ferrocement fountain structure to Prof. P.**

**Paramasivam, Professor of Civil Engineering, NUS, Singapore who was the inspiration for me to work with ferrocement.**

*He has enriched me with lot of information on ferrocement technology and given valuable suggestions in accomplishing my Ph.D. research work".* She dedicated the same with great respect

to her Ph.D. guide Dr. R. Sundararajan, former Principal, GCT, Coimbatore for his excellent guidance and kind encouragement at every phase of her Ph.D.

research work on "Investigation on the behaviour of hybrid ferrocement hollow slabs".





## APPLICATIONS OF FERROCEMENT IN BRIDGE ENGINEERING - CHINA

The construction of long-span ferrocement box bridges and of composite structures may become more widely incorporated into bridge engineering in China.

In China, ferrocement has been used for many years in bridge construction. Examples of such applications include two-way curved shallow shells, two-way curved shells for formwork, where stones are incorporated in the construction of two-way composite arches, thin-walled slabs for box beams, stiffeners for box girders in long-span suspension bridges, floating thin-walled caissons for bridge piers, and protective tubes for piles.



Contact

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## NEW WEBSITE

Since 2008 our website was not modified, that is why committee decided to modify the website in the latest user friendly form and this will be mobile friendly also. Payment gateway will be included in new website. Our old email capacity is totally exhausted. Recently we have created new email address for our society. Therefore all the members are requested to make all such correspondence to the society on our new email address- [indiaferrocement@gmail.com](mailto:indiaferrocement@gmail.com)

## ZAMPAWADI Ferrocement water tank

