RAJALAKSHMI ENGINEERING COLLEGE

DEPARTMENT OF CIVIL ENGINEERING

CIVILIZATION

DESIGNING THE WORLD...........

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VISION

To be a Department imparting knowledge in Civil Engineering education, research, entrepreneurship and Industry outreach services for creating sustainable infrastructure and enhancing the quality of Life with professional and ethical values

MISSION

- *To provide an effective learning environment enabling to be a competent Civil Engineer.*
- *To motivate research and Entrepreneurial initiatives in the Field of Civil Engineering.*
- *To inculcate ethical values to serve the society with high order Professionalism.*

3-D PRINTING IN CONSTRUCTION INDUSTRY

Introduction

3D printing (referred as Additive Manufacturing (AM)) is the computer-controlled sequential layering of materials to create three-dimensional shapes. It is particularly useful for prototyping and for the manufacture of geometrically complex components. It was first developed in 1980s, but it was a difficult and expensive operation and had few applications. It is only since 2000, it has become relatively affordable and has become viable for a wide range of uses including product design, component and tool manufacture, consumer electronics, plastics, metal working, aerospace engineering, dental and medical applications, and footwear. The sales of AM machines, or '3D printers' has grown rapidly and since 2005, the home use of 3D printers has become practical. 3D printing systems developed for the construction industry are referred to as 'construction 3D printers'.

A 3D digital model of the item is created, either by computer-aided design (CAD) or using a 3D scanner. The printer then reads the design and lays down successive layers of printing medium (this can be a liquid, powder, or sheet material) which are joined or fused to create the item. The process can be slow, but it enables almost any shape to be created. Depending on the technique adopted, printing can produce multiple components simultaneously, can use multiple materials and can use multiple colours. Accuracy can be increased by a high-resolution subtractive process that removes material from an oversized printed item. Some techniques include the use of dissolvable materials that support overhanging features during fabrication. Materials such as metal can be expensive to print, and in this case it may be more cost-effective to print a mould, and then to use that to create the item.

Construction industry

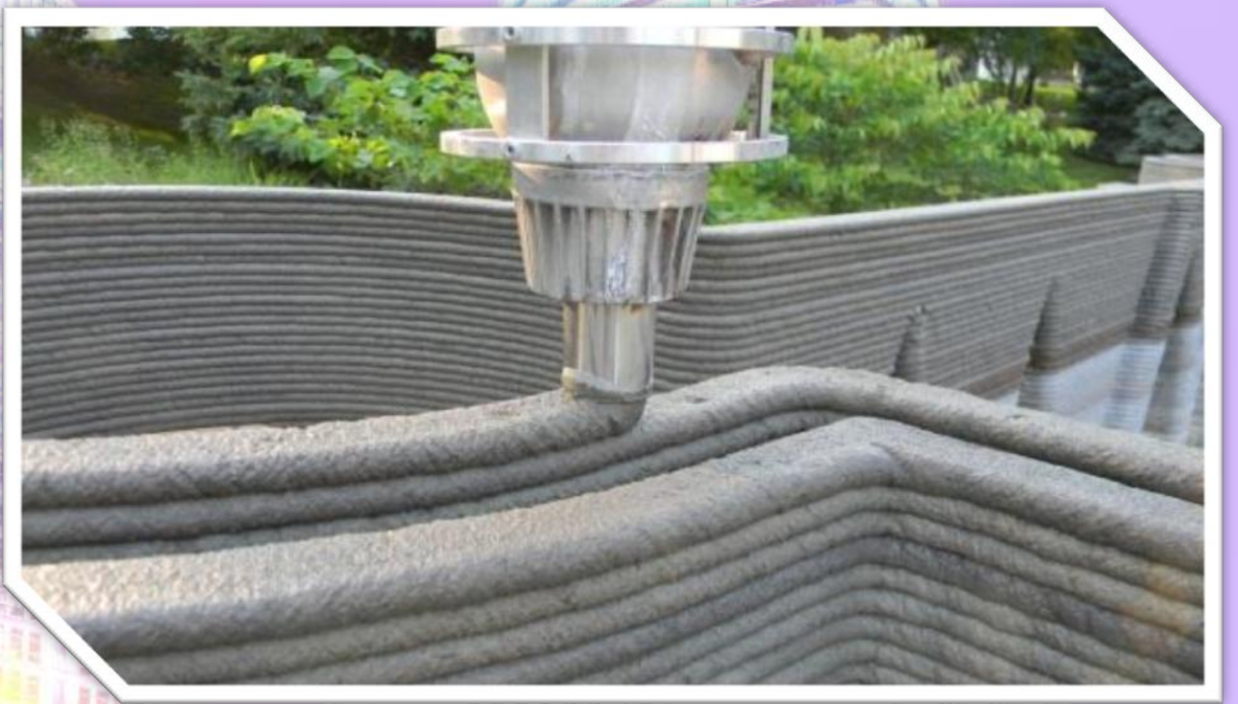
In the construction industry, 3D printing can be used to create construction components or to 'print' entire buildings. Construction is well-suited to 3D printing as much of the information necessary to create an item will exist as a result of the design process, and the industry is already experienced in computer aided manufacturing. The recent emergence of building information modelling (BIM) in particular may facilitate greater use of 3D printing. Construction 3D printing may allow, faster and more accurate construction of complex or bespoke items as well as lowering labour costs and producing less waste. It might also enable construction to be undertaken in harsh or dangerous environments not suitable for a human workforce such as in space.

Examples of projects

In 2014, engineers at Arup used 3D printing to fabricate a steel node for a lightweight structure. Salomé Galjaard, team leader at Arup said, 'This has tremendous implications for reducing costs, cutting waste and enables a very sophisticated design. Professor Behrokh Khoshnevis at the University of California has developed a process of 'contour crafting' using concrete to produce small-scale models of the external and internal walls of houses and tested a giant transportable 3D printer that could be used to build the walls of a house in 24 hours. The robotic system requires a flat ground slab with underground services in place. Rails are installed on either side of the footprint to take a gantry crane that spans the building. A nozzle, driven by a computer-controlled crafter then delivers layers of concrete. The layers build up to form an inner and outer skin for each wall, leaving them to be filled later with insulation or concrete.

Shanghai firm Win-Sun Decoration Design Engineering has used large 3D printers to spray a mixture of quick drying cement and recycled raw materials (ref. BBC). This has enabled them to construct 10 small demonstration 'houses' in less than 24 hours. They have suggested that each house can be printed for less than $5,000. The system fabricates blocks off-site by layering the cement mix in a diagonally reinforced pattern. The blocks are then assembled on site. Win-Sun believes that, it will be possible to use the technique to build larger houses or even skyscrapers in the future.

- ☑ In July 2014, Chinese company, Qingdao Unique Products Develop Co unveiled the World's largest 3D printer at the World 3D Printing Technology Industry Conference and Exhibition in Qingdao. Its first job will be to print a 7 m-high Temple of Heaven.
- ☑ In November 2014, Skanska and Loughborough University signed a deal to develop what they describe as the world's first commercial concrete printing robot.
- ☑ In Spain, the first pedestrian bridge printed in 3D in the world (3D BRIDGE) was inaugurated on 14 December 2016 in the urban park of Castilla-La Mancha in Alcobendas, Madrid. The 3D-BUILD technology used was developed by ACCIONA, who was in charge of the structural design, material development and manufacturing of 3D printed elements. The bridge has a total length of 12m and a width of 1.75m and is printed in micro-reinforced concrete. Architectural design was done by the Institute of Advanced Architecture of Catalonia (IAAC).



The 3D printer used to build the footbridge was manufactured by D-Shape. The 3D printed bridge reflects the complexities of nature's forms and was developed through parametric design and computational design, which allows optimising the distribution of materials and maximising the structural performance, being able to dispose the material only where it is needed, with total freedom of forms. The 3D-printed footbridge of Alcobendas represented a milestone for the construction sector at international level, as large scale 3D printing technology has been applied in this project for the first time in the field of civil engineering in a public space.

Criticism

Clearly all of these projects have enormous potential. There are questions about how Construction 3D printing can be integrated with other building components, and how they will incorporate services and reinforcement, but in the long term, they should produce better, faster and perhaps lower-cost buildings. However, systemised construction is not something we have taken to in the UK. There was a brief boom in panelised systems for high-rise apartment blocks following the Second World War, but many of the resulting buildings were monotonous and ugly, often with condensation problems. There is a resurgence of interest in the UK regarding panelization and prefabrication, however market share remains low.

All of these innovations require complex equipment, and whilst it is possible to envisage using some simplified version to manufacture specialist components on a more industrial scale, it is questionable whether this will replace bricks and mortar.

How The Internet of Things affects Construction Industry????

The Internet of Things or IoT may be easier to describe by what it doesn't do, rather than what it does. The range of applications is vast. When you consider the possibility of connecting any machine, any system or any site to the Internet to know at any time what's happening, it rapidly becomes clear that the only limit in finding uses for IoT is our imagination. However, construction is a practical activity that deserves practical examples. So let's get to it!

Remote Operation

If you can hook up a machine to the web either with a physical or a wireless connection, you can give it instructions remotely. It can operate alone in areas that would be hazardous to humans because of pollution. Similarly, wearable computing like Google Glass can help workers on-site access instruction manuals in hands-free mode, or benefit from remote support that sees what they see.

Supply Replenishment

When units of supply are labelled with RFID tags, a system on site can count them. When the count drops below a given level, the system can trigger a request from a central system to order more. Idle time goes down, and projects have better chances of being completed on time. Costs are also contained because the construction company does not need to buy in significantly more supplies than it is likely to use at any one time. Instead, just-in-time provision becomes possible automatically.

Construction Tools and Equipment Tracking

Similarly, you'll know where that pneumatic drill ended up or how many excavators are currently located at a given construction site. It will help reduce the time lost looking for mislaid items as well as the cost of purchasing replacements. GPS data is already being used to monitor vehicle fleet locations. It also allows excavating or landscaping equipment to be precisely positioned on a terrain to then automatically carry out instructions using a virtual map of the digging, cutting or other terrain modifications to be made.

Equipment Servicing and Repair

Sensors in machines allow them to transmit information about their status and any need for service or repairs. Fixing machines before they break makes more sense than waiting for failure, which by Murphy's Law is all too likely to happen just at the wrong time.

Remote Usage Monitoring

For equipment used by workers, whether power drills or articulated earth-movers, the IoT means construction hours can be logged automatically. Limits can be monitored, to prevent worker fatigue and possible accidents. Wearable computing in the form of wristbands can also monitor driver health and alertness. Action can be taken if the limits are in danger of being exceeded.

Power and Fuel Savings

Via the IoT, sites can send back information on the amount of electrical power they use, so that after-hours lighting can be adjusted for energy-savings. Machines can send back information on idling time (which uses fuel) so that on and off periods can be adjusted without penalizing projects through the time needed to restart machines.

Augmented Reality (AR)

Google Glass offers AR, but you have to be wearing the Google Glass goggles to make use of it. The next step will likely be to integrate AR directly into equipment visors and vehicle windshields. Operational instructions or navigational and driving information will then come over the IoT in real time, and be overlaid onto the real-world view of the job to be done or the journey to be travelled.

Building Information Modelling (BIM)

Computer models that have been used to direct real-life construction can, in turn, be updated by sensors placed in the buildings that have now been constructed. The sensors can send back information on the way that materials are affected by changing climates and the passage of time. They can supply information on possible changes in energy efficiency in roofing, how structures behave when there are earth tremors, or how a bridge bends under the weight of passing traffic.

Use of Manufactured Sand in Concrete and Construction: An Alternate to River Sand

Introduction

Natural or River sand are weathered and worn out particles of rocks and are of various grades or sizes depending upon the amount of wearing. Now-a-days good sand is not readily available, it is transported from a long distance. Those resources are also exhausting very rapidly.

The artificial sand produced by proper machines can be a better substitute to river sand. When fine particles are in proper proportion, the sand will have fewer voids. The cement quantity required will be less. Such sand will be more economical. Demand for manufactured fine aggregates for making concrete is increasing day by day as river sand cannot meet the rising demand of construction sector. Because of its limited supply, the cost of Natural River sand has sky rocketed and its consistent supply cannot be guaranteed. Under this circumstances use of manufactured sand becomes inevitable. River sand in many parts of the country is not graded properly and has excessive silt and organic impurities and these can be detrimental to durability of steel in concrete whereas manufactured sand has no silt or organic impurities. However, many people in India have doubts about quality of concrete / mortars when manufactured or artificial sand are used. Manufactured sand have been regularly used to make quality concrete for decades in India and abroad. Pune - Mumbai expressway was completely built using artificial/manufactured sand.

Issues with Manufactured Sand

- The Civil engineers, Architects, Builders, and Contractors agree that the river sand, which is available today, is deficient in many respects. It contains very high silt fine particles (as in case of Filter sand).
- Presence of other impurities such as coal, bones, shells, mica and silt etc makes it inferior for use in cement concrete. The decay of these materials, due to weathering effect, shortens the life of the concrete.
- Now-a-days, the Government has banned sand mining from River bed.
- Transportation of sand damages the roads.
- Sand mining from river bed causes heavy impact on the environment, as water table goes deeper & ultimately dry.

General Requirements of Manufactured Sand

- ✓ All the sand particles should have higher crushing strength.
- ✓ The surface texture of the particles should be smooth.
- ✓ The edges of the particles should be grounded.
- ✓ The ratio of fines below 600 microns in sand should not be less than 30%.
- ✓ There should not be any organic impurities
- ✓ Silt in sand should not be more than 2%, for crushed sand.
- ✓ In manufactured sand the permissible limit of fines below 75 microns shall not exceed 15%.

Environmental Impact

- Sand mining affects the adjoining groundwater system and the uses that local people make of the river.
- The rainwater flowing in the river contains more impurities.
- Erosion of nearby land due to excessive sand mining
- Destroys the flora & fauna in surrounding areas
- Sand mining generates extra vehicle traffic, which negatively impairs the environment. Where access roads cross riparian areas, the local environment may be impacted.

Conclusion

The Local Authorities/PWD/ Govt, shall encourage the use of Manufactured sand in Public Construction Works.

The Govt. Shall come out with, Policy on Sand – encourage the construction industry to set up more no of Sand crushing Units across the Districts, States to meet the sand requirements.

DEPARTMENTAL ACTIVITIES

STUDENT PARTICIPATIONS

S. No.	Student Name	Class	Program Name	Event Name	Host Institution	Price Won Details	Dates
1	SAKTHIVEL T.	IV B	Anna University Zone-2 Athletic Meet	Decathlon	Anna University	Silver	16-Oct-18
2				4 X100 mts Relay		Bronze	
3	Keerthana s.	III A	MOMENTS'18	Paper Presentation	NIT TIRUCHIRAPALLI	SECOND	05-Oct-18
4	Indumathi d.	III A					

5	*Subashini I.*	*IV B*	*Recent Advances in Concrete Construction and Preservation*	*International Symposium*	*IIT, MADRAS*	*Participation*	*18-Dec-18*
6	*Tejasri G.*	*IV B*					
7	*Balakumar R.*	*IV A*					
8	*Koushik R.*	*IV A*					
9	*Balaji J.*	*IV A*					
10	*Bharadwaj Balaji K.*	*IV A*					
11	*Rameez Mohamed N.M.*	*IV B*					
12	*Sowmiya T.*	*II B*					
13	*Preethi R.*	*II B*					
14	*Pavithra*	*II B*					
15	*Agaliya B.V.*	*II B*					
16	*Nithyasri S*	*IV B*					
17	*SathishAnand M.J.*	*II B*	*tHINK cREATE eNGINEER*	*Project: Smoke and Gas Detector*	*IITM & PALS*	*Participation*	*05-Dec-18 to 08-Dec-18*

FDPs, Workshops, Conferences, Short Term Courses attended by Faculty

1. *Dr. S. Geetha, Professor, Dept. of Civil Engg. and Dr. M. Selvakumar, Professor and Dean, Dept. of Civil Engg. Attended AICTE Sponsored short term course organized at Indian Institute of Technology, Madras*

Name of the Faculty	*Name of the Course*	*From Date*	*To Date*
Dr. S. Geetha	*Human Control and Indoor Air Quality*	*20/11/2018*	*25/11/2018*
Dr. M. Selvakumar	*Membrane Technologies for Water and Wastewater Treatment (MTWWT-2018)*	*12/11/2018*	*17/11/2018*

2. *Dr. S. Geetha, Professor, Dept. of Civil Engg. and Dr. M. Selvakumar, Professor and Dean, Dept. of Civil Engg. had also attended an International Conference on "**Recent Advances***

__in Civil and Mechanical Engineering Practices"__ at Vasireddy Venkatadri Institute of Technology, Guntur, AP from 16/11/2018 to 17/11/2018.

3. *Mrs. P. Anuradha, Assistant Professor (Senior Grade), Mrs. S. Muthulakshmi, Assistant Professor (Senior Selection) and Mrs. K. Divya Susanna, Assistant Professor attended a NITTTR sponsored FDP titled, "__Practical Training on Geosynthetics and Building Materials__" at SRM Institute of Science and Technology, Chennai from 19/11/2018 to 23/11/2018.*
4. *Mrs. M. Gouthampriya, Assistant Professor, Mrs. M. Hemavathy, Assistant Professor and Mr. Ebi PReshnav, Lab Assistant attended a workshop titled , "__Total Station, GPS and GAS Chromatography"__ at St.Joseph's Institute of Technology, Chennai from 09/11/2018 to 10/11/2018.*
5. *Mrs. E. Ramya, Assistant Professor had attended a FDP titled, "__Self awareness and its effect of teaching competency__" at Rajalakshmi Engineering College on 28/11/2018.*
6. *Mrs. Eswary Devi T., Assistant Professor, Mrs. P. Ramya, Assistant Professor, Mrs. V. J. Vedhanayagi, Mr. M. Manoharan, Assistant Professor, Mr. M. Ammaiappan, Assistant Professor had attended a FDP titled, "__Limit State Design of Steel Structures__" at KCG College of Technology, Chennai from 26/11/2018 to 28/11/2018.*

FDP Organized by the Department

The Department of Civil Engineering Organized a Five-Day __Faculty Development Programme__ on __CONCRETE TECHNOLOGY__ from __11th December 2018 to 15th December 2018.__

Dr. A. Rose Enid Teresa, Professor and Head, and Mrs. S. Stella, Professor were the Event Coordinators. Speakers from reputed institutions and from industries, shared their experience and enlightened the Faculty gathering. The FDP had faculty members from various colleges in Chennai and outside Chennai. The FDP was inaugurated with Dr. Manu Santhanam, Professor, IIT-Madras as the Chief Guest. As a part of the FDP, the participants were taken on a Visit to the Laboratory at SRM University, Ramapuram campus, Chennai to demonstrate the research works carried currently in Concrete and its Composite materials. The FDP was successfully completed with Dr. Sobha Rajkumar, Associate Professor, GCE-Salem being the Guest for the Valediction.

Inauguration of the FDP in the presence of Dr. Manu Santhanam, Professor, IITM

The speakers who made their valuable contribution to the FDP are as follows:

1. ***Dr. Manu Santhanam****, Professor, Building Sciences Division, IIT Madras.*
2. ***Dr. K. Chinna Raju****, Associate Professor, Anna University, Chennai.*
3. ***Dr. T. Ch. Madhavi,*** *Professor and Head, SRM University, Ramapuram Campus, Chennai.*
4. ***Dr. Shoba Rajkumar****, Associate Professor, GCE, Salem.*
5. ***Dr. K. Balasubramanian****, Managing Director, Hitech Concrete Solutions Chennai Pvt. Ltd.*
6. ***Mr. Kingsley J D Ernest****, Concrete Technology Specialist, L&T Constructions.*
7. ***Mr. K. Aravindh****, Manager-Technical Services, Hitech Concrete Solutions Chennai Pvt. Ltd.*

FACULTY PUBLICATIONS – Journals and Conferences

1. *Dr. S. Geetha, Professor, Dept. of Civil Engg. and Dr. M. Selvakumar, Professor and Dean, Dept. of Civil Engg. presented a paper titled, "**Optimization of Reactive Powder Concrete for use in Precast Construction**" in an International Conference on "**Recent Advances in Civil and Mechanical Engineering Practices**" at Vasireddy Venkatadri Institute of Technology, Guntur, AP from 16/11/2018 to 17/11/2018.*
2. *Dr.S. Geetha, Dr. M.Selvakumar published a paper titled, "**Graphene Oxide Admixed Aerated Concrete Composite with Carbon Fibres**", in Materials Today: Proceedings, Elsevier Journal, October 2018.*
3. *Mrs. Eswary Devi T published a paper titled "**Enhanced composting of market waste using effective microorganisms**" in International Research Journal of Engineering and Technology, November 2018, Vol 5, pp. 645 – 652.*
4. *Mr. S. Premkumar, Mr. N. Mahamood ul Hasan, Mrs. A. J. Jeya Arthi, Mrs. M. Hemavathy, Mrs. M. Gouthampriya published a paper titled "**Experimental Investigation Of Glass Wool In Concrete**" in Journal of Emerging Technologies and Innovative Research (JETIR) September 2018, Volume 5, Issue 9.*

GUEST LECTURE ORGANIZED

1. ***Hands on Training session** on BIM was delivered by **Mr.Manoj Kumar, Project Head, Estaar Max Technologies Pvt. Ltd.** to the III Year Students on 29th December 2018.*

FACE MEMBERS

- *Rameez Mohamed N M of IV Year B Section – **President***
- *Arjun Shishir Bajjuri of IV Year A Section – **Vice President***
- *Koushik R of IV Year A Section – **Secretary***
- *Sneha Kasturi Rangan of III Year B Section and Lakshmi Priya K of II Year A Section – **Joint Secretaries***
- *Monisha S of IV Year B Section and K. Sathya Priya of III Year A Section - **Treasurers***

Please send us your feedback to

(***civilozine@rajalakshmi.edu.in***)