

# AVEI NEWSLETTER



*Work progresses on the first story of Kaza Community Center in Spiti Valley*

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During June and July, the Earth Institute team has been divided between the Spiti Valley construction site, summer training courses, architectural design projects, and on-going research projects.

In this issue of the newsletter, we invite you to read about the diverse research data that is being collected both in the laboratory and through online surveys.

The Earth Institute participated in two conferences, as a host and as a speaker, in June.

The office team has grown by four new members. We invite you to meet them and read feedback from a recently departed intern at the end of this issue.

Please feel free to share this newsletter with your friends and colleagues as we spread the knowledge of earth architecture to the world!

Earthily yours,  
The AVEI Team

## Biodegradability of Stabilized Earth

The Earth Institute has begun a long-term research project on the biodegradability of stabilized earth. This project has its roots back in 1995, when a pile of cow dung compost stored against a 5% cement-stabilized rammed earth wall caused the surface of the wall to erode by approximately 25mm. The other surfaces of the rammed earth wall, not in contact with the compost, showed no signs of deterioration.

This is anomalous to the general behavior of stabilized earth buildings, as buildings are almost never buried in organic mulches. However, it is very interesting research to better understand how earth buildings in their end-of-life phase can be "returned" to the earth or recycled into new buildings, without generating a massive landfill of waste or a very

high carbon footprint. Conversely, such research on biodegradability must always be juxtaposed with current scientific research, both from the Earth Institute and abroad, on the durability of stabilized earth. As an example, the Earth Institute has a demonstration Compressed Stabilized Earth Block (CSEB) continuously immersed in water since April 1995, which has not shown any deterioration in these past nineteen years.

To test the combined effects of organic material and water on stabilized earth, nine CSEB have been buried in a trench filled with compost that is watered regularly to simulate Monsoon rains. They are being unearthed at six month intervals to be examined for signs of deterioration.

Three types of blocks were used for the test: three blocks made with soil, sand, and 5.25% cement; three blocks with soil, quarry dust, and 5.25% cement;

and three blocks with soil, sand, and 6.24% lime. Measurements of rainfall patterns from the last eight years were collected to calculate the average Monsoon rainfall. A compost mixture made of leaves and food scraps was augmented by the addition of cow dung to create suitably aggressive compost.

Before burying the CSEB, their weights were taken in both wet and dry states. They were then placed in the trench, surrounded on all sides by compost. The trench has since been irrigated two times per week with 60 liters of water, which is added in 10 liter doses. This simulates the weekly precipitation patterns of the North East Monsoon during the entire year – similar to an annual rainfall of 6,240 mm.

The first evaluation was done in June, seven months (instead of six, for logistical reasons) after the blocks had been buried. All nine blocks were unearthed and



*Burying the CSEB in a trench surrounded on all sides by compost*



*Removing compost residue from the freshly unearthed CSEB*

cleaned carefully. They were examined for any signs of pitting, erosion, or broken edges. Then they were weighed: a first time in their humid state, a second time after being dried in a low temperature oven for twenty four hours, and a third time after being immersed in water for twenty four hours. A comparison of the weights of the blocks to their original weights is used to determine whether the blocks are disintegrating, as physical observation may not be able to pick up small changes.

Contrary to expectation, all nine blocks retained the same dimensions and even gained in weight. This might be explained by the incursion of minerals or salts from the hard water or the compost. A sample of the water was therefore sent away for analysis, to determine if this could be the cause.

The blocks have been buried again and the next round of testing will occur in November 2014.

manikkam from Madurai (Tamil Nadu) to present his work to the Auroville architecture community. A specialist in the field, Rajamanikkam has given up using sand on his construction sites and has built numerous notable buildings, including multi-story structures, throughout Tamil Nadu.

The need to find alternatives to sand has impacted the Earth Institute as well, with the availability of sand decreasing and its price increasing. As sand is often used in the composition of CSEB to augment lesser quality soils, the Earth Institute has been experimenting with the use of quarry dust, in particular, as a potential replacement material. ■

**Survey about Attitudes on Houses, Fired Brick, CSEB, and AVEI**

Since 2012, the Earth Institute has had the honor of regularly hosting Algerian PhD student Nourredine Kebaili for his research on the public perception and appreciation of earthen houses. In fact, his interviews of Aurovillians brought to light their questions and concerns about the durability of earthen houses. This has motivated the Earth Institute to pursue more extensive research on durability and biodegradability of stabilized earth. See **Issue 7** for a summary of Nourredine's research in 2012.

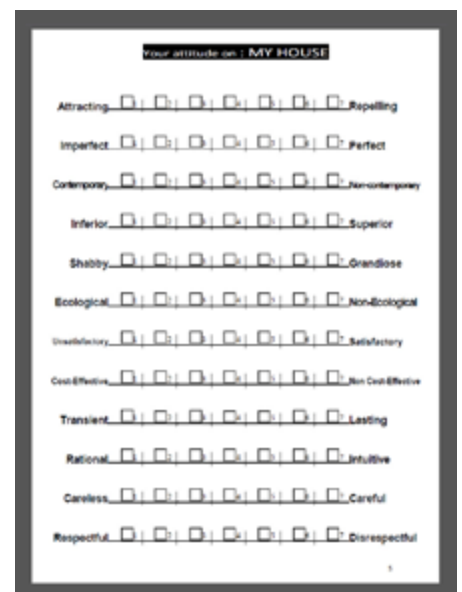
Now, Nourredine is conducting a survey on the attitudes of people around Auroville regarding their houses, fired brick, CSEB, and the Earth Institute. By asking respondents to evaluate their attitudes using paired adjectives and to write and rate their thoughts on CSEB and fired bricks, Nourredine hopes to get a picture of attitudes on CSEB and the factors contributing to these opinions. This data will be very useful to the Earth Institute too, allowing us to better educate and address the needs and concerns of those around Auroville.

Thus far Nourredine has had over one hundred fifty responses, but he hopes to gather far more in order to have a better statistical representation of the population in and around Auroville. So, if you are from Auroville or the vicinity, we encourage you to participate in the survey at the following link:

<http://www.earth-auroville.com/survey.php> ■

**Conference on Building without Sand**

The Earth Institute hosted a conference on Building without Sand in its conference room on the 6th of June. Auroville Architect A.K. Raman, Pitchandikulam Forest Consultants, and the Earth Institute combined efforts to bring veteran structural engineer Raja-



## NIATSUS-ABILITY Conference in Chennai



On the 18th of June, Satprem was invited to speak at the “Niatsus-ability” conference organized by the Faculty of Architecture at the Dr. M.G.R. Educational and Research Institute. For this first conference which focused on sustainable trends in architecture, Satprem presented a lecture on “Building with Earth for a Sustainable Future”. His paper was also published in the inaugural issue of the Faculty of Architecture’s newsletter, *Dott Zero*. ■

## Sustainable Livelihood Institute is Underway

The Tamil Nadu Sustainable Livelihood Institute (SLI) has been set up this year through collaboration between Auroville and the Government of India’s National Rural Livelihood Mission. This Mission aims to re-empower the small-scale local industries, so as to reduce poverty by providing appropriate, local, and sustainable options for employment.

Through the SLI, the key actors in this project will be equipped to think with a sustainable approach toward grassroots livelihood development and poverty reduction. The Auroville location for the SLI will give access to the expertise and practical examples that have been developed in this unique environment with an ecological, sustainable, and local mindset.

The Earth Institute is enthusiastic about this noteworthy project and has been collaborating on an advisory basis with the development team for the SLI. ■

## Research on Mangalam Soil

In the framework of the development of the AVEI School of Earthen Architecture, Satprem has pursued extensive research to optimize the ratio of various components to produce CSEB with the locally available soil.

At Mangalam, the area where our future school is intended to be built, the soil is totally different from the “red soil” composing most of the Auroville plateau. This Auroville red soil is a Ferralsol, which is rather sandy and contains a lot of iron oxide. The soil from the Mangalam area is a light yellowish soil, rich in kaolinite, which contains about 40% clay, 20% silt, 35% sand, and 5% small gravel. On account of

the clay type and content, this soil has required more in-depth study for the CSEB mix ratios.

The first samples were made in August 2013. They were composed only of Mangalam soil with various percentages of cement, lime or mixed cement-lime. As a control reference, one sample was produced with the Auroville red soil. Two series were prepared, either with the addition of sand or quarry dust (fine aggregate from crushed stone). Varying curing procedures were also tested.

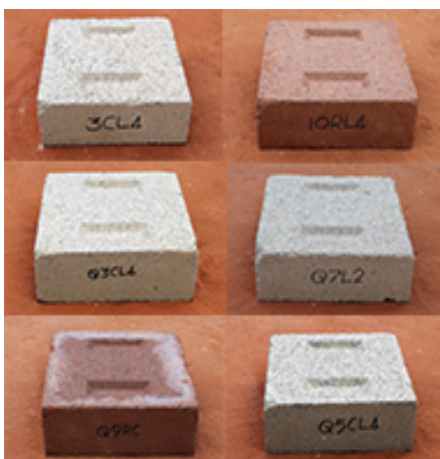
All blocks produced with Mangalam soil were very weak: most samples were below 5 MPa for dry crushing strength while the samples with red soils were at 8.08 MPa. It appears that the quarry dust produced blocks that were generally 14% to 15% weaker than those with sand. Curing appears to be the best with 4 weeks under plastic.

A second series of tests was conducted in November 2013. Red soil and Mangalam soil were mixed in equal parts this time, with varying amounts of cement or lime. Two series were also made with sand or quarry dust and with various types of curing. The strengths were much better in this round of tests and the average compressive dry strength was around 7 MPa with a peak of 8.33 MPa. The wet compressive strength was also improved, being above 4 MPa, with a peak of 5.98 MPa. Quarry dust versus sand gave incoherent results and

this prompted a different approach for the next series of tests.

This third series of samples were prepared in February 2014, and from the best results of this series, we selected 6 sample ratios to be reproduced in April 2014. These selected samples were stabilized with various proportions of a cement/lime mix. All blocks were above 7 MPa for the dry strength and above 4 MPa for the wet strength. The final choice was for the blocks composed of 28.2% Mangalam soil, 28.2% red soil, 43.6% quarry dust sieved (2 mm with fine particles rejected), 5.29% cement and 2.19% lime. Curing was the same as for cement blocks: 2 days below a plastic sheet and 28 more days curing, soaked 3 times a day. These blocks demonstrated 7.69 MPa for the dry strength and 4.30 MPa for the wet strength.

This research will allow the greatest percentage of soil to be extracted on-site for the construction of the school, in order to obtain a very high quality block with medium to low quality soil. ■



CSEB samples made from Mangalam soils

## New Team Members

The Earth Institute has welcomed a new engineer, a returning architect, and two new interns.

### Rajesh

I grew up in Pondicherry. This year, I completed my college studies at Acharya College of Engineering Technology. I received a B.Tech Civil Engineering degree and did a thesis on "Partial Replacement of Sand Using Bagasse Ash". I earned experience in the field working with a Pondicherry engineer on the construction of a go-down (warehouse) as the Site Engineer.

I wanted to work at the Earth Institute because I liked the idea of using natural materials in construction, which is in process here. It gives one wings to fly with dreams.

In the office, I am doing research on the Rate Generator software. I like it very much because it is quite challenging with my knowledge and there remain many more things to learn.

I have wanted to stay in Auroville to live a cost-efficient lifestyle, make friends, and be with nature.

### Arun

I, Arun Raj, have been a student of architecture in PMU, Thanjore.

In those five years, I had a great experience with my friends and staff members in my college life and now they remain sweet memories.

Since I have been brought up in the Auroville surroundings, it has been a great opportunity for me to explore Auroville as much as possible and has also inspired me in many aspects of architecture. This has been a key reason for me to choose a course of study in Architecture. And I always wanted to come here and explore. Architecture shapes the place you practice in and influences places around. Hence this place, to understand the impact of my design on the environment and explore better design.

Two years before I was intern at AVEI and now, I have finally come here as an architect for a year and hope I am able to give back to this place as much as I am gaining from here.

Inspiration from Nature: I don't need to go and try to force my own ideas of what is form and function and how people should build or not build, but just observe how, for instance a little creature in the sea creates the most beautiful seashells out of the elements in water; how a great seed changes the earth into the most gorgeous fruit. All of these are the greatest inspiration for me. So I try to master the art of designing the building using locally available materials.

I feel learning at the Auroville

Earth Institute is an opportunity for me to go back to the essentials of local and sustainable building and for the betterment of society.

### *Théo*

Auroville began to be a place of great interest for me during the few past years. As a fourth year student in Civil Engineering at the School of Engineering at the University of Nantes (France), I was looking for an internship where I could satisfy my wish to associate sustainable buildings, education, and alternative lifestyle experiences. I was already on this path after some other internships, positions in associations, and conference participation.

I heard about the Auroville Earth Institute through one friend of a computer science engineer who also studied in my school. After some research on this institute devoted to Earth construction methods, I decided to apply for a three month internship.

Now, I am here for a four-month internship on poured earth concrete for walls and reinforced beams. And, because of my wish to belong to a great sustainable building movement and to begin working with more sustainable materials than those that we usually study in school, I am ready to also be involved in this project which will bring together all I was looking for: constraints, choices, results, issues, knowledge, meeting, experiences...

### *Divya*

I was born and brought up in Chennai with a Rajasthani background. Now I'm doing my fourth year of architecture in the School of Architecture, Meenakshi College of Engineering in Chennai. The field of architecture being very creative as well as technical, it has given me a varied knowledge. Architecture to me means a sustainable way of living which is very essential today.

With a few short visits to Auroville from my college for case study and once to invite the architects to a cultural program at my college, I admired the new way of living in Auroville and wanted to stay longer, but I couldn't. I got to know about Earth Institute when I had come to invite the architects. I was impressed by the innovative building techniques and materials (earth). The sustainable development practiced in the Earth Institute made me curious to learn about it for my future. The internship program was the best opportunity to come here and learn in detail about the earth architecture. And Auroville has been such a changeover from the city life to a new style of living. The first week I was engaged in the CSEB workshop, which gave me the knowledge about the CSEB blocks and was interesting. And living here in Auroville has been adventurous for me. ■

Everyone who has experienced Auroville will never forget the encounter; everyone wants to come back again. As a student I met a lot of people, I saw different cultures and traditions. I got the opportunity to interact with lot of people.

It was a great opportunity for me to work at AVEI for six months. The time period was too short but still I learnt so much. The thing I missed first in Auroville was the place where I lived, the "bamboo house". When I moved back to my home town, I realized just how comfortable I was there.

AVEI taught me how a student of architecture can think deeply about the term "sustainability". I am truly inspired by the dedicated and determined Satprem sir and Ayyappan sir. Both of them will be my role models in life. And I hope those memories never fade away from my life...

– *Liju George,*  
*Architecture Intern* ■



## Overview of Training Courses at AVEI

The summer courses have begun full throttle at the Earth Institute, starting with the Ferrocement Course at the beginning of the month. This course covered the basic applications of ferrocement and its production. After working on several group projects, the course finished with individual projects conceived by the students based upon their newly-gained knowledge. Full to the maximum student limit like all the courses this summer, thirty one trainees attended, these being primarily architecture students.

The training courses continued the following week with the two-week Arches, Vaults, and Domes (AVD) Theory and Masonry courses. Broken up into two separate weeks to give in-depth theoretical study and a full week of hands-on demonstrations and practice, the course was attended primarily by architecture students from all around India as well as by a German national.

July began with the CSEB Design Studio course, which has been intended for students and professionals who have a solid basis in architecture and AutoCAD drawing and who want to learn the best practices for building with CSEB. This course was attended by twenty six trainees from around India. The rest of the month was devoted to intensive one-week courses. CSEB Intensive, which condenses the CSEB Production and Masonry courses into one week, was attended by thirty one trainees, with a mixture of students, engineers, and other professionals. Among the attendees were two Algerians, one Belgian, one Spaniard, and one Chinese trainee. The next week was AVD Intensive--a condensed version of AVD Theory and Masonry in a single week--with thirty four students in the course. Foreign students came from Algeria, France, Rwanda, and China. A final course of CSEB Intensive will take place in the last week of July and early August.

The only remaining courses for 2014 are in September, so sign up soon to participate. Stay posted for the 2015 schedule! ■

## AVEI Training Course Schedule for 2014

September  
1st to 6th - CSEB Production  
8th to 13th - CSEB Masonry  
15th to 20th - AVD Theory  
22nd to 27th - AVD Masonry

### AVEI Newsletter

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*Construction nears completion of the Kaza Community Center, set against the striking Spiti Valley*