

# AVEI NEWSLETTER



*CSEB production in full swing at the Earth Institute*

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The last two months have been a busy time for the Earth Institute, with several experiments going on, the Spiti construction site, and structural design and block production for the dome of the Sri Vast Ashram's reception hall.

It has also been a time of valuable exchange, with four weeks of training courses, Lara's participation in the AGP Summer School, and several visitors bringing questions, expertise, and opportunities for collaboration.

Not to say that it has been all work and no play! The whole Earth Institute team went to the Tamil Nadu hill station, Ooty, to explore the misty mountain landscape and escape the heat at sea level.

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

## Poured Earth Concrete Road Experiment

Research on the Poured Earth Concrete technique has continued this year at the Auroville Earth Institute with the combined efforts of engineering interns Léo Boulicot and Théo Vincelas. Their goal was to create samples with at least 7 mPa dry compressive strength and 4 mPa wet compressive strength. To this end, they developed thirty-five different mixes with which they made sample cylinders and beams.

At the end of August, the testing took on a new dimension with an experimental stretch of Poured Earth Concrete (PEC) road laid on the Earth Institute premises. Due to the very different requirements of a road, the mix proportions needed to be altered from those used for the cylinders and beams, and the surface required an abrasive finish.

In selecting the mix, the main objectives were to obtain abrasive strength to resist wear from vehicles, compressive strength to withstand the points of concentrated weight from different vehicles passing on top, less than ten percent water absorption, good workability without excess water, and, most importantly, minimal shrinkage to prevent cracking that can make a road dangerous to users. The selected mix with 40% red soil and assorted sizes of gravel was stabilized with a combination of 9% cement and 3% lime.

No joints were planned in the design in order to better observe any shrinkage occurring in the earth concrete.

A uniform 20 cm was excavated with shovels and crowbars from the 7.4 m stretch of driveway to be used for the PEC road. The borders were carefully dug in order to better observe any signs of shrinkage. The area was filled

with a 5 cm layer of aggregate: first a layer of two-inch gravel was laid and then the gaps were filled in with one-inch gravel.

On the 28th of August, a cement mixer was brought in to facilitate thorough and rapid mixing of the earth concrete. The hopper could accommodate the quantity of a half mix and each new batch underwent a slump test to examine the water content's effect on the workability of the mix. The sides of the road were applied first in 60 cm strips to control the level of the road, and then the center portion was applied and screeded. The earth concrete was applied in a 15 cm layer, vibrated, and leveled. Due to the warm weather, the mixture dried very quickly and hand tampers were necessary to speed up the leveling. A steel level was then passed repeatedly over the whole surface, while any holes were filled in with trowels, until the whole surface was smooth and level. →



*Satprem and Ayyappan overseeing the mixing of the earth concrete*



*Applying and vibrating the earth concrete*

For three days, the PEC road was cured under wet burlap and no vehicle passage was allowed. Now the driveway is being used again, but curing will continue for a full month, with water applied daily.

The initial results of this experimental road are positive. There is no visible shrinkage cracking and the road appears very durable. The Earth Institute will monitor the road over its lifetime for signs of any pathologies due to shrinkage, compression, or abrasion. ■



*Screeding the road and filling in any holes with trowels*

### Poured Earth Wall Study

Léo and Théo also tested two mixtures for poured earth walls. The experiment had several goals, including systematizing the production process and quantifying the requirements for equipment, materials, workers, and time in order to produce a cost estimation for poured earth walls. In scaling up the sample size from test cylinders to full-scale walls, it is also easier to gauge the behavior of the material and quantify the effects of shrinkage.

Two mixtures were selected for testing, with each mixture producing a 5.35 m stretch of wall along with six cylinders for compression testing. The first mixture included 40% red soil and 60% varied aggregates, and was stabilized with 9%

cement. The second mixture combined 25% red soil, 15% Mangalam soil (a highly clayey soil), and 60% aggregates, and was stabilized with 9% cement and 5% lime.

The formworks were set up and oiled, and water was added to the prepared dry mix. Slump tests were done prior to casting, and then the mix was poured into the formworks while another worker operated a hand-held concrete vibrator within the formworks. More water than usual was added due to the sun and the absorbent nature of the soil. After the wall was cast and the formworks were removed, all shrinkage cracking was carefully marked and recorded. ■



## Kaza Community Centre Wrap Up

The raw structure of the Kaza Community Centre has finally been completed in this second season of construction. T. Ayyappan visited briefly to begin the construction of the first floor in May, after which time Lara Davis and Samuel Rodrigues stayed for a period of 2 months to complete the first floor rammed earth work and finalize the wood details for the windows, doors and trombe walls. Swati Negi supervised for the remainder of the season to close the roof, begin the finishes, and oversee the construction of the dry toilet and storeroom. At the end of this period, Satprem



*Ramming the first floor walls with mallets*

Māini came for an evaluation mission to clarify final details and to ensure the raw construction was properly completed and closed for the coming winter. Next sea-

son, the local team will complete the trombe walls and finishes in time for the the opening of the building in August 2015. ■

## Vernacular Craft in Spiti

At least six different earth construction techniques have been used in vernacular construction in India: cob, rammed earth, shaped earth, adobe, laterite block, and wattle & daub, with many variations across the country. This wealth of knowledge has been on a dramatic trend of decline and many earth traditions in India have all been but lost. However, there are a few traditions of earthen building which have survived the current waves of "concrete capitalism", and which continue to provide affordable, comfortable, climate appropriate and resource-conscious housing for people.

Spiti Valley is one of these few places in which earth is a vibrant "living tradition" that best answers to the needs and means of local people. In earlier times, adobe was the most prevalent earth technology in the valley, until at some point in time, rammed earth technology was introduced from Tibet. Rammed earth remains the dominant construction technology in villages, primarily on account of its superior thermal insulation in the -35° C winters.

However, it has also survived and prospered as a building technology, because of the strength of the culture of local rammed earth craftsmen. Dur-

ing the short construction season, they live together as would a family. During the harsh winter season, these craftsmen devote their time to Buddhist studies and practices in the remote Pin Valley. They have strong collective practices in regards to shared meals, work, religion and politics.

It has been a very special experience working with these extraordinary people... Chhuing, Sonam, Padma, Gatuk, Dorje, Lobsang, Lama, Shadhap, Kunzang and Tashi. ■

### Auram 4000 & Auramix 5000 in Action

The Earth Institute has begun intensive block production in preparation for the construction of a reception hall for the Sri Vast Ashram in Bommayarpalayam. Two Auram 3000 Presses are producing blocks and the Earth Institute has taken the opportunity to run a full-scale production test of the new Auram 4000 and Auramix 5000 as well.

The Auramix 5000 is a motorized mixer developed through the joint efforts of the Earth Institute and Aureka, a steel workshop in Auroville and the manufacturer of the Auram presses. The Auramix 5000 allows faster mixing of the soil with its admixtures and water to match the speed of a semi- or fully automatic press. The soil

and, if required, sand or quarry dust are poured into the feeder from wheel barrows. The cement is added through a separate feeder with a compressor attached to vibrate the cement to prevent stacking. The components then travel by way of a conveyor belt to the drum where they are first mixed dry, then mixed wet with the addition of the necessary water sprayed from an attached tank. The humid mix then travels again by conveyor belt up to the hopper of the block press (which in this case is the Auram 4000).

The semi-automatic Auram 4000 measures out the necessary amount of block mix with the hopper, and the mix is moved into the mold with the operation of a lever. The lid of the press is then pulled down and locked, and a second lever begins the compression. When finished, the lid pops open and the block rises out of the mold. The hopper

delivering new mix pushes the block onto the roller conveyor, where a worker can offload the block and stack it for curing.

The combined mixer and press can be operated by a team of ten to twelve workers, with three workers to load the mixer's feeder with wheel barrows, one worker to guide the feeder, one worker to maintain the water level in the water pump and to supervise the conveyor belt, one worker to operate the levers and lid of the Auram press, and four workers to remove the blocks from the roller conveyor and arrange the blocks for curing.

On the 10th and 11th of September, the Auramix 5000 and the Auram 4000 arrived at the Earth Institute's premises. After some fine-tuning of the equipment—adjusting the conveyor belt heights, exchanging the drum wire, welding a steel plate to the



*The Auram 4000 and Auramix 5000 set up for block production*



*Water being added to the mix in the drum*

hopper to catch overflow, etc.—a team of twelve workers from the Earth Institute's core team began producing blocks with the Auramix 5000 and Auram 4000.

With each block taking 7 seconds to produce, the team can yield approximately 370 blocks per hour. Thus far, the daily rate has only reached 1526 total, as some adjustments must still be made to optimize the production. The target production rate is 2500 blocks per day.



*One block being compressed while another waits to be offloaded*

The main problems still requiring attention include recalibration of the speed of the Auramix 5000, as it produces mix too rapidly for the Auram 4000's production speed.

But in all, the results of the combined Auramix 5000 and Auram 4000 are promising, with the daily production already almost double that of the manual press, which produces about 850 blocks per day with an experienced team. The physical strain on the workers is also reduced, as the manual mixing and manual compression of the blocks are eliminated.

The Earth Institute looks forward to sharing more news about this new machinery. Once the final adjustments to improve the production levels and functionality of the two machines, they will be available on the market to the general public through the manufacturer Aureka. ■

## Visitors to AVEI

In late July, the Earth Institute enjoyed the visit of **S.S. Kaimal**, a retired civil engineer who worked for many decades with the Central Engineering Service of the Government of India. He published in the early years of the IASS, and also developed a project proposal for a stabilized-earth hypar shell dwelling as a low-cost, sustainable model for rural housing.

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In mid September, **Aftab Jalia** visited the Earth Institute. Aftab is a PhD researcher at the Department of Architecture, University of Cambridge, working under the supervision of Prof. Michael Ramage. He came to discuss with Lara the possibilities and challenges of implementing Catalan vaulting technology in India.

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**Trupti Doshi**, principal architect of Aurospace Architecture & Sustainable Design Studio, dropped by the Earth Institute to announce that her most recent project, Sharanam, has been completed. Trupti previously participated in one of the Earth Institute's AVD course series, after which point she asked Satprem to assist with some of the structural calculations and details for the building. This building, which has been considered as one of the five greenest buildings in India by the UNEP, is the new home of the Sharanam Rural Transformation Centre in Pondicherry. Congratulations, Trupti! ■

## AGP Summer School

Lara gave a lecture for this year's Auroville Green Practices Summer School, "From cradle to cradle: Building for responsible consumption". The lecture, "Building with Earth: Closing Loops in the Vernacular & Contemporary", gave a broad overview of vernacular and contemporary earthen architecture in the world, and presented a case study of the Dangkhar Monastery in Himachal Pradesh (a UNESCO world heritage site). Various arguments were presented for the appropriateness of earth and concrete construction in this remote mountainous context, with careful attention to climatic appropriateness, the availability and required transportation distance of building materials, vernacular resource management practices, and valorization of vernacular construction techniques developed and implemented over a period of hundreds of years. The goal of the lecture was to encourage strategic, cost-benefit strategies for climatically appropriate, low-carbon construction, which best harness the intelligence of the vernacular construction of a region.

Summer School documentation:

<http://www.slideshare.net/AurovilleGreenPractices/3h-summer-school-2014-publication-37977255> ■

## New Team Member

The Earth Institute has a new intern in the architecture department.

### *Mirra*

Hello! I am Mirra Alfasa, a B.Arch student in my final year at the School of Planning & Architecture, Jawaharlal Nehru Architecture & Fine Arts University in Hyderabad. I am doing my internship here at the Auroville Earth Institute. I am very glad and happy that I got an opportunity to learn and explore here, in this wonderful firm in Auroville.

I have always loved nature and strive to be an ecological person. This place is perfect for me to go green in terms of architecture and as a human being. Auroville is a very different place, which gives many opportunities to people, who really want to learn and experience.

And coming to sustainability, in my opinion, is the most important aspect now in the current scenario. Everyone should feel responsible for Mother Earth, so that we don't damage her more and destroy her completely. As an architect, I feel very responsible to save the planet and I want to design only sustainable buildings in the future. Not only architects, every human being should feel that responsibility and make

their move toward sustainability in every aspect of life so that we can see our future generations also utilizing all the resources and nature without any scarcity and living happily with love and peace. ■

## Thank You, Swati!

The Auroville Earth Institute would like to thank Swati Negi for her two years of dedication to the architecture department, as she now goes to pursue new opportunities. After beginning in August 2012, Swati went on to head the architecture department in 2013. Working on the AVEI School development as well as course materials, Swati's heart was most particularly with the Kaza Community Center project in Spiti Valley. Both summers she traveled to the Himalayas to supervise construction on site.

The Earth Institute will miss Swati's fresh enthusiasm and tireless efforts, both in the office and on site. Good luck, Swati! ■



## Office Trip to Ooty

At the beginning of August, the Earth Institute's staff went on tour to Ooty, a Tamil Nadu hill station 440 km from Auroville. Despite a bit of drizzling rain, the 35 masons, workers, architects, interns, office workers, and their family members toured around in the bus visiting the stunning mountain sights. Highlights of the trip included the Ooty Botanical Gardens, paddle boating, a chocolate museum, exotic fruit from roadside vendors, and a walk to a manmade lake nestled between the hills. ■

## Overview of Training Courses at AVEI

The Earth Institute has had a full month of training courses this September with two weeks of CSEB courses and two weeks of AVD courses. The CSEB Production & Masonry courses had a total participation of 45 students, the majority of whom stayed for both weeks. A mix of students, architects, engineers, government officials and even an artist and a paragliding instructor were in attendance. Most trainees came from the different Indian states, but also Senegal, Germany, and Kyrgyzstan were represented. ■

With Satprem in Spiti Valley to wind down the Kaza Community Center construction site, Lara led the Arches, Vaults, and Dome training courses. In the first week of AVD Theory, she taught a revised curriculum, which included more technical details and case studies. The second week continued with Ayyappan teaching AVD Masonry. A total of 39 people participated in the courses, composed of Indian, Senegalese, Australian, Kyrgyzstani, German, and Greek trainees. ■

No more training courses at the Earth Institute are planned for 2014, but the 2015 course schedule will soon be available. ■



*Some of the AVEI team in Ooty*

### AVEI Newsletter

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