# AVEI NEWSLETTER

*Satprem Maïni with a group of short term trainees in July 2011*

## IN THIS ISSUE



The Auroville Earth Institute (AVEI) team is pleased to send you its first newsletter!

To keep you all informed of our upcoming and ongoing activities, we intend to distribute our newsletter once every two months.

2011 has been a very busy year for the Institute with training courses in Auroville, consultancies abroad, research projects and the ongoing construction of Realization community, a 17 apartment residential project in Auroville.

Our Director, Satprem Maïni, also participated in many international events to promote the use of earth as a construction material.

We hope you will enjoy reading about the Auroville Earth Institute. Do not hesitate to send us your feedback to improve the next issue!

## Technology Transfer to Haïti in August 2011

In August, the Auroville Earth Institute conducted a training course for the production and use of Compressed Stabilised Earth Block (CSEB) in Port-au-Prince, Haiti.

Satprem Maïni, Director of the Auroville Earth Institute and Amandine Haviez, Engineer from the Institute spent three weeks from July 30th to August 20th to train the team of an NGO, *1000 Jobs Haiti*. Thirteen workers and three technicians were trained for the production of blocks with the Auram Press 3000 designed by the Auroville Earth Institute and produced by Aureka. Three architects from *MASS Design Group* (Boston, USA) and six local architects were also trained for the design with CSEB for earthquake resistance and building arches, vaults and domes.

A few days of the course were spent to give the basics masonry features for earthquake resistance developed by the Auroville Earth Institute. The first production of blocks will be used to build a hospital for tuberculosis patients in Port-au-Prince. After which, the NGO will go on producing blocks to built guest houses and houses on the central plateau in Mirebalais.

## Conferences and seminars

**January** - Satprem gave a talk in Cairo at a conference on earth architecture organized by the Society of Egyptian Architects.

**February** - Satprem was invited to Washington by the American Association for the Advancement of Science. As an invited speaker, he gave a presentation titled *Stabilized Earth Architecture for a Sustainable Future*.

**March** - Satprem attended an international workshop on thermoregulatory analogies between skin, plants and soils in Reading, UK. This event was organized by the University of Central Florida.

**June** - Satprem went to Kochi for an international seminar on society, technology and sustainable development. This seminar was organized by the Amrita Institute of Medical Science in collaboration with the University of Buffalo (USA) and Deakin University of Victoria (Australia). The conference focused on the crucial interfaces and dynamics of sustainable development with respect to indigenous practices and technology.

**October** - Satprem went to New Delhi to participate in the 9th Edition Green Building Congress. The event focused on the construction industry and aimed to create awareness on green building concepts.

## Visit our redesigned website !

AVEI recently launched a new, more user friendly website. Paul, an AVEI volunteer from France, spent several months to redesign and implement a fresh new layout.
[See our home page]

As the old website needed an in-depth update, Paul made sure that the new version is validated as CSS 2.1 and XHTM 1.0 Transitional by the W3C (World Wide Web Consortium).

In close collaboration with Hilary, our American intern librarian, the website includes an online catalog of our library. It is now accessible to everybody from anywhere in the world!
The search interface is available in English, French, Italian and Dutch. Using keywords, anyone can explore our catalog of books and then come by the Earth Institute to check them out.

The AVEI website aims to be a comprehensive online ressource center, going beyond the activities of AVEI to offer a wide variety of information on earth as a construction material.

Along with data on Compressed Stabilized Earth Blocks, our most used technique, you will find detailed information on other technologies used to build with earth. From traditional rammed earth to cob and poured earth, the pages are illustrated with pictures that help give you an idea of all the wonders you can achieve with raw earth.

Please take a moment to check out the new *World Information* section on the *More Info* page. This page includes a variety of case studies of earth architecture projects.

These *World Heritage Case Studies* feature some of the world's most incredible sites built entirely with raw earth, including buildings in Africa, North America and the Middle East.

*Below, you can read abstracts of these brand new pages.*

**Ghadames**, "the Pearl of the desert", is an oasis in the Libyan Sahara. The city was known as an important stage on the trans-Sahara trade route. It is a World Heritage Site since 1986.

The Old Town of Ghadames was entirely built with adobe bricks, lime and palm tree trunks. Abandoned in the 1970's, it is still used in the summer as its architecture provides better protection against the heat.
[Read more by clicking here]

**Taos Pueblo** or Pueblo de Taos is located in the valley of a small tributary of the Rio Grande. This remarkable example of Pueblo Indian settlement consists of adobe dwellings and ceremonial buildings.

It was established in the 13th and early 14th century and is the best preserved of all the pueblos north of the borders defined by the treaty of Guadalupe Hidalgo.
[Read more]

**Arg-e-Bam**, the Citadel of Bam was a fortified medieval town built on the southern edge of the Iranian plateau. It was built with adobe bricks, both for its walls and vaulted roofs.

Bam developed at the crossroads of important trade routes and became an outstanding example of the interaction of various influences.
[Read more]

## Research Project Poured Earth

From July to September, Jérôme, a French civil engineer intern, worked on the poured earth research and development project. During 10 weeks he worked to conciliate the soil mechanics approach developed at the institute and his knowledge about concrete construction.
His research focused on designing poured earth mixes that would provide the best results in terms of compressive strength, shrinkage and workability.

*What is Poured Earth?*

Poured earth is a technology that would conciliate the characteristics of concrete using local aggregates. The final product would use less cement than traditional concrete and provide a resistance strength according to its intended use. Adding water to the aggregates allow for a workable (plastic to liquid) mix that could be poured in formwork to manufacture walls, beams, slabs, etc. A possible compatibility with steel would allow the use of reinforced poured earth.

There are many other interests in poured earth technology: as its mechanical and chemical behavior would be close to concrete, the full range of already existing machines could be used. Testing processes and calculation methods could also be strongly inspired by those developed for concrete technology, enabling builders to easily employ it.
Since poured earth can directly be implemented on site in its final shapes, it would no longer be necessary to have pre-production sites such as for CSEB. The labor would be reduced with the costs, and the construction efficiency increased.

Poured earth is a very promising technology but only exists at an experimental level. It is therefore fundamental to implement research project and develop on-site experimentations in the near future.

*Dry aggregate mixes*

Jérôme first conducted dry aggregate mixes tests to have an overview of the different material ratios that would later be used for the first series of samples. The goal was to find the best dry aggregate ratio i.e. the dry mix that would reach the maximum compactability.

With these results, he could start pouring samples of the different dry aggregate mixes tested to confirm the results and test their resistance under compressive strength.

*Making samples*

A wide range of samples were designed and tested under compression strength. 85 samples (61 cylinders and 24 10x10x10 cubes) were tested for their compressive strength respectively 7, 14 and 28 days after the day of pouring. Jérôme tested different ratios of aggregates (the dry soil/sand/gravel mix), in addition to different amounts of binder (cement or lime).

*Pouring a sample*

*Cylinders and cubes*

*The manual hydraulic press*

*Compressive strength tests*

The compressive strength tests were performed on the manual hydraulic press of the Institute, according to the test protocols in force here.

*Pouring the walls*

With the results obtained on the different samples, it was decided to pour real walls of dimension 24*120*225. Three different walls were made, using different ratios of materials. They were all stabilized with 7.5% cement out of total mass. The main objective of these experiments was to test the reliability of poured earth walls on site, with heavy equipment and a team of four to five workers. We also aimed to measure the final shrinkage of the walls, and to observe the apparition of cracks inside the structure after drying.

*Formwork for the wall*

All volumes of dry aggregates required were measured using buckets and wheelbarrows, while the precise mass of cement was weighed. All materials were manually mixed by three persons, directly on the floor, which had previously been saturated to avoid soaking of water by the soil thereafter. Water was then gradually added to the mix, while slump-tests were performed until it reached a sufficient workability for pouring.

The final mix was then poured by hand in the previously installed and oiled formwork. It is important to pour the mix in 20 to 30 cm layers and properly vibrate each layer using a mechanical vibrator. This process was conducted until the top of the formwork was reached.

*Vibrating the mix in the formwok*

Then the wall was perfectly leveled with trowels and floats. The final wall was covered with a plastic sheet to avoid drying, and left for setting. The formworks were removed after 24 hours; water was then spread on the wall and it was covered again with a plastic sheet for three additional days. The wall was cured every day for 28 days by spreading water on its surface.

*Conclusion*

These three walls were the first real scale project conducted in the Institute on poured earth. We managed to produce walls presenting a good surface, a sufficient resistance of several MPa, good workability and an easy process for pouring, allowing the work to go very fast with only a few workers. We can say this experiment was a great success. Indeed it proves that poured earth is a credible alternative to CSEB, and that it is now possible to go further in this way, using the technique for real construction.

On the other hand, it could be argued that the only thing we did it is reinventing concrete. It is true that the composition of our walls is clearly that of a classical concrete mix, in which a certain amount of soil would have been included. This giving of course interesting results, but way lower than those we would have obtained with a real concrete. Therefore the next trials should be focusing on how to include higher amounts of soil in the mix while preventing an increased shrinkage and a lower compressive strength. Reducing the total amount of cement would also be an interesting lead, maybe by replacing it by other binders, or using additives.

*The unmolded wall*

## They are talking about us

### *Architecture Student's Corner*

Sujit G.S., an Indian architect and blogger featured the Auroville Earth Institute in one of his article.
"Anybody who is genuinely interested in sustainability and earth architecture should definitely head down to Auroville and immerse oneself in the amazing world of earth architecture."

To read more:
http://arkistudentscorner.blogspot.com/2011/10/for-all-things-earthy-auroville-earth.html

### *De Terre et d'Argile*

Yasmine Terki is organizing an exhibition on earthen architecture for the event *Tlemcen, Capital of Islamic Culture*.
As the curator, Yasmine asked us for a poster presenting our activities.
The opening day is November 19, 2011.

*The following text is an abstract from an article, published in The Hindu[1] on October 15th. It was written by Neelakshi Joshi, a senior architect who has been working at the institute since 2010.*
*She is a graduate from the Birla Institute of Technology, Mesra, Ranchi.*

## Walls of the mind

*by Neelakshi Joshi*

For years women have worked as labourers on construction sites. Unlike men who come in as small boys, assist the mason for some years as helpers and finally, when the time comes, graduate as masons. Later, some of these masons become contractors and move up the social ladder. However, this order of informal training is reserved only for men. Women enter and exit the site as labourers irrespective of the number of years they worked there.

Post-tsunami in Tamil Nadu, the government funded many projects to train women masons so that they become agents of reconstruction. One such project was run at the Auroville Institute of Technology. It involved three months of theory classes followed by three months of on-site experience. We received six coy young girls. After initial hesitation, they settled down well. The masons were more than helpful and taught them well. They actively participated in all aspects of construction. After three months, their skills were commendable. Asked what their future plans were, none of them wanted to be a mason at site. They said the training was fine; however their families did not appreciate their working side by side with men. Some intended to use this experience and study further, maybe learn drafting on CAD and settle in a comfortable job. Others had plans of going to the Middle East (where some family member was already working) and try to get some construction work there.

Though it might be a while before we see women skilfully laying blocks, bending steel or plastering walls, the winds of change have begun to blow. Women have proved that it is not skill that they lack but opportunities. If we strive for better, safer and more equitable sites for them to step forward, I am sure they will not disappoint us.

[1] *The Hindu is the third most widely read English newspaper in India (2.6 million people).*

## Construction Project Realization apartments

One hundred people join Auroville every year. Over the last decades, only a handful of houses and apartments were built. Brought up together by an acute housing shortage and the determination to keep the city growing, many residents initiated a construction process.

This joint effort of professionals and volunteers created the Realization project which began as a movement in October 2007. Aurovilians, Newcomers and volunteers started to work together and they were coordinated by the Auroville Earth Institute.

*Realization, a community project*

Realization is a residential project of 17 apartments for about 25 people in Auroville, Tamil Nadu, India. Realization aims to build sustainable and affordable homes for Auroville with people's participation. It aspires to contribute actively to the development of Auroville as a conscious community and a city of never ending education. Realization proposes alternative ways to answer the housing demand.

The project comprises 3 buildings: the South East Block, the North Block and the South West Block. The South East block was completed in June 2010 and the North Block is under finishes in November 2011. The South West Block is presently being built and walls are at the beam level for the ground floor. The entire project should be completed by March 2012.

*Site planning and design*

Site planning was done according to the local environment.
Site resources were optimally used: the soil dug from the rainwater harvesting tank was used to make stabilized earth blocks for the buildings.

The natural slope of the site was utilized in designing services to minimize labor and cost of trench digging. The existing vegetation was respected: trees, if cut, were used in doors and windows. Simple frameless doors economizing the use of wood were chosen and the wood from trees destroyed after the 2004 Tsunami was also employed for doors and windows.

Prevailing wind direction was used to orient the buildings to have enough draft in the hot humid climate of Auroville. Moreover, double height spaces were used in bigger units to allow for better air movement and light in the house. Overhangs and vaults projections were used to achieve glare free light.

*Appropriate building techniques*

Earth was used as the primary building material from the foundations to the mortar.

The foundations are in Stabilized Rammed Earth to eliminate the need for concrete footings. Walls, vaults and domes are made with Compressed Stabilized Earth Blocks (CSEB). Employing CSEB roofing for vaults and domes saves immense quantities of steel and concrete and also stands out as a unique elevation feature providing interesting spatial quality to the rooms.

Stabilized Earth Mortar was used and the walls exposed to rain were plastered with Lime Stabilized Earth Plaster.

Saving on steel and cement is an important aspect of reducing the embodied energy of a building. Therefore, precast ferrocement elements were employed: ferrocement roofing channels, precast sills and planters and precast gutters for springer beams.

The embodied energy of the South East Block is about four times less than a conventional building built with reinforced concrete frame structure. Employing the local skilled labor for doors, windows and other finishes over buying readymade items helped lowering the total embodied energy.

*Energy conservation systems*

Varied energy conservation systems were implemented in the Realization project. Most innovative was an Earth Cooling Tunnel that blows hot air from the atmosphere in a pipe and makes it travel to the bottom of the rainwater harvesting tank allowing it to cool by heat exchange. The air is then pumped into residential units.

Rainwater from the roof is harvested in an underground water tank and it can be used for gardening. Surface rainwater is harvested in a percolation pit in order to recharge the water table.

## Training Courses in 2012

*February*
6th to 11th - CSEB Production
13th to 18th - CSEB Masonry

*April*
2nd to 7th - CSEB Production
9th to 14th - CSEB Masonry

*June*
11th to 16th - AVD Theory
18th to 23rd - AVD Masonry

*July*
2nd to 7th - Designing with CSEB
9th to 14th - CSEB Intensive
16th to 21st - AVD Intensive
23rd to 28th - CSEB Intensive

*September*
3rd to 8th - CSEB Production
10th to 15th - CSEB Masonry
17th to 22nd - AVD Theory
24th to 29th - AVD Masonry

*December*
10th to 15th - AVD Theory
17th to 22nd - AVD Masonry

Extra training courses can be organized upon request. In addition to those listed above we also offer training in earthquake resistant construction and applications of ferrocement.

For more details on the content of the training courses, please visit our website.

## Internship Opportunity

The Institute welcomes students to apply for internship programme with our architectural team as a part of their academic curriculum.

Work profile will include design development, working drawings, site work, client interaction and a chance to participate in our specialized training courses.

Resumes and portfolios for 4-6 months internship commencing in December can be sent to training@earth-auroville.com

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