AUROVILLE
EARTH INSTITUTE
UNESCO CHAIR EARTHEN ARCHITECTURE

July - December 2024
Issue 54

From the Earth's majestic roof, Auroville Earth Institute team wishes you a year of inspiration & harmony

AVEI NEWSLETTER

In this issue:

As we celebrate 35 years, the second half of this year has brought enriching collaborations with aspiring architects, starting with students from NASA (National Association of Students of Architecture), extending to URVEE Trust in Pune.

Despite being abroad, Satprem's dedication shines through as he manages international commitments and oversees ongoing projects in India remotely, navigating two time zones seamlessly. While virtual collaborations have streamlined our processes, Satprem's physical absence is felt.

The Earth Institute has maintained its momentum with both online and on-campus training, witnessing increased interest in curated workshops. We are excited about unique collaborations planned for the coming year.

We encourage you to share this newsletter and help spread the vision of earth architecture to a wider community.

Earthly yours,
The AVEI Team

AUROVILLE
EARTH INSTITUTE
UNESCO CHAIR EARTHEN ARCHITECTURE

Partner of the UNESCO CHAIR
earthen architecture,
building cultures and
sustainable development
CRATERRE | AE&CC | ENSAG | UGA

Remote Challenges, Remarkable Progress: The 33m Oshodhara Dome Update

Stone wall construction with specially fabricated template, integrating customised formworks for conical windows

The construction of the 33-metre diameter dome at the Oshodhara Meditation Centre, located in the Bhavnagar district of Gujarat, has been progressing at a slow pace.

The foundation work, which included casting 6,350 m^3 of plain cement concrete for a structure measuring 6 metres deep and 8.5 metres wide, took 11 months to complete. This unexpected delay is not only due to the sheer volume of material required but also to the simultaneous casting of the reinforced concrete bowl alongside the foundation.

Initially, Satprem proposed using poured earth concrete for the foundation, stabilised with 7% cement and incorporating 40% of the raw soil excavated on-site. However, improper storage and mismanagement by the local team rendered the soil unusable, as it was dumped on the surrounding hill slopes and contaminated. Consequently, the foundation had to be cast using plain cement concrete with a strength of 7.5 MPa, ensuring structural integrity despite setbacks.

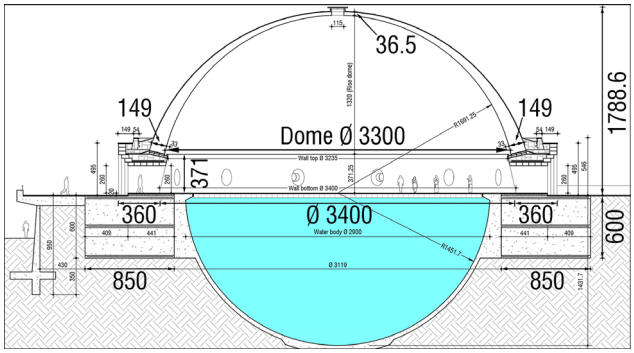
Construction of the 1,800 m^3 stone wall, built using random rubble masonry, commenced in early March 2024. Satprem, accompanied by master mason E. Manikandan, visited the site in late September 2024 to oversee the

Tympan arches under construction

construction of one of the building's stone vaults. Together with the local team, they successfully built the vault and its tympan arches in just 11 days.

The pace of construction has been hampered by the difficulty in sourcing skilled masons willing to work in the remote location. However, towards the end of 2024, more masons joined the team, allowing significant progress. The local team completed casting the springer beam on 1st January 2025, marking a key milestone.

The next phase begins on 27th January 2025, when Satprem and the team will start building the dome, which is estimated to weigh ~3,100 tons. This ambitious structure will require laying approximately 320,000 compressed stabilised earth blocks (CSEBs) of 16 different sizes. With a workforce of 32 masons and 110 labours, the dome is expected to be completed within four months. ■



Dome Section through the Entrance

Glass Fiber Reinforced Polymer (GFRP) bars for ring beam

First entrance vault and its tympan arches completed in 11 days

Sustainable Spaces for Inner Peace - Dhamma Arunachala Meditation Hall

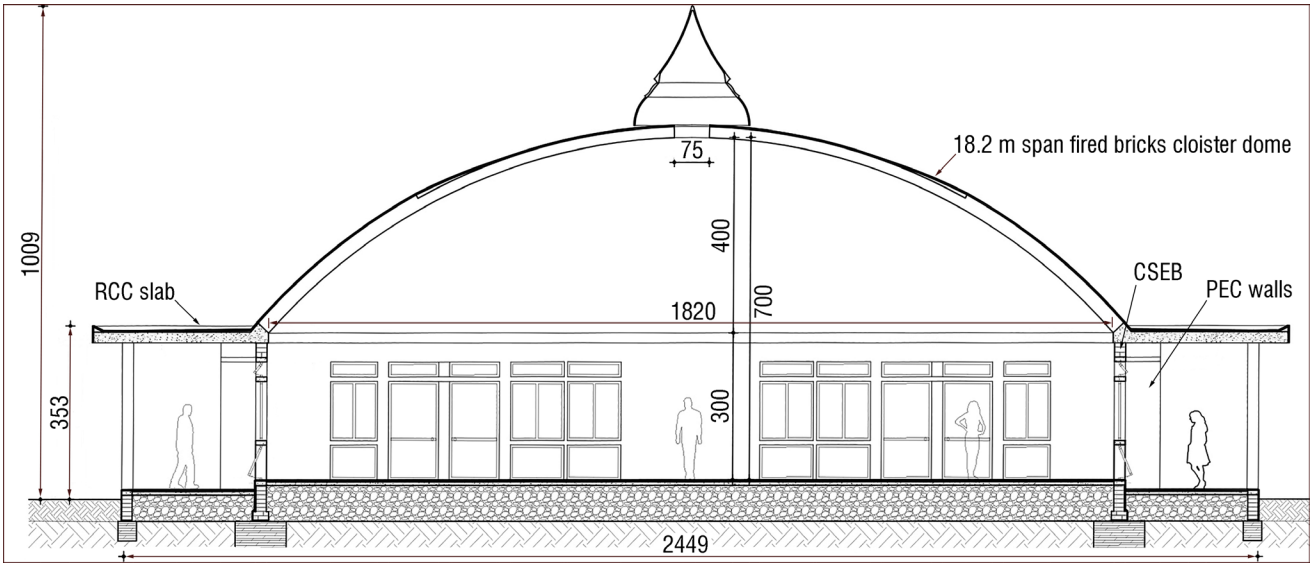
The Dhammamalai Vipassana Dhyana Maiyam (DVDM) in Tiruvannamalai has engaged the Auroville Earth Institute (AVEI) with the design and construction of an 18.26 m x 18.26 m meditation hall. Designed to accommodate 150 students, the structure will feature stabilised poured earth concrete for the foundations and walls, crowned with a segmental cloister dome spanning 18.2 m and rising 4 m. This dome, constructed with fired bricks, will have a variable thickness ranging from 30.2 cm to 22.2 cm.

Dhamma Arunachala, established in 2014, is a serene Vipassana Meditation Centre spread over 12 acres near the Arunachala Hill. Since its inception, the center has hosted over 150 courses, benefiting nearly 8,000 students. The new meditation hall represents a significant expansion of its facilities and its mission to provide a conducive environment for meditation.

In 2019, Satprem was invited to present AVEI's pioneering stabilised earth technologies to the DVDM team. Following this, T. Ayyappan, co-director of AVEI, began assisting DVDM in developing their campus using CSEB (Compressed Stabilised Earth Blocks), rammed earth, and poured earth concrete techniques.

For the new hall, the thrust of the 18.2 m span dome will be supported by a peripheral reinforced concrete slab that also serves as the corridor around the hall. The conceptual design for the project was completed in August 2024, and the working drawings are currently in progress. The stability study for the dome has been finalized, and the structural design and calculations for the reinforced concrete slab are underway, with assistance from Varad Varma of Nandadeep Designers and Valuers, Aurangabad.

Foundation excavation of inner walls and buttresses.



Concept Section

On October 24, 2024, the AVEI team marked the foundation on-site, and excavation was completed in November. However, the casting of the foundation has been delayed due to heavy monsoon rains. Cyclone Fengal brought record rainfall to the region on December 1, 2024, with Auroville recording 594.5 mm in a single day. Tiruvannamalai, 110 km from Auroville, experienced similarly intense rainfall, leaving the foundation waterlogged until recently.

To ensure quality and skill transfer, AVEI will train local labor, led by master mason E. Manikandan, who has worked with AVEI for 31 years. Radhika Soni, chief architect of AVEI, will oversee the construction phases, while Satprem focuses on building a 33 m diameter dome in Gujarat.

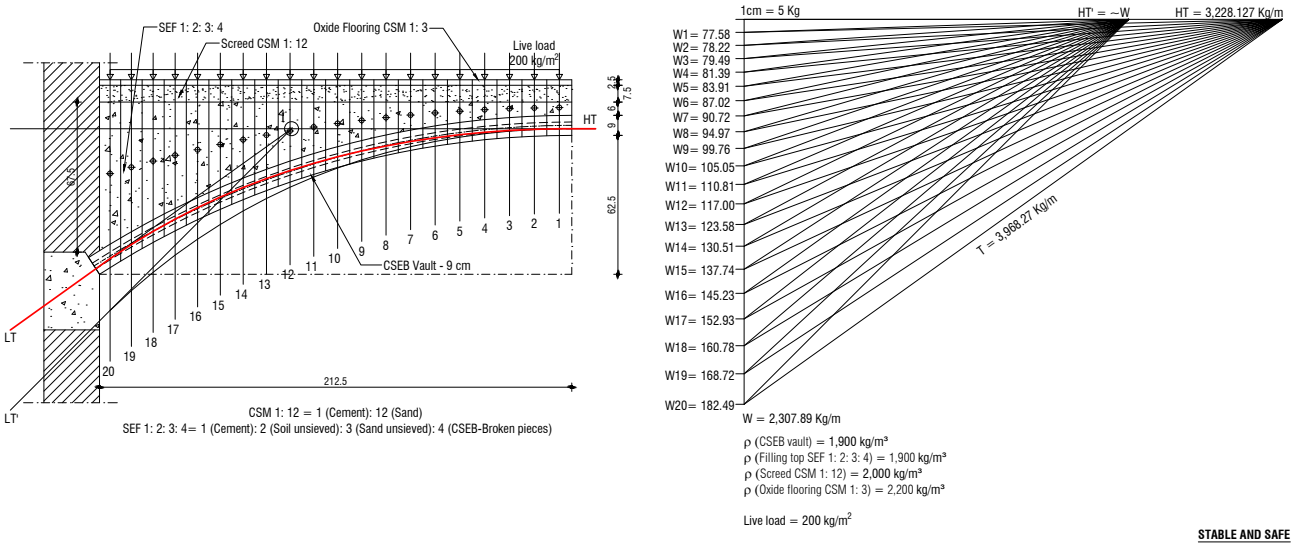
By integrating sustainable construction with a meditative purpose, this project exemplifies environmentally conscious and purpose-led design.

Vault Stability Consultancy to Studio Archology

Ar. Divij Bhardwaj and Ar. Henrik Dutz from Studio Archology, an emerging practice based in Auroville, collaborated with AVEI on the design of an upcoming villa. The project features a series of uniform vaults as the main roofing system and a 33 cm thick rammed earth wall on the south side, providing thermal mass to minimize heat gain and improve energy efficiency. The AVEI team conducted a detailed Vault Stability Analysis considering various overloading scenarios and provided constructive feedback on the rammed earth wall to support structural integrity and performance.

Rendering of the Proposed Villa by Studio Archology

We extend our best wishes to the Studio Archology team for the successful execution of this thoughtfully designed project!



Vault Stability Analysis for One of the Overloading Case

Three-Day AVD Course in Mayotte

Satprem was invited by architect Melvyn Gorra from Art.Terre Mayotte to conduct a three-day awareness course on the construction of arches, vaults, and domes (AVD) in Mayotte. The course, held from September 18th to 20th, aimed to revive interest in eco-friendly building techniques and promote the use of Compressed Stabilised Earth Blocks (CSEB) in the region.

Mayotte, a small French island in the northern Mozambique Channel, west of Madagascar, has a history of adopting innovative housing solutions. In 1978, a program to improve the island's housing stock was launched, with CSEB chosen as a primary building material due to its affordability, durability, and suitability for local conditions. With support from CRATerre ENSAG, the production of CSEB was organized, and technical and economic assistance was provided. Over the next decade, more than 10,000 houses were built using CSEB. However, the past two decades saw a significant decline in its use, leading to the establishment of Art.Terre Mayotte in 2007 to revive and promote the CSEB sector. This three-day AVD course was part of their ongoing efforts to reintegrate sustainable construction practices on the island.

Overall View of the AVD Course in Mayotte

Hands-on session - Segmental arch with Satprem

The training was held at Younoussa Bamana High School and began with a half-day theoretical session. Participants were introduced to the basic structural principles of AVD, including stability calculations, and were shown case studies of AVD projects built by the Auroville Earth Institute (AVEI). The practical sessions involved constructing a variety of arches and culminated in building a hemispherical dome and a pointed dome. The event was attended by 24 students, Melvyn Gorra, and a professor, all of whom expressed great enthusiasm for the course and its outcomes.

In addition to the training, Satprem was invited by the Council for Architecture, Urban Planning, and the Environment (CAUE) to give a lecture on stabilised earth technologies developed by the AVEI. The lecture attracted an audience of 50 architects, engineers, and student engineers, who were impressed by the innovative approaches and potential of these technologies to address modern construction challenges sustainably. ■

ARTerre Mayotte

From Classrooms to Villages: A Collaborative Approach to Sustainability

URVEE Public Trust, based in Pune, is dedicated to empowering Indian villages through sustainable building solutions. This commitment extends to nurturing future architects with hands-on experience, bridging academic learning and real-world applications.

A key initiative, the URVEE Gram Abhiyan (UGA), sensitizes architecture students to community-centered, sustainable building, fostering a revival of vernacular architecture. This year-long program integrates directly with academic curricula, ensuring that students gain practical insights into appropriate construction while communities learn about sustainable solutions through a public building demonstration.

Central to this year's UGA's success is collaboration with AVEI through the URVEE_Vastu_BCM program. This academic exchange enriches the students' experience by integrating expert-led workshops on earthen and appropriate construction technologies. AVEI's contribution includes five online sessions and three offline studios, covering fundamental topics of appropriate construction techniques for foundations, walls, roofing systems, finishes and services with real-time case studies.

Radhika explaining arch geometry for students' design

Top: *Studio session developing working details for sustainable construction techniques*

Bottom: *Radhika presenting AVEI project case study to UGA students and faculty*

The workshops commenced with an orientation on August 12th, followed by focused online sessions from August 21st to 24th, culminating in in-person design studios in Pune starting September 3rd. These sessions have enabled students from Bharatiya Kala Prasarini Sabha's College of Architecture, Dr Bhanuben Nanavati College of Architecture for Women, and Bharati Vidyapeeth College of Architecture to apply theoretical learning to live village projects, ensuring practical, sustainable development.

This pilot collaboration with AVEI underscores URVEE's vision: fostering informed, eco-conscious architects while uplifting rural communities through sustainable practices.■

Sharing Legacy: Arches, Vaults, and Domes at DSA Terre, Grenoble

On December 2nd and 3rd, Satprem was invited by CRATerre to conduct a one-and-a-half-day awareness course on Arches, Vaults, and Domes (AVD) at the High School of Architecture of Grenoble, France. The workshop was part of the postgraduate diploma program in earthen architecture, "DSA Terre," and welcomed 20 students from 11 countries.

The session began with a lecture titled "35 Years of Work of the Auroville Earth Institute," which showcased the Institute's groundbreaking work in stabilised earth technologies. The presentation highlighted some of AVEI's key innovations and major architectural achievements. The students were inspired by these contributions to sustainable building practices.

Following the lecture, students engaged in hands-on learning by constructing four types of arches: pointed, semicircular, catenary, and segmental. Although time constraints limited the number of structures, participants fully immersed themselves in the building process.

The workshop culminated with the students beginning the construction of a vault using the Free Spanning Technique. They completed two courses against a 3-meter segmental arch, which they then enthusiastically tested by having five students climb onto it.

The interactive and practical nature of the workshop left the students eager for more time to explore and build additional AVD structures. Their enthusiasm underscored the success of the course and its ability to spark a deeper appreciation for earthen architecture.

Students enthusiastically testing the segmental arch

Satprem at the Earth Building Association of New Zealand Conference

The Earth Building Association of New Zealand invited Satprem as a guest speaker for their annual conference in Aotearoa, New Zealand, on November 10th. The organizers had initially hoped for an in-person visit, where Satprem could present his work and lead practical sessions on soil identification and constructing arches. However, due to funding constraints, he delivered his presentation online instead.

Titled "Advancement in Stabilised Earth for All Climates – Works of the Auroville Earth Institute", the presentation showcased the innovative stabilised earth technologies developed by AVEI. These advancements were highlighted through compelling case studies of buildings designed and constructed across diverse climatic zones. Given New Zealand's seismic activity, particular attention was dedicated to earthquake-resistant construction techniques.

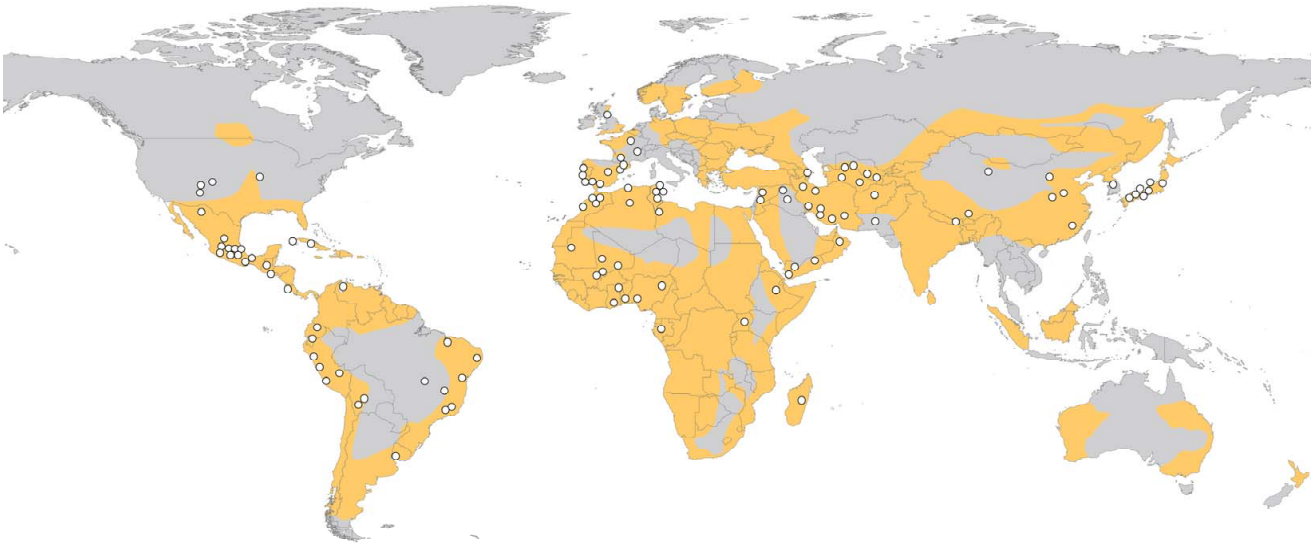
The event drew around 55 professionals, who expressed their admiration for AVEI's contributions to sustainable construction and its dedication to promoting earth-based technologies worldwide. This online engagement bridged continents, inspiring new conversations on sustainable and resilient building practices.

Rethinking "Alternative": Earth as a Timeless Building Material

In recent years, the term "alternative" has increasingly been used to describe natural building techniques like cob, adobe, and rammed earth. However, this label raises an important question: can materials that have sustained human civilization for millennia truly be considered alternatives? Exploring the etymology of the term and reflecting on how we define building materials, reveals how modern biases influence the way we perceive construction materials.

The word "alternative" is derived from the Latin "*alternus*", meaning "one after the other" or "the other of two". This etymology suggests a notion of sequential choice or something that is not primary. In architectural contexts, applying this term to materials like earth inadvertently implies that these are secondary options—a departure from the mainstream. However, a closer examination of history reveals that these materials are anything but secondary; they are the original building blocks of human civilization, shaping the architecture of civilizations like the Indus Valley and Mesopotamia. Calling them "alternative" wrongly positions them outside the mainstream, when, in fact, they are at the heart of our architectural heritage.

In many cultures, earth carries profound spiritual significance. In India, for instance, the concept of *Dharti*, from the Sanskrit root "*dhr*" (to hold or sustain), symbolizes the Earth as a nurturing force. It is seen as the source that sustains life, and in traditional Indian architecture, earth-based buildings are considered more than just structures—they reflect a deep, living connection to the land. This spiritual reverence is echoed in many indigenous cultures, where earth is viewed as sacred, symbolizing harmony with nature and the land's power to protect and support its inhabitants.



UN-Habitat statistics (2017):

- **33% of the world's population lives in earthen dwellings.**

UNESCO statistics:

- **17% of the *"world cultural heritage"* is built with earth.**
- **25% of the *"world heritage in danger"* is built with earth.**
- **14% of the *"100 most endangered world heritage"* is built with earth.**

Area of earthen construction

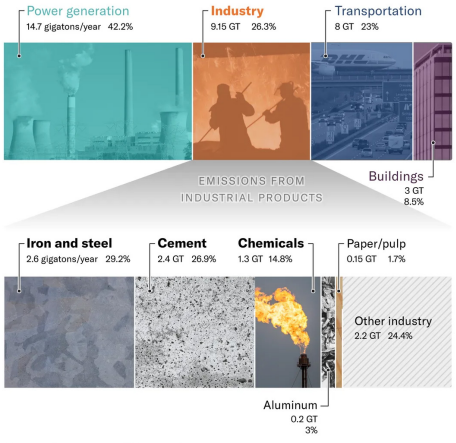
UNESCO World Heritage sites, built with earth

Statistics on earthen architecture around the world

Earth-based materials are not relics of the past—they are gaining recognition as vital components of modern construction. Offering sustainability, thermal efficiency, and low embodied energy, they address critical environmental challenges. With growing awareness of the ecological impact of industrial construction, earthen architecture is experiencing a revival, evident in projects ranging from eco-homes to public buildings.

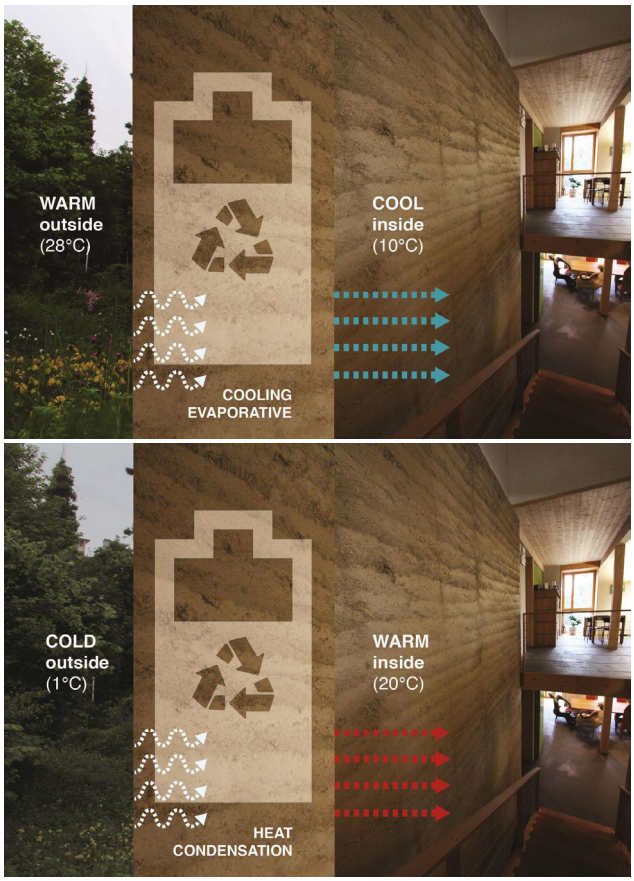
This resurgence highlights how earth can bridge traditional knowledge with modern innovation. Advanced techniques, such as stabilised rammed earth and compressed earth blocks, blend ancient wisdom with engineering solutions, making earth a viable material in both urban and rural settings. These techniques not only ensure durability and aesthetic appeal but also align with the need for low-carbon, locally sourced, and biodegradable materials.

In India, where urbanization and climate change pose significant challenges, native materials like earth offer natural solutions. Earthen structures provide thermal insulation, regulating indoor temperatures and cutting energy demands for air conditioning. Earth's adaptability to modern needs, coupled with its alignment with sustainable practices, makes it a cornerstone for eco-conscious architecture and a path forward in rethinking our built environment.



Source: International Energy Agency

Global Annual Carbon Emissions 2022 - Canary Media



Thermal mass & hygrothermal behavior of earthen wall that helps in reducing energy consumption

The notion that earth is "alternative" stems from a bias toward industrial modernity. However, in a world grappling with climate change and the need for sustainable practices, earth is anything but alternative—it is a timeless material, capable of meeting contemporary needs. Reframing how we perceive and define these materials is essential for creating a built environment that respects both tradition and the future.

By reconsidering how we define progress and innovation, we can shift away from the idea that modern materials are inherently superior. Instead, we can embrace a more integrated approach, where modern technology complements traditional wisdom. Earth should not be relegated to an "alternative" status, but celebrated as a native material—sustainable, spiritually resonant, and deeply rooted in the cultures that have used it for centuries. ■

Summary of Training Courses During July-December 2024

Over the past six months, AVEI has significantly expanded its training offerings in sustainable building techniques, delivering both on-campus and online courses. These programs covered key topics such as Compressed Stabilised Earth Blocks (CSEB), Arches Vaults and Domes (AVD), and Ferrocement. In total, 6 on-campus and 5 online courses engaged 84 trainees, reflecting the growing interest in these sustainable construction methods.

In addition to the specialized training, awareness courses drew over 168 participants, who gained hands-on insights through guided campus tours led by AVEI's team. These sessions provided a practical understanding of earthen construction techniques in action.



AVD Courses



CSEB Courses



Ferrocement Courses

For the past 35 years, AVEI has trained 14,738 individuals from 94 countries, including 10,828 from India and 3,910 from abroad. With courses hosted in 21 countries, AVEI has been instrumental in promoting sustainable building practices globally.

The next cycle of training courses will begin in February 2025. For further details, please refer to the schedule in the Colophon.

Special Workshop - National Association of Students of Architecture

Elementerre demonstration

Students performing Carazas test

Students presenting their design development

Team picture on the last day

In August, we had the pleasure of hosting a unique workshop for the National Association of Students of Architecture (NASA), India team, and what an incredible experience it was! Curated to inspire and educate, the course blended engaging theory sessions with immersive hands-on learning.

We kicked off by diving into the physics of earth as a building material, utilizing our Elementerre toolkit and conducting Carazas test to explore its potential. Discussions about embodied energy in the building industry shed light on the environmental impact of construction choices, making the sessions both insightful and thought-provoking.

The workshop also featured a case study field visit to our project, Sharanam Convention Centre, where participants witnessed the practical application of earthen architecture. Seeing these concepts come to life in a real-world setting was a highlight of the experience.

To conclude the week, we hosted an interactive design exercise, where participants showcased their creativity by presenting innovative solutions using the principles learned throughout the program.

This workshop was a celebration of learning, collaboration, and creative thinking. We're thrilled to have shared this journey with such an enthusiastic group and look forward to seeing how these ideas shape their future projects.

Congratulations Behnaz Motarjem & Pouya Khazaeli on their Publication!

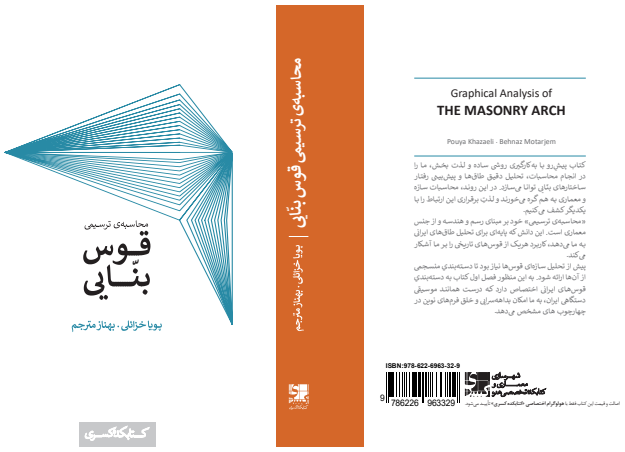
Description of the book - by Pouya Khazaeli

For the first time, I became familiar with graphical analysis of vaults in AVD course held in Auroville Earth Institute (AVEI) 2016. This course taught by Satprem Maini was an inspiration for the book that Behnaz Motarjem and I published (in Persian language) last year under the name of « The Masonry Arch ».

The focus of the book is analyzing and optimizing historical Iranian arches, thus the first chapter starts with describing the geometry of Iranian arches and the way that masons used to draw them on site.

In the second chapter, the relation of geometry and thrust line in a vault has been studied. As you may find under the images of the book, the main source of this chapter was AVEI booklet for the AVD course in Auroville.

Behnaz & Pouya during AVD workshop in 2018 at AVEI



Cover Page of The Masonry Arch

In the third chapter, we will learn the way of graphical statics, in which we used the described method by Jaques Heyman, to be used for optimizing the vaults in the next chapters.

In the fourth chapter, we will study the thrust line of Iranian arches and their optimization. Again the base of this chapter comes from Mr. Maini method, however the method is justified and changed regarding the way of construction and rules for Iranian vaults.

During the research that led to this book, several hypotheses get shaped that we could examined many of them with the described analysis. Such as:

1-The different method of optimization for Ilami arches. (1500 B.C)
2-The statics logic of pointed vaults. (After the Islamic period in Iran)
3-The statics logic of Kalil (blunted) arches.
4-The relation of historical development of arches in Iran and reduction of their weight.
5-Correction of naming for the Iranian vaults in relation to their geometry, so one will be able to draw various pointed arches (as well as Kalil arches) regarding their name. ■

Celebrating 35 Years of The Auroville Earth Institute

Team Picture on 31st August 2024

Satprem connected virtually - Sharing journey of 35years

It ain't AVEI Celebration without choco-banana cake!

On August 31, 2024, The Earth Institute proudly marked its 35th anniversary—three and a half decades of innovation, collaboration, and unwavering commitment to sustainable practices. This incredible milestone is a testament to the passion and dedication of our extraordinary team, and the unwavering support of those who have walked alongside us on this meaningful journey.

We celebrated the day with joy and camaraderie. Satprem joined us online, sharing heartfelt moments and engaging with friends and community members who gathered for a delightful tea, cake, and cookies fiesta.

As we honor the cherished memories that shaped our path, we embrace the opportunities ahead with gratitude, hope, and renewed determination. Here's to continuing this inspiring journey together, stronger and more inspired than ever! ■

AVEI on-campus training course schedule for 2025

February
10th to 15th: AVD Intensive
17th to 22nd: CSEB Design
24th Feb to 1st March: CSEB Intensive

July/August
28th July to 2nd August: Bioclimatic Earth

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

October
6th to 9th: Ferrocement

December
1st to 6th: CSEB Design
8th to 13th: CSEB Intensive
15th to 20th: AVD Intensive

Colophon

AVEI Newsletter
Issue 54 - Jul-Dec 2024

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AVEI online training course schedule for 2025

First Session
6th January to 1st February: AVD Theory
3rd February to 1st March: CSEB Design
3rd March to 15th March: CSEB Theory

Second Session
2nd June to 28th June: AVD Theory
30th June to 26th July: CSEB Design
28th July to 9th August: CSEB Theory

Third Session
6th October to 1st November: AVD Theory
3rd to 29th November: CSEB Design
1st to 13th December: CSEB Theory

Register at: registration.earth-auroville.com