Desert Workshops
Teach Construction Skills

by Scott S. Pickard*

Arcosanti is a small community of people living in the remote mesa country of Arizona with a long-term goal to construct a 25-story, 3,000,000 sq ft (279,000 m²) structure on 13 acres (5.3 hectares) of the 860-acre (351 hectare) site, housing 5000 people (Fig. 1). By incorporating all the functions of a city into this one high-density structure, the surrounding desert is left unspoiled and available for agriculture and recreation. After 11 years of construction, however, Arcosanti is less than one percent complete. The construction of the huge major structure remains a long-term vision of the 80 or so full-time residents of Arcosanti.

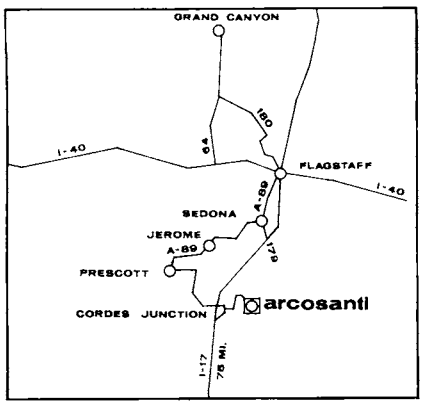

Fig. 1 — Location map

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Fig. 2 — Workshopper placing concrete in the Arizona desert.

Guided by experienced architects, engineers, and construction personnel, unskilled students from all over the world have paid tuition for 5-week workshops to learn basic construction skills while building a piece of the dream (Fig. 2). Approximately 5000 cu yd (3823 m³) of reinforced cast-in-place and precast concrete has been placed to form 100,000 sq ft (9290 m²) of residences, offices, workshop, foundry, and visitors' center in 8 buildings (Fig. 3).

Arcosanti has evolved as a "hands-on learning center" teaching basic concrete construction fundamentals and other trade skills. They have demonstrated that inexperienced workers, properly supervised, can do first-class concrete work when they are taught step-by-step and the work is thoroughly inspected.

Workshop program

Arcosanti is being built primarily by people of widely varying ages and backgrounds who pay a $400 tuition to participate in 5-week construction workshops. Conducted from April to November, the workshops allow people with no construction skills to live at Arcosanti while participating in concrete construction and educational programs. One of the objectives of the workshop program is to offer a bridge between "academia" and the construction site; a bridge between the abstract learning of university architecture and

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Fig. 3 — After 11 years, Arcosanti is less than one percent complete.

engineering programs and the practical world of manual trade skills.

The construction work is hard and progresses during temperatures that range from freezing to 110 F (43 C) in midsummer, including:

1. excavation, both machine and hand
2. concrete construction, both precast and cast-in-place (Fig. 4-8)
3. constructing and erecting concrete forms
4. erection of precast panels
5. erecting and dismantling scaffolding and shoring
6. metal work, welding and cutting, and assembly of windows, door frames, and railings
7. landscape preparation and planting
8. plumbing and fixture installation
9. electrical wiring and installation
10. interior finishing, including rough and finished carpentry

Most of the workshoppers who are from backgrounds in architecture, urban planning, engineering, construction, sociology, and anthropology, come to gain the hands-on construction knowledge. Because of their interest in what's happening at Arcosanti and a desire to get their money's worth out of the experience, the workshoppers usually make excellent workers, some staying on after their 5-week program to accept a crew leader position. All of the permanent Arcosanti residents began as construction workshoppers, and this serves to bind the workshopper and staff together. It is a satisfying achievement for an inexperience workshopper to progress tnrough a construction sequence, learning skills every step of the way and participating in each process to build a concrete wall, suspended slab, or precast panel. Many workshoppers find that the social interaction with such a diverse group is worth the experience alone.

The educational value of the workshop program has been recognized by over 75 colleges and universities whose architectural and urban studies programs grant credit to students who have participated in the Arcosanti Workshop Program.

Fig. 4-8 — Right: Top to bottom, workshoppers of widely varying ages and backgrounds learn basic concrete construction fundamentals.

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Concrete construction

Construction at Arcosanti is accomplished by "people power," and very little machine power, whether it's 40 workers unloading 650 bags of cement from a truck in 15 min, or hoisting their custom-built wall forms into place. The workers are supervised by a construction staff which includes half a dozen crew leaders with construction experience, architects who do both the design and construction inspection, and a resident structural engineer. Experienced operators run the 55-ton crane, transit mixer, and on-site batch plant.

The 3000 psi (21 MPa) concrete mix is batched on site and transported to placement areas in an 8 cu yd (6 m^3) ready-mix truck. The temperature of the mix in the desert heat is controlled by precooling the aggregate. To help the placement of concrete in areas of heavy reinforcement, superplasticizers are used. A spray-on curing compound is typically used. Concrete cylinders are sent to an independent testing lab in Phoenix for strength testing, and records are kept of every batch of concrete.

One of the most innovative and visible construction techniques used is "silt casting." Fine silt is first dredged from the bottom of the nearby Agua Fria River. Once the excavated material has dried in the sun, it is sifted to remove any impurities. The remaining pink-colored silt is then wetted to form a slurry which is leveled and compacted to serve as both a casting bed and a coloring agent. The leveling course of silt slurry dries before the concrete is cast upon it. When the cured panel is tilted up

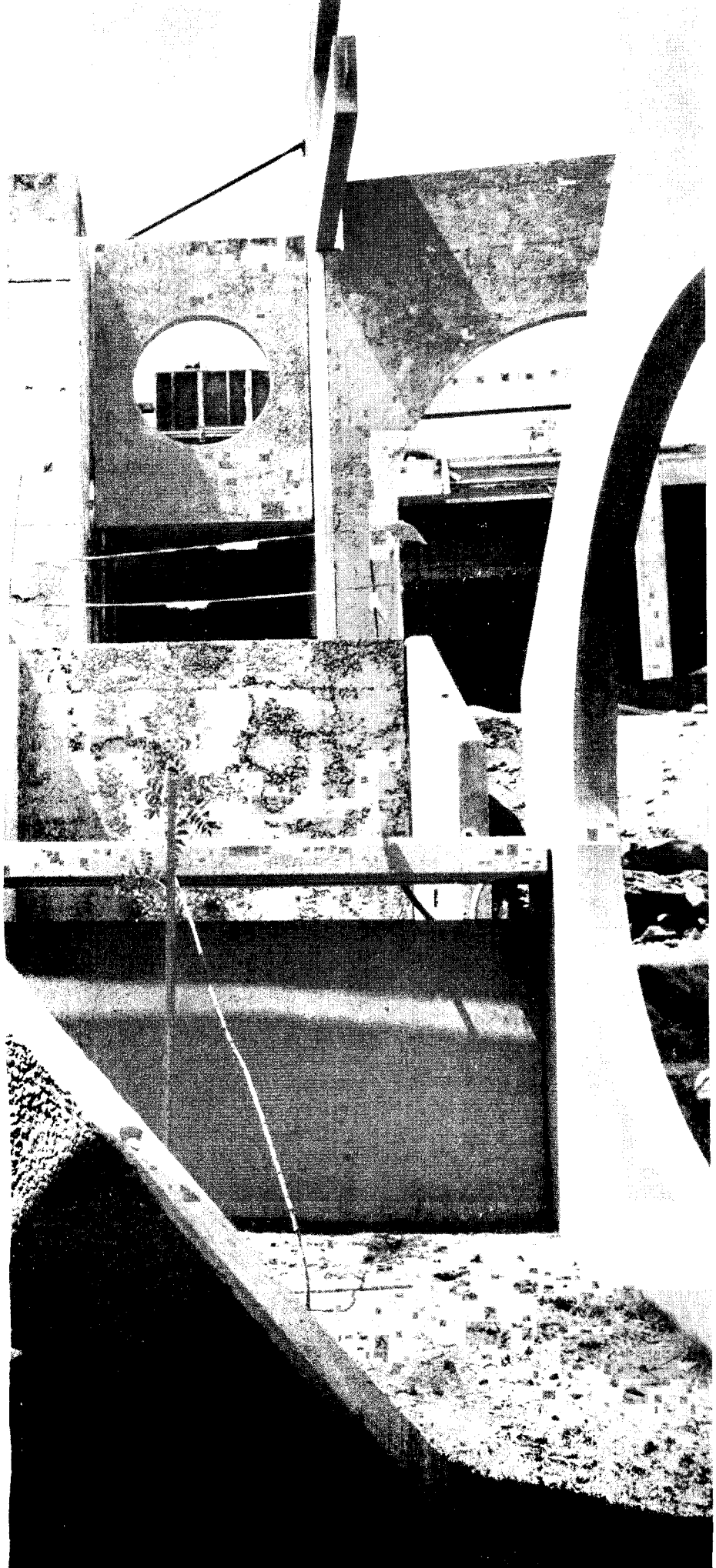

Fig. 9 — Left: Silt casting imparts natural desert color and texture to exterior surfaces.

and away from the bed, a fine layer of silt (which is a grain or so deep) remains embedded in the bottom surface, thus imparting natural desert color and texture to the surface that forms part of the exterior of a building (Fig. 9).

The sculptured ribs and double-curved shells of the major apses were cast on top of compacted silt beds. The silt was painted with mineral colors immediately before placement of the concrete to produce colored concrete shells. Large single-curved arches were stack-cast on carved and painted silt, then erected on shoring and welded together to form the final structure shading outdoor work areas. Arched light scoops were cast on mounds of silt covered by plastic to form a smooth reflecting surface on the concrete.

Stack-casting and tilt-up construction techniques are used whenever possible to speed the pace of construction.

Conclusion

However slow the project is proceeding, Arcosanti is moving in a positive direction, trying to solve problems, offer alternatives, and inspiring every workshopper to take a hard look at his or her own lifestyle.

For a student of concrete design and construction that may want to consider participating in the Arcosanti Workshop program, information can be obtained by writing:

REGISTRAR, Cosanti Foundation
6433 Doubletree Rd.
Scottsdale, Arizona 85253

The 1982 workshop fee is $400.00 for each 5-week workshop. This fee includes room/board, and insurance for the 5-week stay. Also, schools and other organizations can arrange for groups of students to participate in workshops and special programs. □

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