PRECASTING WITH POLYMER CONCRETE
THE ANATOMY OF A DOME

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POLYMERS IN CONCRETE SYMPOSIUM
THE FIRST 30 YEARS OF ACI #548

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INTRODUCTION

Church architects and general contractors know how difficult, time consuming and costly the construction of a dome can be when using conventional framing techniques with copper cladding, or other standard methodologies. A revolutionary technique has now been developed by the METRO CAST Corporation of Westland, Michigan, which permits the creation of large prefabricated dome sections that can be quickly and economically assembled in place at a job site.

This innovative casting procedure utilizes a high strength precast polymer concrete combined with custom designed stud framing members to create interlocking sections that insure positive watertight joints. These lightweight polymer concrete domes are cast in one-inch (1") thick sections. The polymer matrix has a compressive strength in excess of 12,000 PSI and a tensile strength in excess of 2,000 lbs. A support framing system was custom designed to fully meet all wind and dead load requirements. In addition to its cost and time saving advantages, the polymer concrete dome sections are impervious to water penetration and can be cast in a durable polymer copper exterior if desired, or in any specific color selected by the design architect.

As soon as the supporting structural steel is in place, erection work can proceed to completion very quickly. The 22’ diameter dome for All Saints Greek Orthodox Church in Canonsburg, Pennsylvania is an example of the unique capabilities of polymer concrete in dome construction. It was completely installed in only three working days. The project architect, Mr. John Krusienski of Domianos Brown Andrews Architects, Inc. of Pittsburgh, PA. wrote the manufacturer upon completion of the project, “Your ability to fabricate this entire dome in only four (4) sections with a tight interlocking joint detail facilitated and accelerated completion of the total project. The dome color is exactly the shade we wanted and the uniformity is excellent. From both a cost and performance point of view, we feel your new innovative polymer concrete system offers an effective approach to future dome construction.”

In order to appreciate this simplistic yet ingenious structure each step must be analyzed so as to be able to visualize its creation.
Initially, a skeletal dome shape is formed in four sections and pre-erected so as to check alignment and fit and to simulate the finished shape.
Plywood is then attached from the inside to create the casting mold.

Each section is then placed casting face up. The mold surface is finished to a desired smooth texture and coated with parting agents.
Working from the sides as well as utilizing a platform-like gantry, the polymer concrete matrix is applied by skilled trowlers who at times can be considered artisans for performing this tedious and demanding task. Specially designed inserts are cast into it along with fiberglass reinforcement.

Performed galvanized structural steel trusses are then permanently welded to the cast-in inserts.
After a twenty-four hour ambient temperature cure, the entire unit is lifted from the mold by a hi-low truck and set aside until all the other sections are completed.

The units are then test assembled.
All surfaces are checked for any imperfections. The joining of each of the four spherical pieces is tested for water tightness and accuracy and then dis-assembled, placed on a low-bed trailer and transported to the job site, in this case a distance of 300 miles.

The dome sections were lifted and placed onto the structural base, utilizing a simple lightweight crane. All on-site assembly work was done from the inside. Thus, the world's first prefabricated polymer concrete dome is now gracing this edifice in Pennsylvania, a symbol of the versatility and creativity possible with polymer concrete. Similar polymer concrete techniques can be utilized and applied for use in creating arches and domes of almost any size or contour in segments to fit design criteria.
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PROFILE

Constantin Bodea, graduated from the Polytechnical University in Timisoara, Romania, with a degree in structural engineering and architecture. For many years he was Technical Chief of Engineering Construction and was responsible for many high-rise buildings in Romania, most of them built with precast concrete panels. Later he held the position of Director with a major precast plant employing over 500 employees. In the United States he was the head of engineering with Architectural Research Corporation, a large polymer concrete facility in Michigan.

In 1995, Mr. Bodea acquired a major interest in the Metro Cast Corporation, a small precast polymer concrete manufacturer. Under his management, the company has expanded its output and capacity dramatically. Because of his familiarity with both the structural engineering aspects of precasting and polymer concrete’s versatility, he now specializes in problem solving as well as creating polymer concrete artistic precast products not feasible to accomplish with conventional materials.