COMPOSITE FRP UNITIZED FAÇADE SYSTEMS

Design Investigations at the Material Innovation Lab

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1. Introduction

Fiber Reinforced Polymers (FRP) in architecture are often linked to futuristic projects from Buckminster Fuller’s fiberglass Fly’s Eye Dome and Monsanto’s House of the Future to current theoretical proposals from Peter Tes-ta’s Carbon Tower to Greg Lynn’s call for a “chemical architecture.” More than just a distant future, FRP’s potential can be seen through Snohetta’s design for the San Francisco Museum of Modern Art, now under construction, which employs the largest installation of a FRP unitized cladding system in the United States (if not the world), developed as a joint effort between FRP fabricator Kreysler & Associates with façade design-build company, Enclos. While an ambitious project in terms of scale, geometric variation, and delivery, the FRP is utilized as a rainscreen cladding attached to a more conventional light-gauge unitized panel system. Working with Kreysler & Associates, Enclos, and Gensler Los Angeles, we directed a group of students at Cal Poly’s Material Innovation Lab to envision a fully integrated FRP composite panel system.

2. Design Parameters

The design parameters developed through the collaborative design process by identifying the formal and material potential of FRP and the constraints in the molding process with the need to maximize the unitized façade panel system while limited to the constraints of conventional trucking transportation (10’x40’ in the USA). While the thinness and lightness of FRP can be used as a rainscreen, the structural potential and water-proof surface of FRP
could be exploited as a fully self-supported thermally insulated composite panel system that would completely eliminate secondary steel.

3. Design Process

Five proposals were developed, three which employed a monocoque "lost mold" approach which captures the polystyrene mold as the insulated core, a fourth employed a more conventional urethane insulated sandwich panel between an FRP exterior shell and light-gauge interior (Figure 1) and a fifth which exploited the thinness of FRP in a highly tessellated rain-screen façade (Figure 2). The design process developed from messy and improvisational experimentation with paper maché, to refined physical prototypes and studies in pattern tessellation to detailed wall sections.

By combining the formal potential of FRP with the real-world constraints of unitized façade systems, truly innovative FRP composite panel systems were conceived that were as expressive as they were viable as fully integrated thermally insulated FRP composite panels. As the design proposals are literally larger than what the students could build at full-scale, they were required to work across multiple scales and modes of representation and physical prototyping – which represents a more comprehensive approach to digital integration.