



FRP WAFFLE FORMS HELP ACHIEVE STRUCTURAL, AIR & AESTHETIC GOALS FOR TEXAS INSTRUMENTS' NEW \$3 BILLION CHIP FABRICATION FACILITY'S CLEAN ROOM FLOORING

PROJECT PROFILE / CHALLENGE:

Construction specifications for the 200,000 square foot clean room component of Texas Instruments Incorporated's (TI) new \$3 billion Semiconductor Manufacturing Facility in Richardson Texas (RFAB) mandated strict indoor air quality and structural requirements. The specifications were required to provide the demanding infrastructure to build the world's most advanced semiconductors on 300-millimeter (12-inch diameter) silicon wafers for a wide range of digital signal processing (DSP) and analog-based system-on-chip (SoC) devices for wireless, broadband and digital consumer applications.



With groundbreaking for TI's new RFAB facility scheduled at the end of 2005, the clean-zone architectural design, by Alfonso Mercurio and Associates (Rome, Italy), also raised the bar on aesthetic construction considerations. Key design elements had to be synergistically integrated within the massive architectural design of the four component manufacturing campus.

FRP WAFFLE FORM FLOOR SOLUTION:

Since heavy equipment would be used in the RFAB, concrete flooring was necessary versus the lighter weight metal flooring specified for the administration building. Capform Construction Group (Carrollton, Texas), the projects' concrete formwork subcontractor, specified fiber glass reinforced plastic (FRP) waffle forms to achieve the desired aesthetic and superior performance results required for the two concrete floor slabs on the main building's clean room design plan.



For the project Capform rented approximately 8,000 waffle pans manufactured by the Molded Fiber Glass Construction Products Company (Independence, Kansas) who maintains the largest inventory of fiber glass reinforced waffle forms in the world. Each fiberglass-reinforced thermo-set composite form was 19” x 19”, 14” deep and 24” center-to-center.

According to Lucky Gabriano, Capform’s Field Operations Manager, “MFG was selected because they could provide waffle pans that met the standard size, width and depth specifications for the job. Because we were able to rent standard forms, and they were reusable, we were able to achieve substantial cost efficiencies vs. custom forming.”

ASSEMBLY & INSTALLATION:

Capform personnel built a deck frame treatment area and installed the MFG waffle pans according to the design plan. Steel rebar was then installed to sustain the concrete. Cement is poured on top of a designated grid of waffle forms (i.e.- domes, pans) and steel rebar joists. Blow-holes are built-into the pan/joist grid system which allows an air-compressor to “pop” or release the forms easily once the concrete sets. The result is a “waffle effect”.



Solid, closed -slab areas (covering the actual waffle forms) were poured in the main areas of the building where people would walk. Open-slab areas were poured in the middle of building where heavy equipment was placed which allows air to flow from the first to second floors to facilitate air circulation which helps clean the wafers. The flooring is also raised on top of a grate so machines can efficiently move and clean air so no dirt gets into the wafers during production.



POUR SPECIFICATONS:

- ▲ Total of 500K square feet of concrete was poured for the entire project.
- ▲ Waffle Areas: 150K sq/ft = open waffle & 120K sq/ft = closed waffle
- ▲ Over 57 pours were required for the entire job.
- ▲ Pours averaged 7-8,000 square feet at a time and took 4-5 pours each.
- ▲ The pour then set for two days to reach 75% concrete strength (4,000 psi).
- ▲ Approximately 30,000 square feet of pans were used.
- ▲ The pans were utilized in 10-15 x pours each throughout the project.
- ▲ Job completed in record time: 5 months (vs. originally scheduled 6)



CONCLUSION:

Juan Garza, Capform's Project Superintendent, noted the waffle effect stating, "Once the pans are stripped from bottom, the pattern look provides the aesthetic benefit of having no crooked lines; they're all parallel with building design."

According to Capform's Field Operations Manager Lucky Gabriano, "The uniqueness of the forms provided stronger structural deck, the flexibility of open and closed area applications and aesthetically pleasing results that complimented the RFAB architecture design."