Classical Details in a Harsh Environment

Craftsmen build a coastal house to withstand hurricane winds, meticulous architects and exacting clients

by Robert Weinstein

The first time I visited the building site, I was humbled by Mother Nature. With my head bowed, and a site plan held tightly to my chest, I made my way against 45-mph onshore winds and walked to the eastern-most edge of the property. When I looked up, squinting against the blowing sand, I was standing on the lip of a sand dune, about 80 ft. above the Atlantic Ocean. Even during the tail end of a Nor'easter, it was easy to see why the site had been selected as a place to build a house.

The views were breathtaking. The ferocity of the weather added to the drama of the site. This section of New England coastline is frequently buffeted by gales, and over the last decade, the beaches have taken the brunt of three hurricanes. In short, this was a location that would test the integrity of any building.

The people who owned the property wanted a house that would stand up to the weather while looking as if it had occupied the site for decades (top photo, p. 86). They sought a style that would complement the land and reflect the most beautiful aspects of the area's traditional architecture.

Having built houses for more than two decades, I have become a firm believer in the absolute importance of beginning a project with a complete set of plans. Good plans are not those found in plan books or in the back pages of home magazines.

The architect of the house, Allan Greenberg of Greenwich, Connecticut, is known for his adherence to the classical tradition. Given his reputation for strict attention to detail and the client's demand for a beautifully crafted building, it should have come as no surprise to me when, prior to the commencement of the project, I received a 160-page project manual. A brief review of this volume, and I quickly learned that perfection would be the only acceptable standard. This was a job where cost took a position secondary to the quality of the work. The construction took almost two years and incorporated the skills of dozens of tradesmen, including 14 carpenters. A field architect from Greenberg's office reviewed the project's progress at least once a week. There were also two site inspections from representatives of the structural engineering firm.

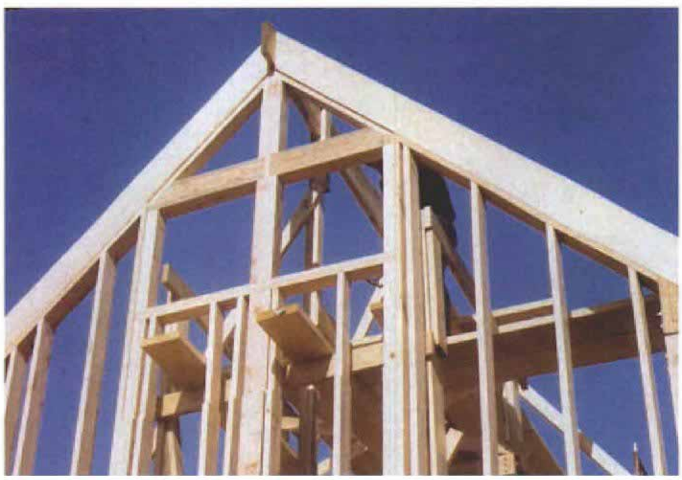
Engineered to withstand 135-mph winds—Because the house occupies a site that would constantly test its structural integrity, it was engineered to withstand 135-mph winds. The specifications required many components not regularly incorporated in a house in this part of the country: glue-laminated beams, hurricane ties and hold-downs (bottom photo, this page), special concrete requirements—including slump tests for all the transit mix delivered to the job—even the framing lumber was unusual.

For a building to withstand 135-mph winds, a strong frame must be connected to a strong, well-engineered foundation. In this case the foundation, starting with the 1-ft. thick footings, which ranged in width from 1 ft. up to 6 ft., depending on their location and function, was reinforced with both vertical and horizontal rebar.

The concrete specs came from the engineer and, like any good recipe, all ingredients were provided to our ready-mix company well before the project began. The mix specified a 3,000-psi ¾-in. pumpable product with the proportions of cement, fine aggregate, coarse aggregate, water content, water-reducing agent, air-entraining agent and the instruction that the batch weights were not to be field adjusted for moisture content, all spelled out in a series of construction memos.

In addition to the rebar and standard anchor bolts, at numerous critical points 1-in. threaded rods were placed in the concrete to provide connection points for hold-downs that would secure the framing from uplift. In many locations dozens of hold-downs for a variety of wood-to-concrete connections augmented the normal anchor bolts.

We used #1 dense-grade southern yellow pine for the framing. This wood is relatively knot-free, very strong, hard and incredibly heavy. There were a lot of aching arms at the end of this framing job. Except where pressure-treated southern yellow pine products were called

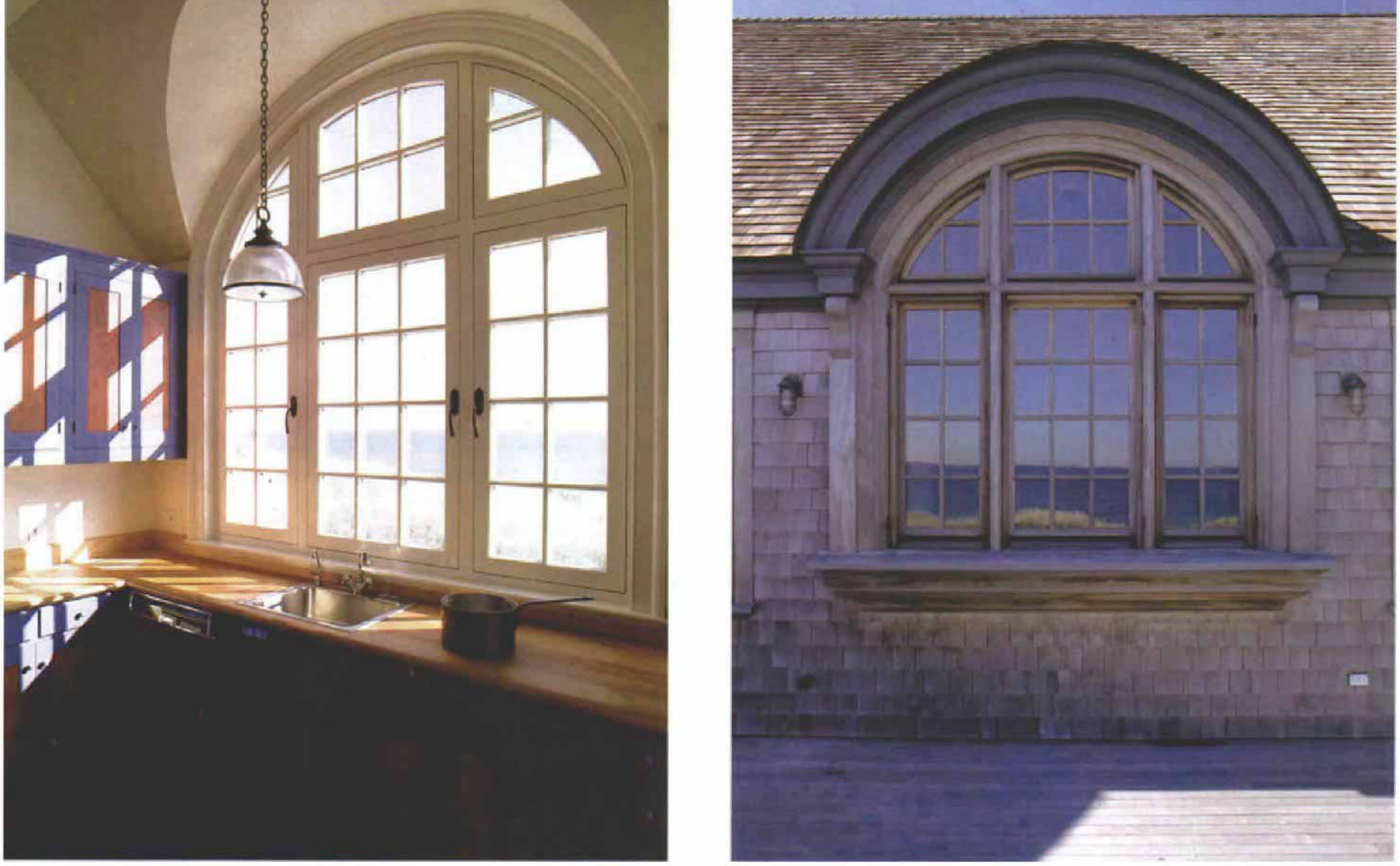


Shear wall. One of two shear walls in the house, this gable end was strengthened with 6x6 timbers that run from the foundation to the rafters. The wall was sheathed on both sides with ¾-in. plywood.

Hurricane straps. Typical of the detailing throughout the house, every rafter was fastened to the walls with galvanized metal straps.

Photos this page: Robert Weinstein

Two miles of trim. Over 11,000 lin. ft. of wood, including teak, mahogany and redwood, was used for the running trim outside the house. The trim includes cornices that were radiused, curved and mitered. All of the trim was biscuited, glued with epoxy and fastened with square-drive stainless-steel screws.



Curved cornice in an eyebrow dormer. The focal point of the house's ocean-side facade is the large, 40-lite kitchen window seen here from the interior (left) and the exterior (right). The curved five-piece exterior cornice terminates in bracketed water tables.

for, kiln-dried southern yellow pine was used throughout the frame.

Shear walk—To minimize racking or lateral motion during storms, the house frame was designed with shear walls at two locations: one at a gable end (top photo, p. 82) and one centrally located in the interior of the house.

The integrity of the shear walls depends on the careful adherence to their design. From the concrete, 1-in. threaded rods were connected to Simpson hold-downs bolted with ⅝-in. dia. bolts to the 6x6 posts that augmented the 2x6 wall framing. The shear walls were sheathed on both sides with ¾-in. CDX plywood that was glued with construction adhesive and nailed off every 8 in. Where the roof sheathing meets the top plate of the shear wall, the sheathing is glued and then nailed with two rows of 10d nails 6 in. o. c.

The studs in the shear walls were tied to the plates with steel stud-plate ties. At the top of the walls, the rafters were held to the plates with steel hurricane anchors. The tops of all the rafters were held to the ridge with sloped or sloped-and-skewed hangers as the location required.

The fasteners used throughout the house were chosen for their holding capacity, corrosion resistance and shear strength. All Simpson Strong-Tie connectors were held in place with nails made by Simpson specifically to meet the load design of these connectors. If we had used regular framing nails or any other fasteners, it would have compromised the function of the various ties and connectors. The framing nails were full-head, either stainless steel or mechanically galvanized. During one framing inspection I told the

Plywood header. The header for the arch top kitchen window is made of seven layers of ¾-in. plywood cut to fit the window's curves.

engineer that if the Simpson Company could fabricate an eyebolt big enough, the whole house could be picked up in one piece.

Keeping out the water—Because water is the main culprit in the decay of wood-frame construction, we tried to keep water away from wood. Where that was not possible, our efforts went toward channeling off the water. Where metal flashing was called for, we used 20-oz. lead-coated copper. Lighter-weight 16-oz. copper is commonly used in residential construction. Many of the flashing details called for the use of both the lead-coated copper and a self-sealing bituminous membrane called Ice & Water Shield, made by W. R. Grace & Company (P. O. Box 620009, Atlanta, Ga. 30362; 800-444-6459).

A soldered head flashing was used over exterior doors, windows and gable vents. A 20-oz. lead-coated copper pan was soldered in place for all the door openings. A soldered flashing also protects the bottoms of windows and gable vents.

The two semicircular bays on the ocean side of the house were a metal smith's nightmare. Paul J. Cazeault & Sons of Orleans, Massachusetts, did the flashing work. The master-bedroom exterior wall incorporates a door and six banked, tilt-turn windows. The flashing of the six windows serves as a counterflashing to the wall flashing below, so it had to incorporate the pan flashing for the door. Small cuts were made in the flashing so that it could be bent to conform to the 9-ft. 1-in. radius of the bay. After the desired shape was attained, the cuts were soldered to make an impermeable metal membrane.

The house's roofs—hips, valleys, ridges and eaves—have weatherproofing components of both bituminous membrane and metal flashings. At the eaves the membrane flashing is applied over 20-oz. lead-coated copper that extends 8 in. up the roof. This eaves flashing is bent so that it projects ⅜ in. over the uppermost piece of the cornice. This same flashing detail—membrane and metal—is also used at the gable ends where it runs along the rake from eaves to ridge.

The bituminous membrane extends down 1 ft. on both sides of the ridge. Over this is a metal cap flashing of 20-oz. lead-coated copper that runs 10 in. down both sides of the ridge. It was later covered with ridge shingles. A layer of Ice & Water Shield extends 3 ft. on both sides of the valleys. And then, as we shingled the valleys with the 18-in. red-cedar roof shingles, we step flashed

Bottom photo, this page: Robert Weinstein

each course with 18-in. diamond-shaped pieces of membrane flashing. The hips were done in a similar fashion, using smaller diamonds.

Following the architect's specifications for the flashing details was time-consuming and at some point seemed to be overkill. But after numerous brutal winter storms, the house remains tight to the weather.

After the house was completed, I drove out to the site during a hurricane. As I stood in the living room, nothing stirred, nothing creaked. The only noise was the wind rushing over the top of the chimney, sounding like a jet engine.

Teak, mahogany and stainless steel—The different woods used on the exterior of the house were chosen for both their beauty and durability (photos p. 83). Red-cedar shingles were used on the roof, and white cedar was picked for the sidewalls. The 11,582 lin. ft. of exterior trim, which includes rakes, cornices, belt course and water tables, is mahogany. Exterior handrails, newel posts and staircase, as well as the 13,220 lin. ft. of exterior quartersawn decking are all teak.

All doors and windows were designed by the architect and fabricated for this project. The exterior doors—12 French doors, five panel doors and their accompanying screen doors—are constructed of pattern-grade mahogany. Pattern-grade wood is considered to be the most defect-free of all grades. The 35 tilt-turn windows and the five casement units are also built with pattern-grade mahogany. This grade of wood was used because the owners wanted the exteriors of all doors and windows to have a natural look with a clear finish. A lesser grade of wood would have imperfections that would mar the finish surface.

All of the running trim was installed with stainless-steel screws. Screws have superior holding power over nails, but there was another reason we used them for the trim. Using screws enabled us to dry-fit the myriad pieces of cornice, columns, water tables and scotia. Because we were working to the highest standards and the smallest tolerances, we had to be able to dismantle easily any of the hundreds of trim components and adjust a particular cope or miter until the joints were perfect. All of our end-to-end joints are scarfed and biscuited and glued with a two-part West System epoxy glue (Gougeon Brothers, Inc., P. O. Box 908, Bay City, Mich. 48707; 517-684-7286). When we were working in the cold, we added a hardener that accelerates the curing process of the glue. More than two years after the completion of the construction, all joints remain perfectly tight.

Numerous times during construction we were asked by the owners or the architect to build a full-scale mock-up of a trim detail on the house for inspection (bottom photo, right). Although it was time-consuming work, both the architect and the client were thoroughly satisfied with the final results. There were no surprises.

Porches and decks—The floors of the decks and the covered porches are made of 1-in. by 2⅞-in. quartersawn teak with slightly eased edges. On the covered porches, the floors are mirrored by the porch ceilings. The ceiling stock is ¾-in. by 2¾-in. mahogany with chamfered edges. Unlike the porch and deck floors, which are left natural, the porch ceilings are painted.

Because of the long, continuous runs of ceiling stock, the eye might pick up slight deviations in the coursing. Therefore, the long runs are broken intermittently by 6-in. wide boards that run perpendicular to the ceiling.

To guarantee that our courses for the long runs of porch ceilings and porch and deck floors remained straight—the deck on the ocean side is 83 ft. long—we strung monofilament fishing line along the framing as a reference line. Monofilament can be strung very tightly, and it doesn't stretch or sag the way nylon masons

No surprises with fall-scale mock-ups. In the photo below, a porch cornice is mocked up with the full-scale profile of a tapered column (cut from 1x stock) set in place for final approval from the architect and the client. This ensured that there would be no surprises when the porches were flanked by 24 columns (photo above). Visible along the outside edge of the porch ceiling are the unobtrusive vents for the roof system.

Bottom photo, this page: Robert Weinstein

Tight to the weather. Utmost care was taken to waterproof the house. The soldered 20-oz. lead-coated copper shown at right is typical of the house's flashing details. All doors and windows had soldered head flashings. A soldered flashing also protects the bottoms of doors, windows and gable vents.

string might. Monofilament's small diameter allowed us to work to high tolerances.

The porch ceilings contain two continuous vents that ventilate the roof system. The vents are screened with stainless steel, and all ceiling framing members were painted flat black so that they would not be visible.

Perhaps one of the most striking features of the house is the arched kitchen window (top photos, p. 84). The construction of the rough opening and the assembly of the window unit as it came to us from the millwork shop presented quite a challenge. The unit itself is made of three rectangular, tilt-turn sash and three curved, fixed sash above. The five-piece cornice at the head

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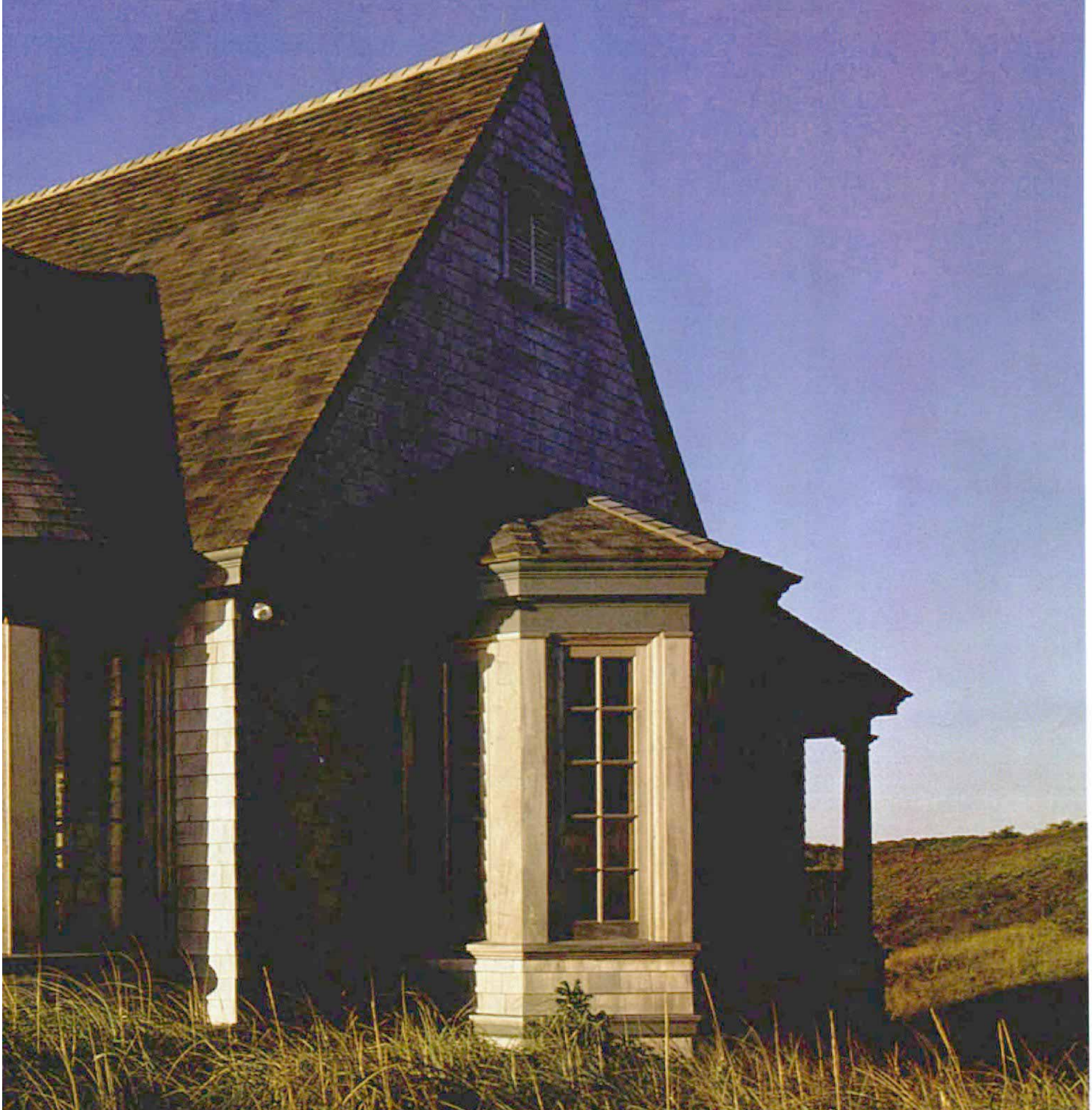

of this massive window is curved; the two ends of the curve terminate in bracketed water tables.

If the window was installed in a flat wall, the installation would have been fairly straightforward. The rough opening complicated things because it incorporates a 3-in-12 pitch eyebrow dormer that ends flush with the sidewall. We built the header out of seven layers of ¾-in. plywood. Each piece was cut to the curve of the window arch as well as to the angle of the dormer pitch (bottom photo, p. 84).

Another area of the exterior that tested everyone's layout and assembly skills was the installation of the 14 redwood Tuscan columns and their attendant teak handrails (top photo, p. 85).

The columns were shipped in halves, which were joined on site around a pressure-treated 4x4 post. We used West System epoxy resin glue to join the column halves together, and 1,000-lb. test nylon band clamps were used to hold the column halves together as the glue cured.

The joint where the top handrail meets the column had to be coped to the radius of the column. The joint is demanding enough where the column is straight, but these columns taper top to bottom. There was a good deal of filing to get a perfect fit.

The construction of this house has been the greatest learning experience of my many years working as a residential contractor. The expertise and assistance from the architect throughout the construction process made an enormously complex job proceed without difficulty. This was a project that depended upon the coordinated collaboration of dozens of players: the architectural staff, the project supervisor, the carpenters, the subcontractors, as well as all material suppliers. The building stands as a testament to this cooperative effort, and each time I visit I am impressed by the beauty and the integrity of what the joint effort produced. □

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