ENGINEERED DESIGN AND CONSTRUCTION
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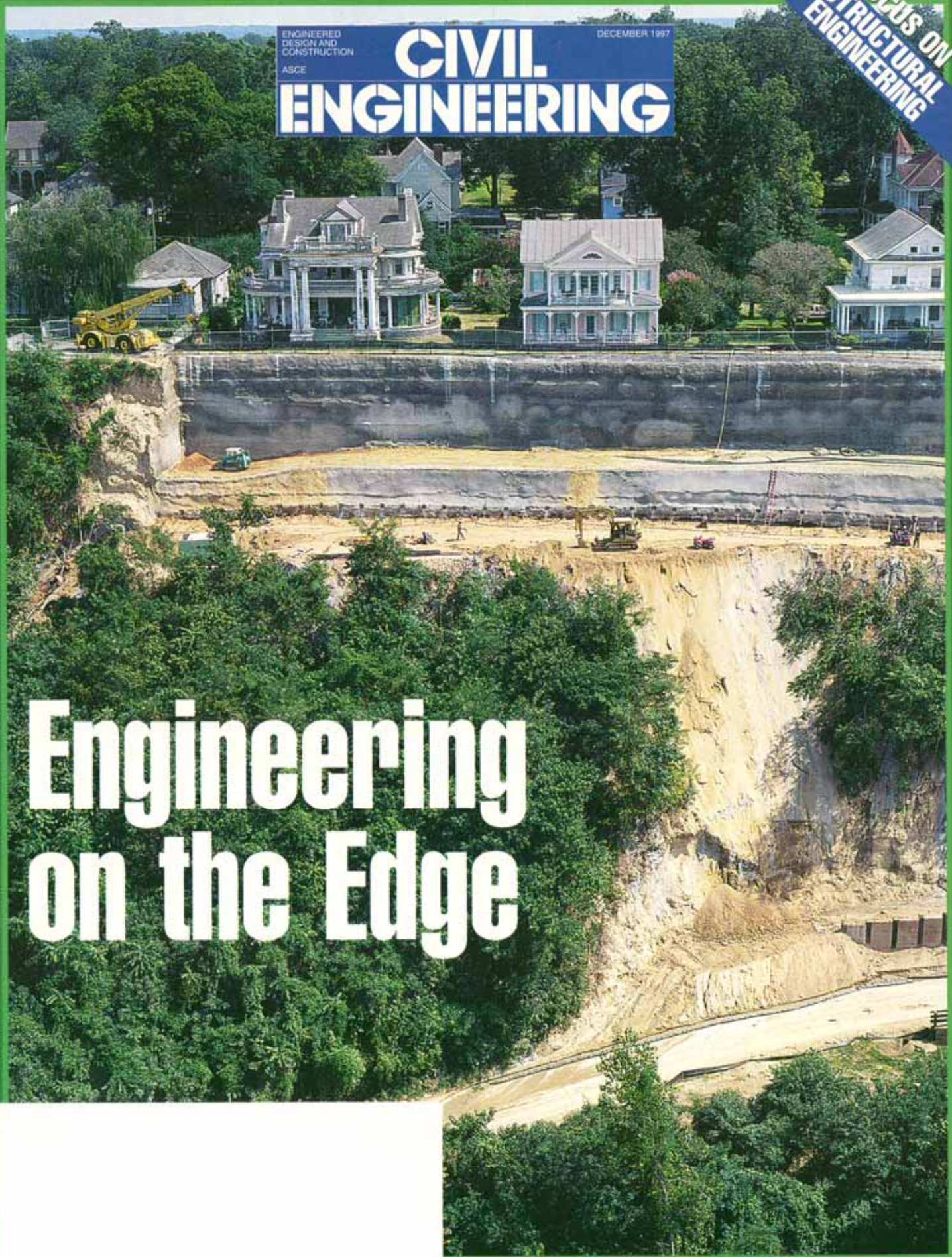
CIVIL ENGINEERING

DECEMBER 1997

FOCUS ON STRUCTURAL ENGINEERING



Engineering on the Edge

A roof replacement project at the Huntsville Memorial Hospital in Houston was completed without disrupting patients and staff.

Rx FOR ROOFS

A roof system installed at a Texas hospital uses layers of insulation board to withstand foot traffic, meet aesthetic criteria and ease maintenance.

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Water was dripping into the magnetic resonance imaging ward at the Huntsville Memorial Hospital in Houston, prompting maintenance personnel to request that a consultant inspect the roof system, determine the cause of the leaks and design a cure. The consultant, Price Consulting Inc., Carrollton, Tex., chose a new two-ply, fiberglass-reinforced modified bitumen membrane roof system to meet design criteria while avoiding disruption to staff and patients.

The hospital comprises a four-story main tower with attached one-story areas. Five different roof areas total approximately 80,000 sq ft. The main tower roof was replaced about four years ago and is functioning well. However, about 8,800 sq ft of roof on the one-story areas had become debilitated and needed to be replaced; another 30,000 sq ft needed repair.

The hospital structure is composed of a steel frame skeleton, brick masonry veneer exterior walls and aluminum-framed horizontal ribbon windows. The roof on the one-story areas consisted primarily of a gravel-surfaced built-up roof membrane over lightweight insulating concrete fill and a corrugated metal form deck. A similar built-up roof membrane over a double layer of rigid insulation board and a fluted steel deck covered a smaller roof section.

CRITICAL DESIGN CRITERIA

The design had to meet the functional and operational needs of the hospital. The roof's finished surface needed to be aesthetically pleasing from overlooking windows and durable enough to accommodate foot traffic when rooftop equipment was serviced. The new roof also had to be

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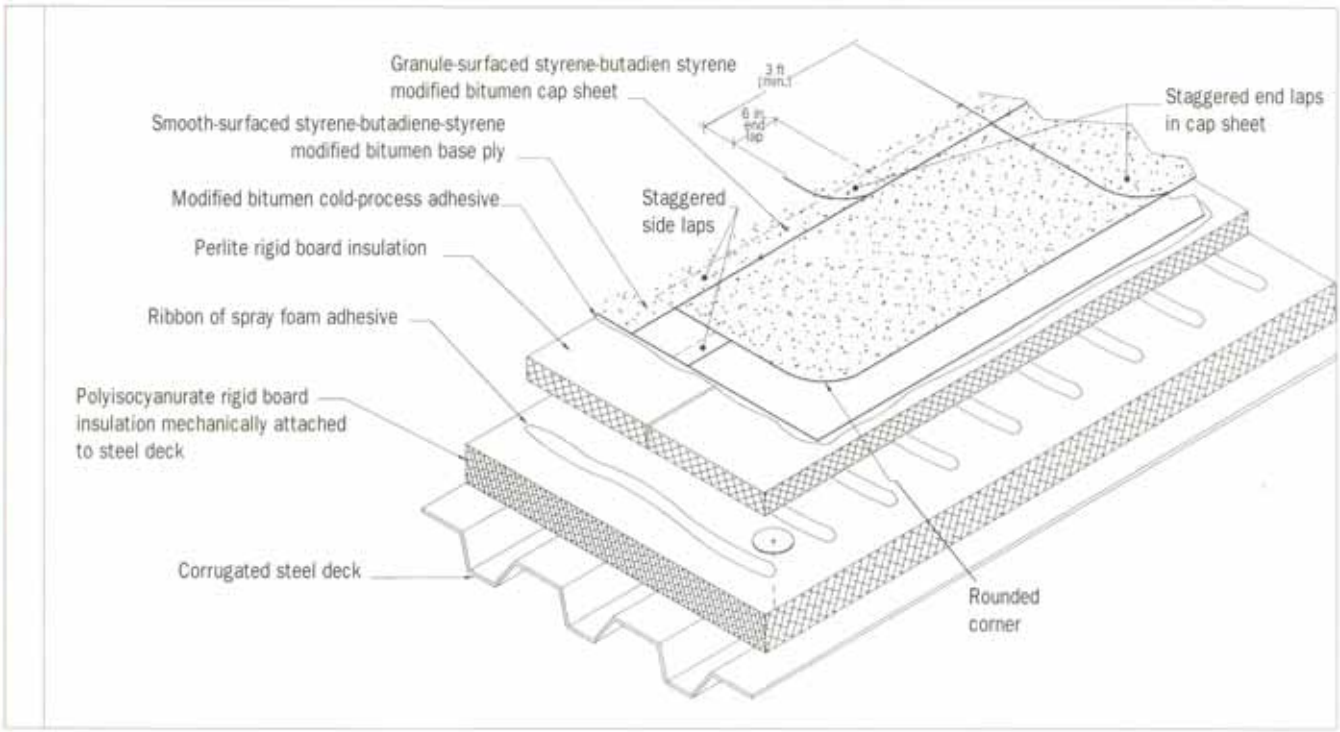

The roof system had to be durable enough to support foot traffic.

compatible with the existing structure to meet insurance requirements and to withstand the hot Houston summers. Finally, the roof had to be relatively easy to maintain, allowing for straightforward identification, prognosis and repair of problem areas.

Operational issues also were critical. Construction could not interrupt hospital operations or impede automobile and pedestrian traffic. Disruptions to in-house staff, patients and visitors needed to be minimized. The consultant selected a two-ply fiberglass-reinforced styrene butadiene styrene (SBS) modified bitumen membrane, consisting of a smooth-surfaced, fiberglass-reinforced SBS modified bitumen base ply (Paradiene 20 and Paradiene 20 TG, manufactured by Siplast, Irving, Tex.) and a granule-surfaced, fiberglass-reinforced SBS modified bitumen top ply (Paradiene 30 TG FR), or cap sheet. The top ply met the required fire rating classification. Workers could install the membrane using a cold-process adhesive or torch-applied methods to avoid tar odors that might affect hospital occupants.

On the portions of the roof that had lightweight insulating concrete fill and corrugated metal form decking, a fiberglass base sheet (Paraglass, from Siplast) was first mechanically attached with FM 90 base-ply fasteners (ES Products, Bristol, R.I.). The Paradiene 20 TG base ply was applied directly to the base sheet by torch. The Paradiene 30 TG FR top ply was then applied by torch to the base ply.

A different roof system was installed over the rigid insulation board and fluted steel deck. A base layer of polyisocyanurate rigid insulation board $1\frac{1}{2}$ in. thick was

Crews attached rigid insulation boards using a foam adhesive.

screwed to the steel deck using self-tapping screws and stress plates. A secondary layer of perlite rigid insulation board was bonded to the polyisocyanurate insulation with an expanding spray foam adhesive. The foam adhesive was applied in ribbons with diameters of about 1 in. across the top surface of the base insulation layer, and the perlite insulation board placed into the adhesive.

The Paradiene 20 was then firmly bonded to the perlite board with a cold-process asphalt-based adhesive applied to the insulation board with a notched squeegee. The base ply was embedded into the adhesive and rolled with a weighted roller. The Paradiene 30 TG FR was then applied to the base ply by torch.

Prefinished galvanized steel flashings enhance the roof's aesthetic appeal.

To achieve optimum aesthetic appeal and technical performance, crews aligned the end laps of every other cap sheet. Corners of the cap sheet end laps were rounded, and granules were broadcast onto the bituminous bleedout, where they adhered, along the side and end laps of the cap sheet. Aluminum dust was placed on the bleedout of base flashing material to maintain the foil's monolithic appearance and provide a protective surface for the exposed bitumen.

ACCESSORIES

Flashings, expansion joint covers and equipment supports were chosen to enhance aesthetic appeal. Prefinished galvanized steel with a Kynar coating was used for visible metal flashing assemblies such as the coping cap flashings along the parapet wall and the counterflashing along the building wall. The color was matched to existing building material colors to minimize future painting requirements.

The exposed sheet metal flashings at penetrations (lead sleeves, flashing pans) and drain strainers were painted with an aluminum pigmented asphaltic coating to maintain visual appeal. Prefabricated expansion joint covers were used at roof-to-roof and roof-to-wall expansion joints. Premanufactured equipment supports eliminated the need for penetrating supports or wooden sleepers at rooftop equipment locations.

Carefully chosen and installed roofing materials have made this hospital roof replacement a success. With annual inspections and regular maintenance, the revitalized roof should provide many years of service.

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