A Gem in the **Mountains**

By Carol A. Stevens, P.E., SECB and Phillip A. Warnock, AIA, NCARB

Restored dome and main entrance.

The Upshur County Courthouse, built in 1899, is situated in the weathered mountains in the north central West Virginia town of Buckhannon. Located on a prominent corner in downtown, the dome of the courthouse can be seen from miles away while traveling through the hills. The building is constructed of brick with a rock face sandstone foundation and monumental sandstone columns supporting the portico. A wooden cornice with heavily detailed dentil molding trims the entire building at the roof level. The dome is supported by a brick tower that draws one's eye to the top of the structure, where decorative Corinthian cast iron columns adorn the façade. The dome itself is constructed of radial arch steel trusses with wood decking and galvanized sheet steel cladding. Time and weather had taken a toll on this gem, which has suffered the consequences of good intentions.

The investigation of this phased project started with the Upshur County Commission applying for grants through the Courthouse Facilities Improvement Authority. Since the grant monies were limited, the project was completed in three phases, with three different contractors. The first issues addressed pertained to the main entrance. Initially, the terrazzo flooring was raised, prohibiting the proper function of the main entrance doors. The terrazzo had cracked and chipped, and had been repaired with grout. It was determined that a structural steel beam directly below the entrance was severely deteriorated, with rust jacking causing the flooring issues above. In lieu of replacing the beam and pipe column support, the masonry wall below was extended up to support the floor above.

In addition to repairing the terrazzo and structural issues at the main entry, accessibility issues were addressed. As the root problem appeared to be water and salts migrating toward the entry, a lightweight concrete pad was provided on top of the existing portico slab to provide positive slope away from the building and provide a level entry plane at the portico. Ramps were provided at the plaza and an ADA compliant chair lift was installed, with all work complimenting the historical aesthetic of the property.

In the second phase of the project, the dome was repaired and restored. During the initial investigation, it was discovered that the dome had actually shifted because the legs of the inverted steel channel that it was resting on failed, causing the south side of the dome to be approximately 1½ inches lower than the north. The rusting was so advanced that the riveted connections between the truss rib and the bottom channel ring were completely deteriorated in some locations. The shifting also caused low slope areas above the cast iron ornamental columns to slope toward the building, essentially funneling water into the structure. Previous repairs, including EPDM roofing installed directly over leaking panels, increased the deterioration of the galvanized sheathing and the water infiltration in the dome area. The brick tower began to deteriorate due to the presence of water. As the interior brick spalled and steel rods anchoring the structure to the brick disintegrated, the deterioration of the dome structure continued until the only thing holding the dome to its unstable base was gravity.

Left: Failed steel channel and riveted connection at truss. Right: Repaired connection at truss.

Brick fired at the same plant and from around the same time that the courthouse was built was salvaged from a local house, and used to replace those bricks that had lost their structural integrity. Bricks and anchors were reset, repointed, and when necessary, replaced to create a structurally stable base for the steel dome trusses. A jack truss was created to allow the replacement of the entire steel ring at the bottom of the trusses. A steel angle was used in place of the steel channel, as the previous channel caught and trapped water and pigeon droppings, leading to its disintegration. Slight corrections were made to counteract the dome shifting without stressing the roofing system. The wood windows and louvers were repaired to deter pigeons from roosting in the dome. The original roofing system on the dome consisted of painted galvanized steel sheets on wood decking. For galvanized steel that was over 100 years old, most of the original steel was in remarkable condition. However, as the processing of steel changed around WWII to speed its manufacturing, the replacement of damaged steel with in-kind materials was impossible. Terne-coated stainless steel was selected to replace damaged areas, and low slope areas were built up to provide positive drainage with no visual impact from the ground. Once all leaks were repaired, the roofing was coated with a high performance polyurethane industrial coating that provides the greatest protection for the roofing and provides a clean white gloss finish. The dome's cast iron columns and column bases were repaired and coated as well.

When the dome was painted, the front entrance columns and all of the exposed wood were also scheduled to be painted. The sandstone columns were also a victim of time, good intentions, and available materials. Being sandstone, the columns were coated early on, most likely with a lime wash, to protect them from the weather. Over time, repairs up to ten inches deep on the 30-inch diameter columns were made with nonshrink grout. In an effort to further protect the columns, hide the nonshrink grout repairs and smooth out the column finish, the columns were coated with a cementitious parging and a waterproof coating. This system was in line with preservation techniques at the time, and worked fairly well as long as there were no cracks in the parging and the coating was maintained.

However, when hairline cracks appeared, water penetrated the system and could not escape. Freeze-thaw cycles and hot days combined to break down the underlying stone's properties, essentially rotting the stone because water could not escape the waterproofing. Areas of parging began to fall off, uncovering softened stone and sometimes pulling good stone with it, as the bonding strength of the parging was greater than that of the stone. The parging and waterproofing were removed from the columns and left exposed over the winter, allowing the stone to "breathe" and dry out. Many areas of stone were much stronger after drying out, no longer crumbling when rubbed with fingertips. The removal of the parging also exposed some beautiful detailing, that had been hidden for unknown years, at the stone capitols of the entry columns and at the column bases. Core samples were taken to determine the properties of the inner stone, including compressive strength, bond strength and color.

Scaffold around dome to facilitate repairs.

The repair of the stone elements at the main entrance (columns, railings, cheekwalls and foundations) turned into the third and final phase of the project. Matching the original stone properties, repair mortar was created to repair portions of the stone columns, railing and foundations. Other stones were too severely damaged to repair and were replaced in-kind with dutchmen. Steel bracing was installed before the deepest prior repair materials were removed due to concerns with the structural integrity and stability of the columns. Where cracking of the stone carried through an entire column, injection repairs complemented stainless steel cross-pinning to stitch the column together. All areas of grout and other cementitious repair materials were removed and repair mortar was installed. Shallow cracks were routed and repaired; deeper cracks were injected with repair materials. Column base and railing sections were repaired with the repair mortar and the original stone profile was restored.

Due to funding limitations and a conscious decision not to remove all traces of work, wear and weather from the columns, only the most egregious of the pits and ruts on the stone were repaired along with the structural issues discussed above. This created a structurally sound set of columns, railings and foundations while retaining a patina of the 100 plus years of use. The smooth-tooled areas of stone that had historically been coated were provided with a self-cleaning, mineral coating specifically formulated for stone and approved for historic preservation use. This coating has a very high rate of vapor permeability and allows the stone to breathe while preventing liquid water from penetrating the stone. At the rock-faced stone, color-matched mortar and dutchman were used to match the existing stone.

In all instances, the design team endeavored to fix the root cause of each problem, while making repairs in a historically accurate and sensitive method with the best materials and methods currently available. The Upshur County Courthouse Renovations project has been awarded the Honor Award for Excellence in Architecture by AIA West Virginia.

This series of projects, performed by three separate contractors, was completed for $865,000, an amazing deal when the price of a new courthouse is considered. The result has provided the people of Upshur County with a courthouse complex that is stable, accessible, beautiful, and well positioned to provide services for the next 100 years. The "Gem in the Mountains" has been polished.▪

Project Team

Structural Engineer of Record – CAS Structural Engineering, Inc.
Architect of Record – Chapman Technical Group
Restoration Consultant – William S. Kostelic
Owner – Upshur County Commission

Contractors:

First Phase – Huffman Corporation
Second Phase – Allegheny Restoration & Builders, Inc.
Third Phase – Keystone Waterproofing, Inc.

Left: Distressed sandstone columns discovered upon parging removal. Right: Restored sandstone columns and bases.

Carol A. Stevens, P.E., SECB, is president of CAS Structural Engineering, Inc, a consulting firm in Alum Creek, WV. Ms. Stevens has been recognized by both AIA-WV and AIA–NY for restoration projects within West Virginia. Ms. Stevens can be reached at ***calalane@aol.com****.*

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