ADC/BEE contracted with the College of Charleston under an open-end contract for building enclosure consulting services to implement the rebid Avery Research Center enclosure renovation and mechanical system replacement based on a previous field investigation and subsequent written report.

The combined project was necessary because the air/moisture intrusion and mechanical issues needed to be resolved simultaneously.

The three elements of the facility were the roof, exterior (including fenestration), and the mechanical systems, which created a complex and unique project:

1. The initial bids were over budget.
2. The mechanical portion of the work was the greater cost in the current project, but its value/benefit was directly related to addressing four critical aspects of the building enclosure. These were:
   a. The roof,
   b. The exterior walls and fenestrations,
   c. Windows specifically, and
   d. The fascia/soffit and attic air leakage.
3. Redesigning and repackaging the project in this format with the reduced mechanical scope provided the best option and value for the College of Charleston.

The base bid included building enclosure renovations, a mechanical system upgrade, and related architectural work. Cleaning; preparation of existing elastomeric coating over stucco, historic masonry, concrete, and CMU block surfaces; repointing of brick and CMU masonry; repairs to stucco and concrete surfaces; removal and replacement of all exterior sealants; and removal and replacement of all windows (including modifications to openings) were also part of the base bid. Base bid work also included total removal of the existing roof system, down to the structural deck, and replacement with a new thermoplastic roof system, including flashings (membrane and sheet metal), edge metal, tie-in to fascia/soffit conditions, gutters, downspouts, an insulation system with taper and cricket layout, closures, underlayment systems, and roof assembly components for roof areas A, B1, B2, C1, and C2.

This project is a historic facility and accordingly required various submissions and meetings to the City of Charleston Board of Architectural Review (BAR) and the state of South Carolina State Historic Preservation Office (SHPO).

The project also presented unique challenges that were resolved (including trapped bats at the end of the project due to the closure to all openings, including chimney locations).

Due to the corrective actions for air/moisture infiltration and mechanical renovation, all client criteria were met.

Richard Cook, Jr.
ADC Engineering, Inc.

Enclosure Renovation and Mechanical Systems Replacement
Avery Research Center, College of Charleston
Charleston, South Carolina
Since its completion in 1937, the Main Building, designed by architect Paul Philippe Cret in the Beaux Arts style, has served as one of the most recognizable symbols of the University of Texas at Austin (UT). It was constructed in two separate phases; the original library building was built in 1933, and the second phase, which includes a 30-floor tower, was constructed in 1937. The Main Building consists of concrete and masonry construction, with primarily stone cladding. The 307-ft. tower is surrounded by a larger three- and four-level administrative office space.

Water leakage had been reported throughout the building below the low-slope roof, steep-slope roof, and terraces. Numerous localized repairs had been made with varying degrees of success. UT retained WJE to evaluate the condition of the roofs and provide repair/replacement design, followed by construction administration services. The 26 different roof, terrace, and roof garden areas include approximately 22,750 sq. ft. of steep-sloped roofs and clay tile, approximately 19,250 sq. ft. of low-slope, gravel-surfaced built-up coal tar roofs (BUR), and 5,800 sq. ft. of waterproofed terrace and roof garden areas around the UT president’s office.

WJE’s comprehensive evaluation began with a review of the original construction drawings, as well as interior and exterior visual surveys to document existing conditions of the roof assemblies and terrace waterproofing. With the assistance of a contractor, WJE performed exploratory openings at low-slope roofs, roof gardens, and terrace areas to determine the composition of the existing roof systems and deck types. We also performed fastener pull-out strength testing at various locations and calculated the slope of each roof system.

As a result of our assessment, WJE identified low-slope roofs with low R-values (i.e., little to no insulation), low flashing heights, a terrace waterproofing system that was more waterbed than waterproofing, and a large grass terrace with a host of other drainage issues. UT requested that all the roof systems be updated to meet code, fall arrest systems be installed, ADA compliance be integrated into the terrace, drainage issues be addressed, new turf be installed, and a majority of the demolition/construction of the project be completed on a 73-day timeline.

Our design included a new terrace system with lightweight concrete, providing the structure and slope for new ADA ramps; hot fluid-applied, fabric-reinforced membrane with a pedestal/paver combination system; grouted tiles; and artificial turf. For the remaining roof systems, we designed replacements to include an increased R-value, meeting current code standards.
This entire campus was constructed new in 1995. All the buildings are single-story masonry buildings surrounding a central courtyard. All roofs were fiberglass composite shingles over Loadmaster composite gypsum board, rigid insulation, and a structural steel roof deck system. There were ongoing water intrusion issues throughout the school, primarily due to the anchorage of the fiberglass shingles directly to double layers of gypsum board with specialty “spreading-leg”-style nails, which created holes through the underlayment. Due to the lack of a nailable substrate to which replacement shingles could be anchored, the owner elected to apply a pre-finished metal standing-seam roof system over a new self-adhesive, modified-bitumen membrane underlayment.

This is the fourth campus of this prototype design that has been addressed by our office. Although familiar with this design, we performed a field investigation to document the existing conditions and flashing details specific to this campus.

The scope of roof replacement was to remove the existing shingle roof down to the underlayment, which was retained, as well as the underlying gypsum board and rigid insulation to avoid disturbing the Loadmaster deck system. The new roof system was a mechanically fastened, pre-finished, 24-gauge Galvalume® steel snaplock standing-seam roof system applied over the new underlayment and secured directly to the underlying steel roof deck.

All edge conditions, transition flashing, and penetrations were detailed. All flashings were either soldered stainless steel or epoxied prefinished Galvalume® steel, except for the gutters, which were prefinished aluminum, and downspouts, which were extruded aluminum tube. The roof and flashing system interfaces with fascia and gable end walls that are clad with residential-style lap siding. This siding was removed and reinstalled over a new self-adhesive, modified-bitumen membrane underlayment. A 20-year NDL manufacturer’s weathertightness warranty with a high wind rider was provided for the new metal roof system.

This was a design-bid-build project that required full bidding and construction documents to ensure that the roofing and flashing system would be installed as intended. Our office provided roof plans and detailed all flashing components and fabrications associated with the roof system using AutoCAD®, and compiled all technical specifications, which were distributed and bid as digital files. Our office also assisted with bidding and permitting, supplied construction administration, and performed periodic quality assurance observations with written photographic reports.
Based on a previous investigation and written report provided by ADC Engineering, Inc./The BEE Group, The Citadel contracted with ADC/BEE to provide roof consulting, design, and construction administration services for the replacement of the Citadel Coward Hall roof.

The scope of work included field investigation, design, and construction administration. This included conducting the mandatory pre-bid conference, preparing addenda, conducting a bid opening, assisting with the award of bid and the pre-construction conference, and performing milestone visits during construction. The milestone visits included progress site visits, pre-final inspection, final inspection service, and a future one-year warranty inspection. Submittal review, general construction administration, and contract close-outs were also included with the scope. The design was based on the current Office of State Engineer (OSE) and code requirements for the State of South Carolina. Unique and customer submittal logs, weekly progress reporting/monthly project schedules, and close-out documents were included in Division 01 requirements.

Various issues were addressed and resolved:

1. Improper drainage of upper roof over Roof Area C

2. Improper terminations and transitions of structural standing seam metal roof (SSSSMR) at the exterior insulation and finish system (EIFS), and lack of “kick outs”

3. Thermally inefficient design, with lack of continuity at wall termination, roof terminations, and at Roof Area C’s structural standing seam metal roof, with batt insulation over bar joists

Two options were provided to address/resolve the issues:

1. Roof replacement using a mechanically fastened thermoplastic single-ply membrane for low-sloped Areas A, B, D, E, and F from the original construction of 1992 (25 years old). Note: reuse/recycling of the insulation with added new insulation and cover board was included.

2. An alternative for roof replacement of the steep-sloped metal roof, Area C, with a fully adhered thermoplastic roof system with ribbed applications to simulate the previous structural standing seam metal roof thermoplastic single ply

This was a unique project in two ways:

1. At Roof Area C, due to original drainage issues directed over a structural standing-seam roof intersecting with a barrier EIFS wall assembly, the existing SSSSMR assembly was removed. Metal decking with multiple layers of insulation and a fully adhered thermoplastic roof with ribbed accessory to maintain the appearance of metal while providing a thermally efficient and waterproof roof, were added.

2. The mess hall remained in operation at all times, with significant pedestrian traffic and ongoing operations around the facility due to its location in the middle of the five barracks.

The project ran smoothly and was completed within the time restraints.
The entire campus of Alice B. Landrum Middle School was constructed in 1991. The campus is a mixture of pre-finished standing-seam metal sloped and low-sloped aggregate-surfaced built-up roofs, both over rigid insulation and a steel roof deck. The metal roofs were refurbished by our firm in 2009, which included limited replacement, flashing repairs, and refinishing the metal panels themselves. At that time, we performed focused membrane and flashing repairs, which extended the service life of the built-up roof system to 28 years and allowed the owner to budget for replacement. This two-phase roof replacement project was the result of water intrusion issues appearing over time due to the age of the roof system. This project was to replace the first half of the built-up roof during the summer of 2019. Due to our previous experience with this campus, our field investigation was to document the existing conditions and flashing details. It also revealed that the refurbished metal roof systems were still performing well.

During the 2009 project, we had designed many of the flashing and built-up roof repairs, anticipating the future low-slope roof replacement work by using removable and reusable flashing to separate the two roof systems. The scope of replacement was to remove the existing roof membrane and rigid insulation down to the metal deck, inspect existing conditions, and replace any deteriorated materials. The new roof system was mechanically fastened rigid insulation, adhered gypsum board, and a 3-ply, reflective, granule-surfaced, heat-welded, polyester-reinforced, SBS modified-bitumen membrane system. All parapet, transition, and penetration flashings were detailed; coping caps were installed at parapets; stainless steel flashing was used throughout; and all gutter drainage was calculated and corrected. One severely overloaded gutter was enlarged and an additional downspout provided. At the existing edge-metal-to-coping-cap transitions, freestanding area dividers were constructed to allow for a reliable flashing transition between the two conditions.

This was a design-bid-build project that required full bidding and construction documents to ensure that the roofing and flashing system would be installed as intended. Our office provided roof plans and detailed all flashing components and fabrications associated with the roof system using AutoCAD®, and compiled all technical specifications, which were distributed and bid as digital files. Our office also assisted with bidding and permitting, performed construction administration, and conducted periodic quality assurance observations with written photographic reports.
This reroofing project encompassed the entire building, which was divided into three distinct roof areas with a total roof area of approximately 13,800 sq. ft. The primary roof area was designed and the installation monitored by our firm 24 years ago, but it was experiencing water intrusion into the space below due to age and damage from a recent mechanical renovation project, which threatened critical court records.

Our office still had the documents and records from the reroofing project 24 years previous, but we needed to perform a new field investigation to allow us to confirm the current conditions and discover any changes to the building. The existing roof system was a granule-surfaced, modified-bitumen-capped, built-up roof system over an unusual precast concrete deck system. The main roof area was a deck using 24- x 48-in. precast lightweight concrete planks secured to the underlying steel joists with wire clips, many of which were corroded or broken. Therefore, deck anchorage had to be supplemented.

Building code updates over the years required increased insulation be installed and emergency overflow drainage corrected. The scope of replacement was to remove the existing roof and insulation down to the metal deck, inspect existing conditions, and replace any deteriorated materials. Steel plates at the corner intersection of four planks were secured to the structure and a preliminary roof membrane applied to protect the building interior and contents. The new roof system was adhesively fastened, with ¼-in.-per-ft. tapered rigid insulation and gypsum board, followed by application of a 3-ply reflective granule-surfaced, heat-welded, polyester-reinforced, SBS modified-bitumen membrane system. All parapets, transition flashings, and penetrations were detailed; coping caps were installed at parapets; stainless steel flashing was used throughout; and a 20-year NDL manufacturer’s weathertightness warranty with a high-wind rider was provided for the new roof system.

This was a design-bid-build project that required full bidding and construction documents to ensure that the roofing and flashing system would be installed as intended. Our office provided roof plans and detailed all flashing components and fabrications associated with the roof system using AutoCAD®. We compiled all technical specifications, which were distributed and bid as digital files. Our office also assisted with bidding and permitting, as well as construction administration, and performed periodic quality assurance observations with written photographic reports.
The EvergreenHealth project was a hospital building with uninsulated masonry and concrete walls. A new rainscreen cladding was proposed, and the architect, SRG Partnership, Inc., wanted to add continuous insulation between the existing masonry wall and the new metal cladding. Hygrothermal analyses of three different wall assemblies were performed using WUFI® software to evaluate where to locate the vapor barrier to minimize condensation potential within the walls. The purpose of this report was to provide recommendations on where to locate the vapor barrier on the three wall assemblies investigated, and to recommend a product for the vapor barrier.

The wall assemblies investigated were:
1. Uninsulated masonry wall with continuous insulation and metal panels applied to the exterior side;
2. Uninsulated masonry wall with a new concrete shear wall, and continuous insulation and metal panels applied to the exterior side; and
3. Uninsulated concrete beam with new continuous insulation and metal panels applied to the exterior side.

In all cases, wall assemblies with the combined air barrier and vapor retarder stay dryer through the wet season and do not experience as much fluctuation in moisture content as wall assemblies that have vapor retarders located at the interior face of the wall. We found that installing a vapor retarder on the same plane as the air barrier was the preferable solution for limiting condensation potential and encouraging long-term drying. We recommended that the combined air barrier/vapor retarder be semi-impermeable, with a permeance of 1 perm.
This building was purchased and converted to its current use by Florida International University (FIU) in the mid-1980s. It had been initially built as a corporate headquarters with some limited production/testing and warehousing. No documents from the original construction were available—only some renovation drawings. The building was clad with precast concrete panels applied to a steel floor deck and framing structure. The glazed aluminum curtainwall is located outside of the structure, is non-load-bearing, and has been protected with an externally applied, aluminum storm shutter system. The building enclosure consisted of approximately 35,600 sq. ft. of precast concrete wall panels, 10,000 sq. ft. of stucco-clad concrete block walls, and 23,000 sq. ft. of aluminum-framed curtainwall system.

This building had ongoing water intrusion issues associated with walls, and interior columns at the lower floor levels, or within the lower levels at random locations. Existing roof system conditions were considered. Although the roof was in good condition, there were water intrusion concerns at specific flashing details. Our investigation focused on the wall systems, the curtainwall system construction, the storm shutter system, and the interrelation of each.

Our services were provided through a local architect with a continuing service contract with FIU. The university wanted several repair options to evaluate and consider cost vs. benefit for future budgeting purposes. We were assisted by the building maintenance staff to provide access, a history of the specific problems, and the locations where they occurred; this investigation was limited by the owner to non-destructive observations.

Our investigation revealed that many wall leaks resulted from the Florida practice of stucco applied directly to concrete block without an effective water barrier. Some leaks were the result of condensation within an unvented ceiling plenum at the lower level. The leaks at the internal columns were a combination of a lack of exterior sealant maintenance and cantilevered steel beams that directed water to the internal columns. Sequencing prohibited curtainwall repair or replacement without removal of the storm shutter system.

We provided recommendations and estimated costs for building enclosure repairs to minimize water intrusion, as well as curtainwall repair and replacement (due to previous poor storm performance and existing damage that should be repaired). The owner plans to perform recommended building enclosure repairs and budget for curtainwall replacement in lieu of repair due to the cost of access because of the storm shutter system.
At the request of Clemson University, ADC Engineering/The BEE Group provided a proposal to complete a detailed survey of the concrete pedestrian access walkway/ramp/bridge structure at the Clemson International Center for Automotive Research (CU-ICAR) facility. The survey consisted of the exterior walkway ramp walls (interior sides and exterior sides), fenestrations (inset light fixtures), top and bottom deck surface, and other associated components of the concrete access structure. ADC Engineering/The BEE Group conducted the survey of the facility. The survey included providing detailed plans and elevations identifying and quantifying the type and extent of cracks and spalling, as well as identifying their causes and providing solutions and preliminary costs.

The purpose of the report was to determine the general condition, extent, and types of cracks and spalling, as well as to propose options to correct inset lighting, sealant joint/transition at the building, and drainage at troughs. Recommendations and costs for the maintenance, modifications, and repairs, were provided.

After field work for measuring and developing unique CAD models was completed, the first phase—the exterior review of the concrete access ramp structure—was then conducted, which included locating and quantifying deficiencies such as cracks, spalling concrete, etc.; taking photographs; and conducting observations of the general appearance of the ramp and its penetrations, terminations, and transitions. The next phase was review and documentation of the exterior deficiencies, which were indicated on the drawings.

All testing, field work, CAD, and cost estimating was completed in house by ADC Engineering, Inc./The BEE Group.

The concrete cracks (both static and dynamic), spalling, and delamination that had occurred provided us with the game plan to correct the substantial or problemat-ic concrete deficiencies. Three-step details were provided to define the existing condition, preparation, and new work.

With the addition of improved drainage at the trough, a pedestrian traffic coating, and a complete sealant replacement, the concrete issues will be addressed, less the inset vertical light fixtures. Coordination with the owner resulted in photovoltaic lights being used due to issues and deficiencies with the inset lights.

An abbreviated scope of work was developed to complete the recommend-ed maintenance, modifications, and repairs.

ADC Engineering/The BEE Group recommended leaving the underside of the ramp, the interior of the parapet walls, and the columns uncoated. We also recommended only coating the exterior top portions of the exterior parapet wall. This was to reduce ongoing maintenance costs, and not to “seal” all sides of the concrete structure.

John Goff
ADC Engineering, Inc.
Survey of Concrete Pedestrian Access Walkways
International Center for Automotive Research, Clemson University
Clemson, South Carolina
The entire Pedro Menendez High School campus was constructed in 1999. The majority of the campus consists of two-story masonry buildings surrounding a central courtyard. All roofs were prefinished standing-seam metal over rigid insulation and a structural steel roof deck. This limited roof replacement project was the result of ongoing water intrusion issues at the school administration wing, which had occurred since the original construction of this single-story addition to a two-story classroom building. Over the years, numerous repairs had been attempted by others. All had been unsuccessful in correcting the problems inherent to the roofing and flashing system.

Following a roof and wall investigation, our analysis indicated the ongoing water intrusion problems were due to the low drainage slope of the metal roof, poor flashing details, and stormwater drainage from the roof above. The basic problem was that the trapezoid-style roof panel, which worked well on the main roof with a 2:12 slope, was being overwhelmed by the aggregate stormwater discharge from above. The water from above was concentrated in two or three panels on this lower roof, which was sloped at only ½ in. per ft., and the transitional wall flashing was poorly installed.

Our recommendation for repair was to remove the existing metal roof, retain the existing rigid insulation over a metal deck, install gypsum coverboard, install a new PVC/Elvaloy single-ply roof membrane and flashing system, clad all parapet walls with full-height membrane, and correct/improve all transition flashings. Although small, this was a design-bid-build project that required full bidding and construction documents to ensure that the roofing and flashing system would be installed as intended. Our office provided roof plans and detailed all flashing components and fabrications associated with the roof system using AutoCAD®, and compiled all technical specifications, which were distributed and bid as digital files.

Our office also assisted with bidding and permitting, performed periodic quality assurance observations with written photographic reports, and provided construction administration. In addition to the roof replacement, the existing drawings, details, and specifications were provided for competitive bidding, permitting, and construction. During the roof replacement, the existing corroded prefinished steel gutters were replaced with stainless steel, and a 20-year NDL manufacturer’s weather-tightness warranty with a high-wind rider was provided.
convert the mansard roofs to a standing-seam metal roof system. Due to the small size of the building, our field investigation was to document the existing conditions and flashing details. It also revealed that the transition between the main roof parapet walls and the tile-clad mansard roofs was poorly conceived and allowed water intrusion into the building. The scope of replacement was to remove the existing roof membrane and rigid insulation down to the metal deck, inspect existing conditions, and replace any deteriorated materials. The new roof system was mechanically fastened, ¼-in.-per-ft. tapered rigid insulation and gypsum board, followed by a mechanically fastened, polyester-reinforced, PVC-based thermoplastic single-ply membrane. The design of the tapered insulation was based on a four-way design to provide the best possible drainage, and the use of ¾-in.-per-ft. tapered sumps at roof drains. All parapet, transition flashing, and penetrations were detailed, and coping caps were installed at parapets. Stainless steel or PVC-clad aluminum flashing was used throughout, except for the mansard roofs, which were clad with a prefinished snap-lock standing-seam metal roofing system. During the roof replacement, the existing emergency overflow drainage system was upgraded to comply with the current building code requirements, and a 20-year NDL manufacturer's weathertightness warranty with a high-wind rider was provided for the single-ply roof system.

Although small, this was a design-bid-build project that required full bidding and construction documents to ensure that the roofing and flashing system would be installed as intended. Our office provided roof plans and detailed all flashing components and fabrications associated with the roof system using Revit/BIM, and compiled all technical specifications, which were distributed and bid as digital files. Our office also assisted with bidding and permitting, performed periodic quality assurance observations with written photographic reports, and provided construction administration.