The Veterans Memorial Highway in South Central Ohio (also known as Route 823/Portsmouth Bypass) is 16 miles of new highway, which reduces commuting time while also opening up opportunities for economic growth and commerce. As the largest single transportation project in the State of Ohio’s history, it was also Ohio’s first true public-private partnership (P3). Construction of the $634 million project began in 2015 and was completed on schedule in December 2018.

EXTREME SITE REQUIRES SEAMLESS MATERIALS TESTING

The company of record enlisted Terracon for our expertise in quality control and quality management. Not only is it unusual to complete 16 miles of new roadway in a single phase, nearly 23 million cubic yards of Appalachian mountain earth had to be cleared and moved first, cutting as deep as 200 feet into the rock. Our quality control technicians monitored the placement of this material into the valleys to build road, or back into the terrain. We also evaluated the cut slopes, providing the
risk rating for the exposed rockface consisting of shale, sandstone, and clay stones.

Working seamlessly with the P3 team, we also helped design, develop, and provide quality control for the materials used in the 21 bridges needed to complete the bypass, more than half of which required mechanically stabilized earth (MSE) walls for support. In all, 300,000 square feet of MSE walls were built. In addition to the MSE walls, there were numerous structures and substructures for bridges, as well as culverts, that required verification of the specified material and foundation installations. Terracon reviewed and performed testing on the reinforcing steel and formwork prior to concrete placement. In the three years of the project, more than 13,000 material reports were provided, illustrating the complexity and wide scope of the project. Safety was always a priority during the project’s duration, which was demonstrated by Terracon reporting zero recordable injuries.

AN EXTENSIVE TEAM AT THE READY

A project of this magnitude required significant (and trusted) manpower. Our team was equipped to send 22 quality control technicians and inspectors from multiple locations (including Cincinnati, Columbus, Charleston, Cleveland, and Lexington) to assist, and by project completion, more than 100 Terracon employees were involved. With the flexibility and resources to meet changing needs throughout the project, Terracon provided the resources and creative problem-solving required to make this complex project a success.

In addition to Terracon’s team, we partnered with "Ohio Means Jobs" within the State of Ohio’s Office of Workforce Development to bolster the project workforce by hiring local materials technicians and providing on-the-job training. This investment in the community benefited all involved.

Responding to supplemental engineering or additional approved scope changes during the life of this project allowed our team to demonstrate the partnership and flexibility needed to keep the work moving. Terracon was glad to contribute to this history-making roadway, while facilitating economic growth with new, easier access, and a safer alternative route.

Drilling and setting charges to blast rock which needed to be excavated and moved.

Installation of geotechnical instrumentation to monitor settlement.

To learn more about Terracon’s work on Veterans Memorial Highway, visit: terracon.com/Ohio-Hwy
Managing more than 15 million square feet of pavement would be a daunting task for any facilities team, but it’s especially complex when 32 campuses and 16 facilities managers are involved. This is the scenario for Terracon client Maricopa County Community Colleges, the largest U.S. community college network. Based in Tempe, Ariz., the Maricopa County Community College District (MCCCD) includes 10 regionally accredited locations serving more than 200,000 students each year.

**BEYOND INSPECTIONS**
Successful deployment of a long-term pavement management plan has resulted in substantial cost savings and operational efficiencies for the college network. This systematic approach allows for consistent field data collection and processing.

The plan is built upon annual evaluations of pavement condition based on regularly scheduled inspections of sample units at the network level and project level. For each sample unit, the Terracon team determines the type, amount, and severity of pavement distress present. Distress survey information is entered into software to determine Pavement Condition Indices (PCI) and ratings for each pavement.

Based on the PCI, the team prioritizes pavements into four categories that need various levels of maintenance or rehabilitation. The results are then used to develop a rolling five-year budget. As part of Terracon’s services, the team also prepares the plans, specifications, and contract documents recommended in the management plan.

**DEMONSTRATING VALUE**
Due to our involvement with the project since 1995, we collected field data to determine PCI for every pavement section owned by the MCCCD, and included annual construction costs. These accumulated values are graphed to show cost savings over time by implementing a pavement program.

With a pavement management program, the average overall PCI is maintained in the mid-70’s range—satisfactory to the client—despite additions of deteriorated pavement from acquisition of new properties. Without a pavement management plan, the average overall PCI declines to the 20-point range, which is considered “serious” according to ASTM standards and would require extensive repairs.

Though facility managers and property owners may find it challenging to capture the return on investment of a pavement management program, the results can be significant. The MCCCD estimates it has saved more than $30 million by maintaining the average overall PCI at an acceptable condition. If you consider the pavement management implementation expense of $2 million, this means the MCCCD has made a 1,500 percent return on investment by use of Terracon’s program.

Terracon’s experienced team of pavement professionals provides clients with a full range of pavement services. Helping you effectively manage these assets can include evaluation and maintenance, to recommendations for existing pavement rehabilitation and replacement. These geotechnical and materials resources are available to meet all your pavement needs.

The MCCCD estimates it has saved more than $30 million by maintaining the average overall PCI at an acceptable condition.
LEAD-BASED PAINT HAZARDS

Understanding and Managing the Impacts of Lead-Based Paint

The U.S. government banned lead-based paint more than 40 years ago, but it’s still prevalent. According to government statistics, more than 75 percent of the housing stock in the U.S. contains lead-based paint. Such statistics for commercial facilities are not readily available, but any facility built before 1978 is at risk of containing lead-based paint. Exposure can cause real and lasting health problems, including: permanent brain and organ damage, reduced intelligence, behavioral problems, and abnormal fetal development. Currently an estimated 1.7 million children in the U.S. have high blood lead levels.

DID YOU KNOW?

Lead from paint, including lead-contaminated dust, is one of the most common causes of lead poisoning. (source: US EPA)

Disturbance of lead-based paint is regulated by the Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), and U.S. Department of Housing and Urban Development (HUD). The EPA’s lead renovation, repair, and painting (RRP) program covers a wide range of contractors that disturb paint in pre-1978 housing or facilities occupied by children under age six. These requirements cover any disturbance of lead-based paint in areas greater than 6 square feet indoors or 20 square feet outdoors.

Federal statistics show that more than 75 percent of the housing stock in the U.S. contains lead-based paint.

The RRP program requires the use of a certified renovator or firm, testing of surfaces, special work practices, and post-abatement testing.

Terracon helps a variety of clients manage issues with lead-based paint. For example, we serve as the lead-based paint consultant for Nebraska’s two largest school districts. Terracon’s Omaha, Neb., office has assessed more than 130 schools for lead-based paint and other lead hazards.

If lead-based paint is found at your facility, there are multiple options for addressing the hazard. If the paint is in good condition, you may be able to establish a program to maintain it in place. If the paint is in bad condition, options include interim controls, permanent coverings, abatement, or replacement of the painted surfaces. Compliance is key when renovating sites that contain this hazardous material.

Terracon provides a full range of lead consulting, testing, and training services including lead RRP training, a pathway to becoming “lead certified.” Terracon’s environmental consultants have assisted hundreds of clients by investigating and testing sites, determining risk, providing advice, solutions, recommendations, and helping to reduce liability.

Exposure to lead-based paint can cause serious health issues, including reduced intelligence, behavioral problems, abnormal fetal development, and permanent brain and organ damage.
The market for low-rise, wood-framed, multifamily construction has been one of the fastest growing market sectors over the past five years, a trend that’s expected to continue. Water penetration around openings is consistently an issue in new construction. While this type of construction typically utilizes vinyl-flanged windows, there is no consensus regarding the best way to install this type of window to mitigate the issue.

With increasing energy efficiency regulations nationally, we have seen contradictory recommendations for installing flanged windows based on the desire for improved water penetration resistance or reduced air leakage. This can be confusing for building owners and facilities managers. Terracon’s team of building enclosure consultants routinely performs air and water penetration testing for our clients, so we are uniquely positioned to research and answer this question.

Within the industry, general contractors continually are challenged with the “means and methods” to improve water-tightness of the various installed water-resistive barrier systems. Contractor JE Dunn was searching for better approaches to remove the guesswork on its projects. Working together with the contractor, the Terracon team evaluated approaches to determine and understand best practices for this issue.

A METHODOLOGICAL APPROACH TO TESTING
To arrive at our recommendations, the Terracon team took a step-by-step approach. First, we reviewed the industry guidelines for flanged window installation, then designed and built six mock-ups, each with a flanged window “blank” installed with a distinct sill installation and detail. The next step was testing each mock-up for air and water penetration using established test methods.

FINDINGS
Our testing results indicated the following clear recommendations for the installation of low-rise, wood-framed, vinyl-flanged windows:

1. The low-pressure foam or backer rod and sealant installed around the full perimeter of the windows from the interior side is essential for increased resistance to both air leakage and water penetration. The research team was not able to determine any increased performance between foam versus sealant, but at least one of those strategies is always recommended.

2. The open-sill approach generally appears to manage water better than the barrier approach. The open-sill approach also plans for drainage from windows that may fail in the future and allows the installer more error margin.

3. The barrier approach is generally more airtight than the open-sill method, however, the open-sill approach can be very airtight if the foam or sealant is installed from the interior side around the full perimeter of the window. At 75 Pa, which is the test pressure required of the high-performance Passive House Institute U.S. standard, the open-sill approach, with full perimeter interior seal, measures close to zero air leakage.

Based on our testing results, the recommendation for low-rise construction with vinyl-flanged windows and a mechanically fastened water-resistant barrier is the open-sill approach with full perimeter interior seal of either a low-pressure foam or a backer rod and sealant. More testing is required to clarify recommendations for hurricane zones, high-rise construction, and other conditions.

Results helped verify Terracon’s consulting approach and provided JE Dunn with directives for its installation practices, all with the goal of improving water and air tightness performance in new construction.

Find the full description of this team’s research methods and findings at: [Terracon.com/flanged-windows](Terracon.com/flanged-windows).
THANK YOU FOR SHARING YOUR JOURNEY
AND THANK YOU FOR BEING A PART OF OURS.

All year long we want to say thank you. Thank you for letting us be a part of your journey: your projects, your successes, and most importantly, your lives! But don’t just take our word for it! Watch the videos to hear from five of our more than 5,000 employee-owners as they share their personal style for providing you with an awesome Terracon experience.

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