Would you like to know how subsurface conditions will impact your construction cost and schedule—even before you select the location for a new retail site or an alignment for a transmission line, pipeline, or highway? There’s a new way to reduce the unknowns in your planning process, because what we already know will help you.

To reduce risk associated with site selection and due diligence, Terracon has developed a new way to anticipate site conditions. This predictive analysis, known as Stage1 GeoReport® (Stage1), can be applied to small sites, large sites, or linear projects. Utilizing innovative processes for compiling and managing data, we are streamlining site selection and providing clients access to a conceptual geotechnical model before field exploration takes place.

**DRAWING ON DATA AND EXPERTISE**

Intrusive geotechnical exploration and testing of a site is required to design foundations, pavements, and retaining structures. This work usually takes weeks or months to complete. By the time the geotechnical exploration and testing is completed, many decisions have already been made about location and construction that would benefit...
from having the geotechnical data in advance. With technological advances in other industries creating an expectation that we should be able to find the information we need to know in seconds via internet-based, knowledge sharing services, the time needed to get even preliminary geotechnical information has become a painful experience. Until now.

Tackling this challenge head-on, Terracon has created a powerful new tool that utilizes valuable data collected from more than 50 years of previous studies and the deep experience of our geotechnical practitioners across the country. We’ve meticulously documented the location and conditions encountered in nearly 300,000 projects nationwide and are adding more than 15,000 new projects annually to our database.

Our Geographic Information Systems (GIS) database details information associated with each historical project location, allowing our practitioners to draw on a vast and readily available database to supplement their understanding of local subsurface conditions.

Digitizing the historical subsurface information creates a catalyst for our interactive, web-based GeoReport platform which combines the historical data collected by Terracon with data currently available in the public domain, and utilizes the opinion of a local, experienced Terracon geotechnical practitioner. Adding that essential local, personal experience, Terracon’s practitioners render a conceptual model of subsurface conditions, possible variability in those conditions, and a confidence level in the predictions. This is done incredibly fast. We deliver these opinions within days of your request, not weeks.

It is easy to see how this combination of historical data, public domain resources, and local experience, delivered within one week, aids in the reduction of risks associated with unknown conditions on prospective project sites.

The advantages go beyond risk reduction. With adequate confidence opinions, more precise project feasibility analyses are possible, and preliminary designs can proceed. A customized exploration and testing work plan can be dialed in to the known site conditions.

**HOW STAGE1 BENEFITS YOU**
- Predicts expected subsurface conditions in days
- Helps to make better and faster decisions regarding candidate sites and routes
- Allows an understanding of subsurface risk prior to site purchase for a very low cost
- Provides key information to lead site location studies
- Serves as a basis for an efficient exploration and testing program
- Gets construction design started earlier

**THE COMPLETE RISK-REDUCING PACKAGE**
Stage1 is Terracon’s way of maximizing the value of data in site selection and design. We have developed systems to make this an easy, first look for any project that needs to discover what is below the surface allowing for the elimination of non-invasive sites and routes.

Though not all risk can be eliminated, and all sites should be explored to allow final designs, Stage1 clients are better informed and able to anticipate geotechnical conditions, construction challenges, and reduce the inherent risks in development, saving valuable time and money. Our clients move forward into the next steps of geotechnical exploration and engineering much quicker than ever before.

Learn more about this innovative service at: terracon.com/stage1
BENCHMARKING ENERGY USAGE LOWERS OPERATING COSTS

Increasingly, municipalities and states are requiring disclosure of energy and water use during commercial building real estate transactions. This trend is creating demand for usage analysis and documentation, including benchmarking similar buildings and development of improvement recommendations for underperforming buildings.

Energy analysis performed during the due diligence phase of commercial building transactions is growing in importance and demand. In some geographic areas, it is putting focus on ENERGY STAR® certification.

MEASURING UTILITY CONSUMPTION

For a majority of commercial buildings, energy and water utilities are the largest operating expenses. Reduction can lead to substantial savings. By taking a comprehensive approach, Terracon is helping building owners and managers identify areas for improvement and recommend solutions.

To develop benchmarks of an existing building’s energy and water usage, Terracon uses tools such as an American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Level I Energy Analysis, ENERGY STAR Portfolio Manager, and Commercial Building Energy Consumption Survey (CBECS). Compiled by the U.S. Department of Energy, the CBECS survey is based on a total of more than nine million square feet of commercial office buildings. CBECS data for benchmarking is available for bank branches, medical and professional offices, retail stores, hotels, distribution warehouses, financial office buildings, residential halls and dormitories, schools, commercial office buildings, supermarkets, courthouses, wholesale centers, and worship facilities. ENERGY STAR scores are typically based on CBECS data plus other survey data for data centers, hospitals, senior care centers, water and wastewater plants, and multifamily housing.

The results of Terracon’s energy usage analysis allow a commercial building to be benchmarked in comparison to the usage of a peer group of similar buildings considering location, occupancy, building enclosure, mechanical, electrical, and lighting systems. The comparison identifies corrective actions or adjustments that will yield the greatest return for the building owner.

CONSERVATION SAVES BIG

The results of making improvements in energy consumption can yield significant benefits. For example, the Terracon team performed analyses of a 45,000-square-foot, three-story commercial office building built in 1985 in Covina, Calif. The building was a Type B office occupancy with 150-square-foot per person and a 12-hour per day operating schedule. Features included steel-framed structure and roof deck, single-pane glass, exterior stucco, R-10 wall insulation, built-up roof with R-20 insulation, and HVAC comprised of packaged roof-mounted, direct-expansion cooling units and boiler supplying conditioned air through a variable-air-volume air distribution system.

Our recommended energy conservation measures (ECMs) included:

- Interior lighting controlled by motion sensors, new packaged roof-mounted cooling units, new heating boiler, replacement of lighting with LEDs, replacement of water heaters and plumbing fixtures with high-efficiency, low-use types, and upgrading the energy management controls.

The annual energy usage and cost of the subject building is high as compared to other buildings in a peer group. The estimated effect of installing ECMs on the energy cost for the subject building was a reduction of nearly $0.68 per square foot, $30,600, or 13 percent annually.

Notably, a typical commercial building of significant age would warrant an energy usage analysis and likely receive benefit from operational, mechanical and lighting repairs and improvements.

Whether you’re an owner or a property manager, improving the efficiency and economic performance of your real estate assets is a priority, and in some locales, a requirement. Terracon’s team of specialized facilities professionals provides owners the expertise to comply with constantly changing efficiency standards and energy and water usage disclosure requirements while optimizing the performance of their building assets.

JEFFREY MILLER, P.E.

Jeffrey is a senior engineer and principal in Terracon’s Houston office. Jeffrey has more than 40 years of experience specializing in mechanical, electrical, and plumbing diagnostics, engineering, and commissioning.
NON-COMPLIANCE IS NOT AN OPTION

Protecting people while meeting standards

In March 1930, Mohandas Gandhi was in the midst of his Salt March to the Arabian Sea, the industrialized world was about to experience the lowest point of the Great Depression, and ground was being broken in West Virginia on construction of a diversion channel known as the Hawk’s Nest Tunnel. The tunnel was to be a critical component of a hydroelectric plant, but before the three-mile tunnel through Gauley Mountain was completed, at least 109 and perhaps as many as 764 laborers died from acute silicosis, a lung fibrosis caused by the inhalation of dust containing silica. Eight decades later, the Hawk’s Nest Tunnel incident is still recognized as one of the worst occupational disasters in modern history.

In 1936, a congressional subcommittee published its findings regarding the Hawk’s Nest incident. While the report included a strong indictment of the tunnel’s builders, no further actions were undertaken. Fortunately, publicity regarding the incident did shape opinions, and by the close of 1937, all but two of the then 48 states had enacted laws benefiting workers with silicosis. While these measures constituted steps in the right direction, they were not preventative in nature. Such critical employer requirements would not be enacted for another 80 years.

REGULATIONS PREVENT EXPOSURE

In 1997, the World Health Organization’s International Agency for Research on Cancer (IARC) classified crystalline silica dust as a human carcinogen (Group 1). This act placed the IARC in agreement with the U.S. National Toxicology Program and the National Institute for Occupational Safety and Health that occupational exposure to silica increases one’s odds of developing lung cancer. This meant silica was a human carcinogen, present at countless workplaces, whose exposure limit had not been re-evaluated in nearly half a century. It was finally time for significant regulatory change.

In March 2016, the Occupational Safety and Health Administration (OSHA) issued a final rule to protect workers from exposure to respirable crystalline silica. The silica rule is comprised of two separate standards. The first (29 CFR 1926.1153) is known as the Silica Construction Standard, and applies to work within the construction industry including construction, demolition, alterations, repair, bridge erection, roadwork, excavations, large-scale painting projects, etc. The second (29 CFR 1910.1053) is known as the General Industry and Maritime Standard, and applies to work within the manufacturing (static in nature) and shipyard industries.

OSHA estimates that 2.3 million workers in the U.S. are routinely exposed to respirable crystalline silica, the vast majority in the construction industry. Of these, more than 640,000 are being exposed to concentrations exceeding the permissible exposure limit (PEL). When compared to other regulated hazardous substances, crystalline silica has an alarming rate of positive exposure assessments.

PROTECTING WORKERS AND ASSISTING EMPLOYERS WITH COMPLIANCE

Before and since OSHA’s Silica Standard went into effect, Terracan industrial hygienists have been providing the requisite services to ensure workers are protected and employers are prepared for the challenges of compliance. With accomplished Certified Industrial Hygienists (CIH) situated across the country, Terracan provides businesses from a wide range of industries with the following services:

1. Training for personnel involved in silica work, including instruction regarding the OSHA Standard and Respiratory Fit Testing;
2. Written Exposure Control Plans developed specific to the client, including assisting with plan implementation;
3. Determination of Silica Concentration via collection of personal air samples to which personnel may be exposed; and
4. Consultations with clients regarding:
   - Compliance with the silica standards
   - Proper control methods
   - Designation of a competent person
   - Personal protective equipment
   - Interpretation of sampling data
   - Proper housekeeping practices
   - Medical surveillance programs
   - Recordkeeping requirements

Protect your employees and achieve complete compliance; non-compliance is not an option.

ANDY ROWLAND, CIH

Andy is a principal and Terracing’s national environmental manager of industrial hygiene and training services. He is known throughout the United States for his exhaustive body of work in the fields of industrial hygiene, environmental health, safety, and education. Andy has more than 35 years of field, laboratory, and classroom instruction experience. He is based in Terracing’s North Charleston, S.C., office.
HELPING HEALTHCARE FACILITIES MEET SEISMIC REQUIREMENTS

Healthcare facilities must meet a high standard of excellence. It is the strong relationship of trust, combined with technical experience, that Mayes Testing Engineers, A Terracon Company (Mayes) brings to Seattle Children’s Hospital’s continued expansion. The hospital serves the largest region of any children’s hospital in the U.S. (Washington, Alaska, Montana, and Idaho), and its location requires its facilities to meet special seismic zone requirements. The materials and structural recommendations for the hospital’s expansion are critical to its ability to deliver vital care to children in the region.

The latest expansion of Seattle Children’s Hospital includes a seismic force resisting system with special steel moment frames, which incorporate the latest AWS and AISC seismic welding requirements.

BRINGING STRUCTURAL AND MATERIALS EXPERTISE
To continue to meet the needs of the communities it serves, the hospital has been adding new services and updating its facilities. Since 2000, three major building expansions have been completed, with a fourth expansion, “Building Care,” underway and expected to be complete in 2021. This expansion includes demolition of a parking area and helicopter landing zone, followed by the relocation of utility lines and construction of a bicycle and bus stop shelter. The expansion also includes the relocation of the helicopter landing zone to the top of Building Hope on the hospital campus.

Working with the design team, Mayes’ materials engineers provided input for concrete and structural steel specifications. Mayes engineers have also provided welding procedure review, fabrication audits, and led preconstruction meetings.

Because Mayes worked on the hospital’s Phase 3 expansion, the team was ready to handle all the usual structural monitoring activities and perform inspections of the interior build-out to meet seismic requirements adapted from California’s Office of Statewide Health Planning and Development (OSHPD). Construction must meet a seismic AWS D1.8 code requirement, which covers certain welded elements of the structure.

The new expansion includes a seismic force resisting system with steel moment frames, which incorporate the latest AWS and AISC seismic welding requirements. Inspections and testing include reinforced concrete, shotcrete, structural steel fabrication, structural steel erection, fireproofing, auger cast piles, welding, ultrasonic testing, magnetic particle testing, and floor flatness testing.

CARING FOR OUR COMMUNITIES
Working on the latest expansion for Seattle Children’s Hospital is a point of pride for our team members, many of whom have trusted the staff with their own children’s care. Building upon a more than 15-year client-consultant relationship, the hospital’s commitment to excellence has been well served by the Mayes team’s focus on delivering innovative solutions.

“Serving the needs of the community, especially its most precious and vulnerable members, is the common goal behind the long-term success of this partnership,” said Laura Reinbold, P.E., Terracon national director of healthcare.

MORE ABOUT THIS UNIQUE FACILITY
To learn more, visit these online resources.
Seattle Children’s Hospital’s expansion plans: http://masterplan.seattlechildrens.org/
Current construction updates: https://construction.seattlechildrens.org/

LONNY MORRISON
Lonny is a principal and senior project manager with Mayes Terracon office in Seattle. He has more than 20 years of experience in special inspections and is certified in every discipline, including large-scale high-rise buildings constructed with both structural steel and concrete as well as wood-framed structures.
M. Gayle Packer is now chief executive officer (CEO) and president of Terracon Consultants, Inc. This completes a deliberate, multiyear succession process, following her appointment as president in June 2018. Prior to being named president, Packer served as executive vice president and chief administrative officer. She succeeds David Gaboury, P.E., who served as CEO and president at Terracon for more than 16 years. Gaboury continues as Terracon’s chairman through 2021.

TERRACON FOUNDATION GIVES $50,000 TO ENGINEERS WITHOUT BORDERS USA

National Partner Grant to support providing safe and sustainable infrastructure

Terracon has awarded a $50,000 National Partner Grant to Engineers Without Borders USA in support of its goals to bolster university education at 187 colleges and universities nationwide, enhance workforce training and professional development, and complete infrastructure projects in hundreds of communities.

For more information about the Terracon Foundation and other organizations that have received Foundation grants, visit: terracon.com/foundation

Jody Deah, Engineers Without Borders USA (EWB-USA) board president, along with EWB-USA University of Nebraska-Lincoln Chapter engineering students Andrew Butler and Ethan Triplett, accept the Terracon Foundation donation on behalf of EWB-USA from Ed Prost, P.E., geotechnical department manager with Terracon’s Omaha office.