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ACP

NEW ENGLAND CONSTRUCTION

New Science Building at Historic St. John's Prep Underway

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Embarks on M

CAT 315C, 324E, 330C Excavators and a D25C Off-Road Truck are used to clear out rock blasted by J Masterson, the site contractor for new science building.

In the fall of 2015 in Danvers, Massachusetts, students will enter an imposing new five story science building for the first time at the campus of St. John's Prep, a private high school and a landmark for more than a century in this North Shore community.

A college preparatory school sponsored by the Xaverian Brothers, St. John's is at present constructing the stately academic science building as part of a Prep 20/20 initiative announced in 2013. In addition to the science building, the initiative calls for the construction of a new wellness facility and the fit-out of an existing building to convert it to a new middle school. The middle school will add 300 students in grades 6, 7 and 8 to the present enrollment of 1,150 high school students.

The Project Team

Windover Construction of Manchester, Massachusetts, has the contract for construction of the new science building. Stuart Meurer, the company's Vice President of Construction, is serving as principal in charge of the project.

Flansburgh Architects of Boston designed the 74,000 square foot building. Other members of the project team include: Danvers-based Hancock Associates, civil and geotechnical engineers and surveyors; Boston-based LeMessurier Consultants, structural engineers; Boston-based TMP Consulting Engineers, MEP and fire protection; and Andover-based Edvance Technology Design Inc., data and communication.

Architectural Harmony

Located between the school's Xavier Hall and Ryken Center for the Arts, the new science building has a footprint resembling a rectangle measuring roughly 175 feet by 115 feet, and a north front entrance facing Spring Street, the main east-west road traversing the campus. The new building displaces a five-court tennis court complex and a religious grotto. Replacement tennis courts have already been built by Windover next to the school's Cronin Memorial Stadium, while a new design for a relocated grotto is currently underway.

Flansburgh designed the science building to complement existing architecture at the campus, and to expand on the concept of STEM education (Science, Technology, Engineering and Mathematics) being provided at the Xaverian institution. The new structure will house 30 classrooms, 12 science labs, three computer science labs, a robotics laboratory, fabrication shop, seminar room, study room, flexible

ohn's Prep Major Construction Program

By Paul Fournier

Rendering depicts new five story STEM building for St. John's Prep School designed by Flansburgh Architects and currently being built by Windover Construction in Danvers, Massachusetts.

work and meeting spaces, and a two story multi-purpose lobby on the first floor.

Standing approximately 70 feet above grade, the new science building has a brick veneer, standing seam metal roof panels, and some metal siding for the inside corners between the main building and the east and west wings. The new structure will be fully handicap accessible and is designed to meet the requirements for Silver certification in LEED (Leadership in Energy and Environmental Design).

Site Work Logistics

The extensive site work required for this project is being performed by J. Masterson, a Danvers excavating contractor that has worked with Windover on a number of projects.

"We've completed a half dozen projects for Windover in the past three years, and this is our second project for them at St. Johns," said William Peach, P.E., of J. Masterson.

"There was a great deal of planning with the project team before we even mobilized to the site because of the logistics involved with a project on an active campus," he said. "The site is in the middle of the campus and is constrained on all sides by areas that need to remain open to the public."

In connection with this, he noted that there are school administration and maintenance buildings within the construction site to which access has to be maintained at all times.

Peach said they fielded a crew of up to 15 personnel and about 15 pieces of heavy construction equipment to work on campus. Among the machines being employed are four excavators, two mini-excavators, two skid steer tractors, two front-end loaders, two off-road haul trucks, a dozer, roller, and a backhoe. He pointed out that they began preparing the building site as soon as school got out for summer vacation.

Appearance of new science building generally resembles that of this older academic building in accordance with Flansburgh's intent to complement existing architecture at the campus.

"As part of the new STEM building project we're also completely rebuilding and enlarging an adjacent parking lot," he said. "This work includes earthmoving, blasting ledge, installing new utilities, paving and installing curbing,

"All of the parking lot work has to be completed prior to school starting again in the fall," he added.

Soils Evaluation

Building excavation and foundation design were preceded by the completion of an engineering evaluation of subsurface soil conditions conducted by Geotechnical Services Inc. (GSI) of Boston, Massachusetts.

During the soils investigation, five test borings and three probes were drilled at the site by New Hampshire Boring Inc. Very little groundwater was encountered at the site.

Based on available subsurface data and the current site development plan, it was recommended that proposed building walls, columns, and other structural elements be supported on spread or strip reinforced concrete footings bearing on a prepared subgrade of natural silt deposits, glacial deposits, weathered bedrock or competent bedrock. As an alternative, compacted structural fill or crushed stone wrapped in a geotextile fabric could be used.

An allowable soil bearing pressure of 4,000 pounds per square foot was recommended for the design of footings placed on these materials.

Blasting Bedrock

Due to the prominence of bedrock at the site, it was decided to reduce the amount of blasting by limiting the size of the basement. About one-third of the building in the western portion has a full basement, while the remaining two-thirds, which showed considerable bedrock, was primarily unexcavated except for an area in which a subsurface duct trench was planned. The trench is essentially a 6 1/2-foot by 12 1/2-foot concrete tunnel extending easterly from the full basement area about 80 feet into the otherwise unexcavated area beneath the main building. It will house ducts for various utilities.

Windover's Meurer described the blasting of bedrock at the site:

"We estimate that there were about 3,500 cubic yards of ledge removed from the excavation pit due to the blasting, which was performed using TNT. Holes were drilled about 16 to 18 feet deep,

Glacial till and weathered bedrock is removed by Cat excavator which will be followed by placement of engineered base material to support new building footings and walls.

cleaned, filled with sand and fertilizer accelerant, and then the blasting cap was dropped in followed by crushed stone to fill the rest of the hole.

"The largest set of charges detonated was 500 pounds in 18 holes. Others varied in size depending on location and depth," Meurer said.

Substantial Concrete

The building's design features a robust foundation and framing system. On-grade floor slabs in the basement and on part of the first floor are 5 inches thick and constructed of regular weight concrete reinforced with welded wire fabric. The elevated first through fourth floor slabs are constructed of 3 1/4-inch lightweight concrete on 2 inch deep galvanized steel decking. These slabs are likewise reinforced with welded wire fabric. There is a 4 foot elevation differential between two areas in the basement to accommodate different function areas – i.e. electrical and mechanical rooms – plus two, 2 foot thick concrete pedestals to support machinery and equipment. And at the eastern end of the building is a 3 foot thick, 30 foot by 25 foot concrete mat.

Concrete foundation walls typically range in size from 4-foot-tall, 8-inch-thick frost walls on the perimeter to 20 foot tall by 16 inch thick walls around the full basement area. Footings for these structural elements vary between 4-foot by 4-foot by 14 inches thick, to 12 foot by 12 foot by 24 inches thick.

Concrete is being supplied by McLellan Concrete and placed by Southern New Hampshire Concrete.

Sturdy Steel Work

The layout for structural steel framing and concrete piers and walls follows a grid comprised of 14 bays north-south, and 12 bays east-west. The heaviest steel columns are W10X45 to W10X60 in the basement. Spliced upper columns are lighter, with the smallest columns typically being W10X22s on the fifth floor. Where interior floor layouts do not accommodate placing upper floor columns directly over lower columns, their loads are carried by transfer girders to other lower columns.

Heavy rebars await placement of forms and ready mix pour for high walls around basement.

Officials from St. John's Prep, Flansburgh Architects and Windover Construction take part in groundbreaking ceremonies at Danvers, Massachusetts, site of new science building. From left to right are: Madeline Le (Flansburgh); Joe Marshall (Flansburgh); Shannon Long (Windover); Dave Henderson (Windover); Ken Kovachs (Flansburgh); John Merchant (Windover); Lee Dellicker (Windover); David W. Ives (St. John's); Bernard L. Caniff (St. John's); Edward P. Hardiman (St. John's); Steven Cunningham (St. John's); Stuart Meurer (Windover); David Crouteau (Flansburgh); and Keith A. Crowley (St. John's).

Serving to stiffen the building and increase resistance to drift from lateral forces are eight braced vertical steel frames positioned between second and third, third and fourth, and fourth and fifth floors. Four of the eight frames on each floor are oriented north-south and the other four are oriented east-west. Significantly, hollow structural section (HSS) tubes are used as diagonals in these braces. HSS have uniform geometry and wall thickness, and provide better resistance to torsional buckling than wide flange shapes.

Jay Steel Company of Tewksbury, Massachusetts, is supplying the hundreds of tons of steel required for the new science building.

Students Involved in Project

Construction taking place at the school is serving as a learning opportunity for some students whose instructors are taking them on tours of the job site led by project team members. These classes are relating various building activities to classroom subjects, according to Windover's Meurer. He spoke of how students have been actively involved in the project.

"Among the classes that have visited the site are Geometry, Physics, the Environmental Club, Art and Religion," he said. "A geometry class did a take-off of the concrete quantity, worked on the bracing angle for wall construction, and calculated the volume of concrete to order per pour.

"The Physics class was present for the blasting and was able to witness the force of TNT breaking rock, trajectory into the air and safety measures taken. The students were also introduced to Geotechnical Engineering and the importance and application of it as a career field. Also, the Environmental Club was briefed on various ways Windover is striving to match LEED standard recycling and waste management goals.

"Furthermore, the Art and Religion classes have been actively collaborating with Windover since the beginning of the STEM building to demolish, design and rebuild the grotto that was originally on the site of the building," he said.

Ready for 2015 Classes

Construction of the new science building got underway officially at a groundbreaking ceremony held April 3 at the Danvers site, allowing Windover about 16 months to construct the building in time for classes in the fall of 2015.