BUILDING STATISTICS II

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Construction Management

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Cardinal Wuerl North Catholic High School

Cranberry Township, PA

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Part 2 – Building Systems Descriptions

Primary Engineering Systems

Construction

Cardinal Wuerl North Catholic High School is being delivered as a traditional design-bid-build project. Despite the design-bid-build designation, construction experts were called in early in the design phases which created a hybrid Integrated Project Delivery environment. The owner chose a multiple prime (GC lead) with CM agency project structure based on his past experience with this delivery method. BIM is planned to be used on this project from the preconstruction phases all the way through the life of the building by the use of a facilities management model. Earthwork and site clearing were the focuses of construction early on in the project. The extensive tree clearing and excavating that needed to occur drove the project during Summer 2012. Temporary excavation support (shoring & rigging) was needed during excavation due to reported groundwater and the possibility of landslide due to excessive redbed soil. Onsite roadwork and earthwork resulted in a change of site entrance/exit several times. Parking areas were static but material laydown areas and interior access points evolved on several instances. Finally, the second floor in Area G was delivered as a core & shell package due to lack of enrollment to fill the extra space. This can be explained by expansion of facilities.

Figure 1: Construction of Chapel Footers & Column Piers (Property of Mascaro Construction)

Electrical/Lighting

An underground electrical utility service enters the building at the south side in the mechanical yard into the utility transformer. The primary service power then travels to an exterior current transformer cabinet and inside the building to the 3,000A main switchboard. Power is distributed from here to the 42-208/120V & 32-480/277V panelboards. EMT conduit runs the length of the building, feeding power to the entire complex. Classrooms utilize pendant linear fluorescent lighting while the auditorium utilizes 6" pendant LED downlights. There is a diesel generator in the mechanical yard of the building, which serves emergency power and is equipped with optional standby power. Branch electrical and IDF rooms are located in various areas throughout the school. The main electrical room is located in the southeast corner of lower Level A.

Figure 2: 3000A Main Switchboard (Property of Mascaro Construction)

Mechanical

Cardinal Wuerl North Catholic High School is cooled by eleven VAV rooftop air-handling units, two fan coil units and thirteen split system air conditioners. The primary method of cooling spaces is by providing chilled water to the AHUs, utilizing the chilled water coil in the unit, and delivering conditioned air through overhead ducts at traditional grille, register & diffuser terminals. The aforementioned air-handlers range in size from 5,000 – 25,000 CFM and serve the library, music suite, lower level, administration areas, athletic suite, academic wings, auditorium & gymnasium. All chilled water to these units is returned to the three B&G 1510 36 Model chilled water pumps located in Room A006 (MEP) and are rated at 450 GPM (25-HP; one of these CHWPs must be on standby at all times). From here, the 30% propylene glycol chilled

water passes through a glycol fill station and recirculates through one of two chillers (310/364 ton capacities) in the mechanical yard on the south side of the building. The majority of the chilled water supply feeds the rooftop AHUs but a small portion is delivered to the two fan-coil units for the purposes of providing conditioned air to the academic wing stairwells. Aside from the water-to-air system described, thirteen split system air conditioners are installed at roof level to serve MEP/MDF/machine rooms on lower level A, electrical/IDF rooms through Areas B, E, & F, and the auxiliary/storage rooms (D103/D104) in the auditorium. The SSACs used in CWNCHS supply either 240, 345, or 640 CFM and are necessary to provide constant volume air conditioning to these critical spaces.

The rooftop air-handling units also provide heated air through means of natural gas and deliver conditioned air through overhead ducts at traditional grille, register & diffuser terminals. The natural gas service enters North Catholic at the south end of the building in the chiller yard from a 3" pipe at 2-psig/8,702 cfh. The service feeds the eleven air handling units and the three water heaters through branch piping from this single entrance. The natural gas is used as fuel for the AHU's at a max gas inlet pressure of 14 in-wg in each unit and the natural gas burner shall be fully modulating with a minimum turndown ratio of 10:1. Additional heating devices are used such as electric baseboard heaters in the main hallway and cafeteria to minimize heat loss through the large windows, unit heaters in the main MEP rooms to make sure all equipment is kept at an appropriate operational temperature and electric wall heaters in stairwells/vestibules.

Figure 3: Chillers & Diesel Generator shown in Mech. Yard (Property of Mascaro Construction)

Structural

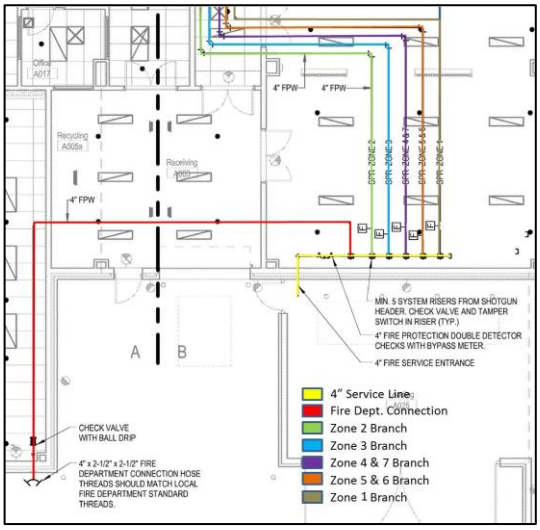
By utilizing a system of W10, W12 & various HSS columns, the steel skeleton supports 5" composite slabs in areas A, F & G as well as TPO/standing seam metal roofing systems. CWNCHS utilizes shear walls in the stairways & elevator shafts as well as moment connections on beams throughout the structure for lateral strength. A Linkbelt Model #LS-218H and a Terex Model #T-560 navigated the site between November 11th, 2012 and December 17th, 2012 for structural steel erection. Crawler cranes were utilized due to the large footprint of the high school. Since most of the school is on one level, a majority of the concrete flooring was poured on grade (5"). It took approximately 9 months to complete from the first pour in November 2012 to the last in August 2013. More SOG placement will occur in the chapel during Fall 2013/Winter 2014. Mascaro self-performed all concrete which included footers, retaining walls, slab-on-grade, slab-on-deck, cast-in-place stairs, prefabricated steel pan stair cast-in-place concrete, etc. Where it was necessary, the primary formwork used was lumber. Formwork was not necessary in an abundance of the SOG area due to the two courses of CMU on the footers. These CMUs shaped the outer edge of the cast-in-place slab on grade. Power buggies were used for all 1st level concrete placement while a concrete pump truck was necessary for composite slab-on-deck pours at higher elevations. Shallow foundations such as footings & grade beams were used as well as an additional 48 caissons on the north side in Areas E, F & G.

Figure 4: Auditorium Riser Seating Construction (Property of Mascaro Construction)

Engineering Support Systems

Fire Protection

North Catholic uses a wet-pipe sprinkler system. Automatic sprinklers are attached to piping containing water, which is connected to the water supply through the alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts the fusible device or destroys the frangible device. A 4" water service enters at the SE end of CWNCHS in the mechanical yard. Piping splits off into 5 branches that serve the different zones of the building show in the diagrams below. A sixth branch (shown in red) exits the building to Lower Level A to a 4" x 2 ½" x 2 ½" fire department connection.



Figures 5 & 6: Diagrams showing FP System Zones and their branch division at the service entrance (Property of Astorino)

Transportation

Cardinal Wuerl utilizes two hydraulic elevators. A 2,500 lb. elevator travels at 150 FPM between the first floor of Area F and the second floor. This allows access to the second story of the building, which is located in the classroom wing. Another hydraulic elevator rated at 4,500 lbs. and 125 FPM serves Area A between the cafeteria and the upstairs main corridor. A heavy elevator transit system is not required since most of the building is located on grade.

Cast-in-place concrete stairs are used between the cafeteria & the main corridor on the first floor and between the main corridor & the landing of the upstairs classroom wing. Prefabricated steel pan stairs are installed in-between areas F and G and at the end of Area G in order to achieve multiple points of egress for fire safety and ease of access to/from the second story. Each pan was filled with cast-in-place concrete at 3,000 PSI.

Figure 7: Recently Poured & Finished F11 Staircase (Property of Mascaro Construction)

Telecommunications, Data & Security

Specific information regarding these systems has been withheld at the request of the owner.

Sources

- All photographs shown are property of Alec Hanley
- Rendering on cover provided by Astorino
- Drawings & Specifications provided by Astorino were utilized to determine most of the provided information.