BUILDING SYSTEMS NARRATIVES

STRUCTURAL NARRATIVE

4.1.2 – 09e

MODULE 4: Schematic Design

Structural Narrative

1. STRUCTURE

NEW CONSTRUCTION

Structural: Designed in accordance with the 9th Edition of The Massachusetts State Building Code and incorporating IBC 2015 with Massachusetts amendments.

The proposed scheme will consist of construction of the new school that would include a new, 4-story Academic Wing, Auditorium, Gymnasium, etc. located north of the existing High School; a standalone two story Locker Building, a single story Concessions Building, and a single story pre-engineered steel framed Maintenance Garage Building.

SUBSTRUCTURE

Foundations

Based on the foundations of the existing school structure and preliminary recommendations from the Geotechnical Engineer of the soil conditions on the proposed site, the columns of the proposed structure would bear on reinforced concrete spread footings and the perimeter foundation walls would bear on continuous reinforced concrete strip footings extending at least 4 ft. – 0 in. below grade. The walls around the spaces below grade will be cantilevered retaining buttressed walls supported on reinforced concrete footings. With the recommended bearing capacity of the soil of 5 tons/sf, a typical interior footing at the academic wing would be 11 ft. – 0 in. x 11 ft. - 0 in. x 24 in. deep and the typical exterior footings would be 10 ft. – 0 in. x 10 ft. – 0 in. x 24 in. deep in the four story areas. In the two story areas of the Administrative Department, Media Center and the Cafeteria, typical interior footings would be 9 ft. – 0 in. x 9 ft. – in. x 24 in. deep and typical exterior footings would be 8 ft. – 0 in. x 8 ft. - 0 in. x 24 in. deep. Typical interior and exterior footings at the Metal Fabrication shop, Auto Body, Auto Tech / Gymnasium and Auditorium would be 11 ft. – 0 in. x 11 ft. – 0 in. x 24 in. deep. The exterior foundation walls would be 14 to 16 in. thick, reinforced cast-in-place concrete walls on 24 to 36 in. wide continuous reinforced concrete strip footings around the perimeter of the building extending a minimum of 4 ft. – 0 in. below finished grade. The retaining walls at portions of the building 20 to 25 feet below grade would be 2 ft.-6 in. thick reinforced concrete walls supported on 14 ft.-0 in. wide x 2 ft.-0 in. thick continuous reinforced concrete footings with 12 in. thick reinforced concrete full height buttress walls. The heel of the footing would be 10'-0" wide and located towards the existing buildings. The buttress walls will be a minimum 12 ft.–0 in. long and spaced approximately 20 ft.-0 in. on center. The buttress walls would be located either in the interior space or on the back side of the retaining wall depending on the location of the walls in the program spaces. Foundation drains will be installed around foundations of all structures below grade. Foundations will be founded on 12in. of compacted sand gravel fill or 6" of crushed stone placed above compacted structural granular fill in wet conditions.

Reinforced masonry shear walls will be supported by 8 in. or 12 in. reinforced concrete foundation walls and 2 ft. – 6 in. wide by 12 in. thick continuous reinforced concrete footings.

Slabs-on-Grade

Based on the existing school construction and recommendations from the Geotechnical Engineer, the typical lowest level of the proposed structure would be a 4 in. thick concrete slab-on-grade, reinforced with welded wire fabric over a vapor barrier on 2 in. thick rigid insulation on 12in. of compacted sand gravel structural fill. The slab on grade will be 6" thick, reinforced with welded wire fabric, in all the shop areas. Interior non-structural masonry walls will bear on continuous 14" thickened slabs.

SUPERSTRUCTURE

Floor Construction

Typical Floor Construction

A 5 1/4 in. light weight concrete composite metal deck slab reinforced with welded wire fabric on wide flange steel beams spanning between steel girders and columns. The weight of the structural steel is estimated to be 15 psf for the typical framing. The weight of structural steel at the second floor above the Automotive and other shops is estimated to be 20 psf (maximum span above this space is 45 feet). Weight of steel for Auditorium Balcony framing is estimated to be 20 psf. The weight of structural steel is estimated to be 18 psf for framing supporting elevated courtyards or play areas. Note the floor above the second floor would be the typical floor construction.

Roof Construction

Typical Roof Construction

The roof construction would be galvanized, corrugated 3 in. deep, Type 'N' metal roof deck spanning between wide flange steel beams and girders. At locations of roof-supported mechanical equipment, a concrete slab will be provided similar to the typical supported slab. The weight of the structural steel is estimated to be 14 psf.

Low Roof Construction

The portion of the low roof in front of the Media Center would serve as the patio and the vegetated roof would be a continuation of the adjacent floor and would be similar to the typical floor construction of 5 1/4 in. light weight concrete composite metal deck slab reinforced with welded wire fabric on wide flange steel beams spanning between steel girders and columns. The remainder of the low roof in front of the classrooms would be typical roof construction. The mechanical units located on this roof would be screened by a screen comprised of structural steel posts and beams. The weight of the structural steel for the patio, the vegetated green roof and portions of roof supporting mechanical equipment is estimated to be 18 psf. The weight of the structural steel of the portion of the roof that is typical roof construction is estimated to be 14 psf.

Gymnasium and Auditorium Roof Construction
The roof construction would be acoustic, galvanized, corrugated 3 in. deep, Type 'NA" metal roof deck at the Gymnasium and the Cafeteria, spanning between long span steel joists. The weight of the steel joists and structural steel framing is estimated to be 13 psf.

Vertical Framing Elements

Columns
Columns will be hollow structural steel columns. Typical columns would be HSS 12 x 12 and HSS 14x14 and the columns at the double height spaces would be HSS 12 x 12.

Lateral Load-Resisting System
The typical lateral load resisting systems for the school would be ordinary concentric braced frames comprised of HSS structural steel members and reinforced masonry shear walls.

Expansion Joints

The proposed school will be divided in to three parts separated by way of two expansion joints.

Pre-Engineered Superstructure for Maintenance Garage

The pre-engineered superstructure would be a steel framed structure supported on reinforced concrete spread footings and the perimeter foundation walls would bear on continuous reinforced concrete strip footings extending at least 4 ft. – 0 in. below grade. The interior and exterior foundations supporting the columns of the single story, pre-engineered steel structure would be 5 ft. – 0 in. x 5 ft. – 0 in. x 2 ft. – 0 in. deep. The structure would be comprised of steel bents with tapered columns and beams. The roof deck would be a composite deck spanning between steel 'Z' shaped purlins. The lateral loads would be resisted by ordinary steel moment frames and ordinary concentric braced frames. The slab would be the typical 6 in. thick concrete slab-on-grade reinforced with welded wire fabric over a vapor barrier on 2 in. thick rigid insulation on 12in. of compacted sand gravel structural fill.

Two Story Locker Room Building

The building construction would consist of steel beams bearing on reinforced masonry walls. Typical interior and exterior footings would be 6 ft. – 0 in. x 6 ft. – 0 in. x 24 in. deep. Exterior masonry bearing walls would be supported on continuous reinforced concrete foundation walls and 2 ft. wide strip footings, extending at least 4 ft. – 0 in. below grade. The retaining wall at the rear of the building will retain soil up to the second floor, and would be a 2 ft.-0 in. thick reinforced concrete wall supported on a 9 ft.-0 in. wide x 2 ft.-0 in. thick continuous reinforced concrete footing. The first floor slab would be the typical 6 in. thick concrete slab-on-grade reinforced with welded wire fabric over a vapor barrier on 2 in. thick rigid insulation on 12in. of compacted sand gravel structural fill. The second floor would be a 5 1/4 in. light weight concrete composite metal deck slab reinforced with welded wire fabric on wide flange steel beams spanning between masonry walls. The weight of the structural steel is estimated to be 15 psf for the typical framing at the second floor and roof levels. The roof construction would be galvanized, corrugated 3 in. deep, Type 'N' metal roof deck spanning between wide flange steel beams

and girders. The elevator shaft would be constructed with full-height reinforced masonry, bearing on reinforced concrete foundation walls and a 3 ft. – 0 in. deep mat footing.

Concession Building

The building construction would consist of steel roof beams below the bleacher seating, bearing on reinforced masonry walls. Exterior masonry bearing walls would be supported on continuous reinforced concrete foundation walls and 2 ft. – 0 in. wide strip footings, extending at least 4 ft. – 0 in. below grade. The first floor slab would be the typical 6 in. thick concrete slab-on-grade reinforced with welded wire fabric over a vapor barrier on 2 in. thick rigid insulation on 12in. of compacted sand gravel structural fill. The roof deck would be galvanized, corrugated 3 in. deep, Type 'N' metal roof deck spanning between wide flange steel beams. The weight of the structural steel is estimated to be 15 psf for the typical framing at the roof level.