

APPENDIX 8

6.4 Structural Assessment of Options

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MODULE 3: PRELIMINARY DESIGN PROGRAM

SECTION TITLE

1. STRUCTURE

BASE REPAIRS & CODE UPGRADES ONLY

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 require repairs and only minor renovations and upgrades to the existing school triggered by requirements for compliance with the International Existing Building Code. All of the proposed renovations will essentially be Architectural in nature and will require no major reconfiguration of the structure. The proposed scheme requires replacement of all mechanical equipment, renovations related to ADA requirements and the addition of a vestibule and bathrooms.

PRIMARY STRUCTURAL CODE ISSUES RELATED TO THE EXISTING STRUCTURE

Based on the proposed scope, we would recommend following the compliance requirements of the Work Area Compliance Method since it will be the most cost effective method for this proposed scheme. Given that there is no reconfiguration of demising walls or spaces, the work area as defined in the International Existing Building code will be less than 50% of the aggregate floor area of the building; therefore, no structural upgrades or interventions are required by the code.

PROPOSED STRUCTURAL SCHEME

Based on the scope of the proposed scheme, no structural upgrades are triggered or required. The replacement mechanical units can be supported on the existing framing, if the proposed units are lighter in weight than the existing units. Some of the mechanical equipment may be required to be supported on dunnage platforms. Allow for costs for reinforcement of the roof structure as a percentage of the cost of the mechanical units.

MODULE 3: PRELIMINARY DESIGN PROGRAM

SECTION TITLE

1. STRUCTURE

OPTION 2 – RENOVATION / ADDITION OF EXISTING ELEMENTARY SCHOOL

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

The proposed scheme requires renovation of the entire school and reconfiguration of the majority of the demising walls. The scheme requires construction of a new two to three story Academic Wing Addition and a two story Gymnasium/Cafeteria Addition.

Specific dimensions are as follows:

- Addition (61,000 GSF Total)
- Renovation (62,500 GSF Total)
- Total Area (123,500 GSF Total)

Primary Structural Code Issues Related To The Existing Structure

Due to the extent of the proposed renovations and additions to the existing structure, the existing structure will have to be upgraded by the addition of some masonry shear walls. All of the existing masonry walls will be required to be clipped at the top to the floor and roof structure.

PROPOSED STRUCTURAL SCHEME

Due to the extent of the proposed renovations and reconfiguration of the interior spaces, additional reinforced masonry shear walls or braced frames of structural steel will be required. The proposed shear walls or braced frames would be located at the existing column lines. An allowance for 8, 20 ft. long, full height shear walls should be made in the project budget. These new shear walls will be supported on new 2 ft. – 0 in. wide x 1 ft. – 0 in. deep reinforced concrete foundations. Allow for replacement of 5 ft. – 0 in. width of existing slab-on-grade along the length of the proposed shear wall.

Due to the replacement of the entire mechanical and HVAC system, an allowance should be made for reinforcement of the existing roof framing to support the new units. This cost should be carried as a percentage cost of the mechanical units in the budget.

All of the existing masonry walls will be required to be clipped at the top to the existing floor and roof structure with steel angle clips at 4 ft. – 0 in. on center.

PROPOSED ADDITIONS

SUBSTRUCTURE

Foundations

Based on the foundations of the existing structure, the columns of the proposed addition would bear on reinforced concrete footings and the perimeter foundation walls would bear on continuous reinforced concrete strip footings extending at least 4 ft. – 0 in. below grade. With the assumed bearing capacity of the soil of 2 tons/sf, a typical interior footing would be 9 ft. - 0 in. x 9 ft. - 0 in. x 24 in. deep and a typical exterior footing would be 8 ft. – 0 in. x 8 ft. 0 in. x 24 in. in the three story addition. Typical interior and exterior footings at the Cafeteria and Gymnasium would be 8 ft. – 0 in. x 8 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 x 12 in. deep continuous reinforced concrete strip footings around the perimeter of the additions extending a minimum of 4 ft. - 0 in. below finished grade.

Slabs-on-Grade

Based on the existing school construction, the lowest level of the proposed additions would be a 5 in. thick concrete slab-on-grade reinforced with welded wire fabric over a vapor barrier on 2 in. thick rigid insulation on 8 in. of compacted granular structural fill and a base course of 8 in. of compacted gravel.

SUPERSTRUCTURE

Floor Construction

Typical Floor Construction

A 4 ½ 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 14 psf for the typical framing.

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 connected to the existing steel beams. The weight of the structural steel is estimated to be 14 psf.

Gymnasium and Cafeteria Roof Framing

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 8 x 8 columns and the columns at the double height spaces would be HSS 12 x 12.

Lateral Load-Resisting System

The typical lateral load resisting system for the school would be ordinary concentric braced frames (as defined in the International Building Code) comprised of HSS structural steel members.

MODULE 3: PRELIMINARY DESIGN PROGRAM

SECTION TITLE

1. STRUCTURE

OPTION 3 (SITE A) – 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 a new, two story structure on the existing school Site with the following dimensions: 98,200 GSF Total.

SUBSTRUCTURE

Foundations

Based on the foundations of the existing structure, 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. With the assumed bearing capacity of the soil of 2 tons/sf, a typical interior footing would be 9 ft. – 0 in. x 9 ft. - 0 in. x 24 in. deep and the typical exterior footings would be 8 ft. – 0 in. x 8 ft. – 0 in. x 24 in. deep in the three story areas. In the single story areas, typical interior footings would be 7 ft. – 0 in. x 7 ft. – in. x 24 in. deep and typical exterior footings would be 6 ft. – 0 in. x 6 ft. - 0 in. x 24 in. deep. Typical interior and exterior footings at the Cafeteria and Gymnasium would be 8 ft. – 0 in. x 8 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.

Slabs-on-Grade

Based on the existing school construction, the lowest level of the proposed structure would be a 5 in. thick concrete slab-on-grade reinforced with welded wire fabric over a vapor barrier on 2 in. thick rigid insulation on 8 in. of compacted granular structural fill and a base course of 8 in. of compacted gravel.

SUPERSTRUCTURE

Floor Construction

Typical Floor Construction

A 4 ½ 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 14 psf for the typical framing.

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.

Gymnasium and Cafeteria Roof Framing

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 8 x 8 columns and the columns at the double height spaces would be HSS 12 x 12.

Lateral Load-Resisting System

The typical lateral load resisting system for the school would be ordinary concentric braced frames (as defined in the International Building Code) comprised of HSS structural steel members.

MODULE 3: PRELIMINARY DESIGN PROGRAM

SECTION TITLE

1. STRUCTURE

OPTION 4 (SITE B) – 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 a new, two story structure on the existing school Site with the following dimensions: 98,200 GSF Total.

SUBSTRUCTURE

Foundations

Based on the foundations of the existing structure, 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. With the assumed bearing capacity of the soil of 2 tons/sf, a typical interior footing would be 9 ft. – 0 in. x 9 ft. - 0 in. x 24 in. deep and the typical exterior footings would be 8 ft. – 0 in. x 8 ft. – 0 in. x 24 in. deep in the three story areas. In the single story areas, typical interior footings would be 7 ft. – 0 in. x 7 ft. – in. x 24 in. deep and typical exterior footings would be 6 ft. – 0 in. x 6 ft. - 0 in. x 24 in. deep. Typical interior and exterior footings at the Cafeteria and Gymnasium would be 8 ft. – 0 in. x 8 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.

Slabs-on-Grade

Based on the existing school construction, the lowest level of the proposed structure would be a 5 in. thick concrete slab-on-grade reinforced with welded wire fabric over a vapor barrier on 2 in. thick rigid insulation on 8 in. of compacted granular structural fill and a base course of 8 in. of compacted gravel.

SUPERSTRUCTURE

Floor Construction

Typical Floor Construction

A 4 ½ 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 14 psf for the typical framing.

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.

Gymnasium and Cafeteria Roof Framing

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 8 x 8 columns and the columns at the double height spaces would be HSS 12 x 12.

Lateral Load-Resisting System

The typical lateral load resisting system for the school would be ordinary concentric braced frames (as defined in the International Building Code) comprised of HSS structural steel members.

