3.1 Design

3.1.1 Guidelines for New Foundation Design - High Water Table or Surface/Perched Water

Description/Design Approach:

A. As per Section BC **1805** of the **2022**4 NYC Building Code, foundations are to be designed to take into account water conditions at the subject site. Such conditions may arise due to a high water table or from inundation from a perched or surface water condition. In order to ensure that any such conditions are adequately addressed, a dedicated meeting is to be held by the design team and the SCA structural managers on every capacity project to discuss the geotechnical findings and the site data to determine the appropriate level of water resistant design.

B. To protect the building from water infiltration due to high water table, including potential current and future fluctuations in the water table and to minimize hydrostatic pressure on the foundation, the building is to be raised above the design groundwater level unless there is no other way to facilitate the building on the site. The design groundwater elevation is to include an additional 5'-0" above the highest water table reading taken from the borings.

C. Where the foundation may be subject to a perched water or surface water condition, detailing of structure shall be such to prevent intrusion of water into building. This may entail detailing the project to include full waterproofing, or upgrading the environmental vapor barrier system typically installed on new capacity projects to a more water resistant system.

D. Where design ground water levels will be above cellar/basement slabs, the architect/engineer shall prepare cost estimates for the following foundation alternatives. Alternatives should also look at the construction methods that will be employed to ensure their feasibility:

   1. Make basement slab thick enough to counteract the uplift pressure.

   2. Design reinforced concrete slabs that are tied into the footings, walls and columns, such that the overall weight of the structure is utilized in resisting the uplift forces, or employ the use of tie downs, if feasible.

E. Structures are to be designed for hydrostatic pressure and waterproofed for a design water table elevation five feet above the highest level given on the borings, as a minimum. The intent to account for the effects of normal cyclical rising and falling of the water table as well as long term rising of the water table. The geotechnical engineer is to study the historic data for the area, make an analysis and determine if the design ground water elevation needs to be greater than five feet above the highest actual shown on the borings.

   Refer to DR 3.2.2 for guidelines for Foundation and Slab design.

F. The preferred method of waterproofing is a positive-side waterproofing applied to the outside surfaces of foundation walls and slabs. Utilities are to be designed such that they run within the building space (preferred) or are encased and placed above the waterproofing to avoid penetrations in the waterproofing to the greatest extent possible. Provide waterstop at all joints.

G. Where dewatering is likely to be required during construction activities for the foundation system, the geotechnical engineer shall determine the estimated pumping rates required. The I&EH Division is to be consulted to determine if the ground water is safe to be disposed of in the sewers

and if there is potential of bringing in contaminants to the site based on the estimated pumping rate. The capacity of the local sewers shall be evaluated to determine if the dewatering rate and disposal falls within DEP allowable range for temporary dewatering and the possible need for off-site disposal. The result of these studies is to be discussed with Construction Management and I&EH to determine what is to be included in the bid documents, which will typically involve incorporating items in Section 02200.

3.1 Design

3.1.2 Design Live Loads

Description/Design Approach:

A. Live loads used in design shall be as per the **2022** NYC Building Code required by Table BC 1607.1 (minimum), except as modified by the following table. Due to the possibility of change in the use of various areas in a school building and the increase of the student population in the future, live-load reduction as allowed by the Building Code is not to be used, except as approved by the Authority for unusual cases.

B. Structural elements shall be designed to support the uniformly distributed live load or the concentrated load, whichever produces the greater load effect.

Use Area	Design Live Load LL (PSF)
Kitchen Areas*	150****
Mechanical Spaces**	75
Roofs with water retention***	45 or $R=5.2(d_s+d_h)$... [see EQ. 16-**43**] whichever is greater. Ensure Ponding Instability is addressed as per Section BC 1611.2
Toilet Rooms	60****

The uniform distributed design live load for each floor and the equivalent uniform partition loads or actual partition load shall be tabulated and shown on the drawings.

Note that the live load in school corridors above the first floor is 80 psf.

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* The indicated live load includes most equipment loads. If a piece of equipment is in excess of this, such as the walk-in freezer, the design load shall be that of the equipment for that area. This loading shall be mapped on the floor plan.

** If a piece of equipment is in excess of this indicated live load, the design load shall be that of the equipment for that area. This loading shall be mapped on the floor plan. Note that condensing boilers vary in weight substantially depending on manufacturer and a 150 psf LL is recommended to be used to accommodate the equipment. Design the entire room for that load if it is a smaller dedicated room rather than the boilers being installed in larger mechanical room with many other lighter equipment.

*** This live load is only to be used for roofs subject to roof detention, and may be sufficient to account for some equipment loads supported on enclosed curbs weighing less than the live load. If a piece of equipment is in excess of this indicated live load, the design load shall be that of the equipment for that area.

**** ASCE Standard 7-**16**, Table **C4.3-1 of the commentary**

C. At the roof level where rooftop mounted photovoltaic (PV) solar panels are to be installed, as per Section BC 1607.13.5.1 of the 2022 NYC Building Code the roof structure shall be designed for the greater load effects from either (1) the installed PV system case, or (2) the case without the installed PV system. In the installed PV system case, the exception to item 1 of Section BC 1607.13.5.1 allows for the removal of uniform or concentrated roof live loads where PV systems are installed and the panels are less than 24 inches clear from the roof surface.

Note: As indicated in Section BC 1607.13.5.4, roof structures that provide support for ballasted PV systems shall be checked in accordance with Section BC 1604.3.6 for deflections and with Section BC 1611 for ponding. Ballasted PV systems introduce sustained dead loads that will produce long-term deflections in concrete slabs and must be considered in design of such slabs.

3.1 Design

3.1.3 Seismic Design Criteria

Description/Design Approach:

A. As per Section BC 1613 of the **2022** NYC Building Code, new school buildings and additions shall be designed and constructed to resist the effect of earthquake motions as described in ASCE 7-**16**, excluding Chapter 14 and Appendix 11A.

B. As per Table BC 1604.5, new school buildings and additions are assigned to /Risk Category III, with a seismic importance factor I = 1.25 in accordance with Table 1.5-2 of ASCE 7-16 as required by Section BC 1604.5.2. The site class shall be determined in accordance with Section BC 1613.3.4.1, Table BC 1613.3.4.1. A site-specific evaluation in accordance with ASCE 7-16 and Section BC 1815 shall be used for structures on sites classified as Site Class F, in accordance with Section BC 1613.3.4.1.1.

C. Each structure shall be assigned to a Seismic Design Category in accordance with Section BC **1613.3.5**.

D. All structures shall be separated from adjacent structures as prescribed in Section BC **1613.4**. Structural separation refers to the property line, not to an adjacent property. When a structure adjoins a property line, that structure shall be set back from the property line by at least 1 inch for each 50 feet of height. If the adjoining structure is an unreinforced masonry building, the gap is to be filled with material having a compressive strength of between 25 to 100 psi in accordance with Section BC 1613.4.1.

E. Existing structures and alterations to existing structures need to comply with the provisions of seismic design only when required by Appendix 11B of ASCE 7-**16** and NYCDOB Technical Policy and Procedure Notice (TPPN) 4/99. Section 11B.2 of ASCE 7-**16** indicates any addition that is structurally independent from an existing structure shall be designed and constructed in accordance with the seismic requirements for new structures. As per Section 11B.3 of ASCE 7-**16**, when an addition is not structurally independent from an existing structure, it shall be designed and constructed such that the entire structure conforms to the seismic force resistance requirements for new structures unless all three of the following conditions are complied with:

- The addition complies with the requirements for new structures.
- The addition does not increase the seismic forces in any structural element of the existing structure by more than 10% unless the capacity of the element subject to the increased forces is still in compliance with these provisions.
- The addition does not decrease the seismic resistance of any structural element of the existing structure unless the reduced resistance is equal to or greater than that required for new structures.

F. Section 11B.5 requires that when a change of use results in a structure being reclassified to a higher Risk Category, the structure shall comply with the seismic requirements for new construction. Refer to section 11B.5 for exceptions. This is for structures designed **starting with** the 2008 NYC Building Code and those structures required to be seismically designed under Local Law 17/1995 of the 1968 Building Code. Per Section BC 1601.2.3, the determination as to

whether seismic requirements apply to an alteration shall be made in accordance with the 1968 Building Code and interpretations by the Department of Buildings relating to such determinations. Refer to Local Law 17/1995 and TPPN 4/99. Any applicable seismic loads and requirements, including for the bracing of architectural, mechanical, plumbing, fuel gas, fire suppression and electrical systems and equipment, shall be permitted to be determined in accordance with Chapter 16 of the **2022** code or Reference Standard RS 9-6 of the 1968 code.

G. The following information related to seismic loads shall be shown on the drawings **per Section BC1603.1.6**:

1. Risk category
2. Seismic importance factor
3. Mapped spectral response acceleration **parameters**, S_S and S_1
4. Site class
5. **Design s**pectral response accelerations **parameters,** S_{DS} and S_{D1}
6. Seismic design category
7. Basic seismic force-resisting system**(s)**
8. Design base shear**(s)**
9. Seismic response coefficient**(s)**, C_S
10. Response modification **coefficient(s),** R
11. Analysis procedure used

3.1 Design

3.1.4 Vibration Criteria for Floor Construction

Description/Design Approach:

A. A vibration analysis is to be performed to determine the sensitivity of the floor construction to motion. The design criteria for vibration shall be to limit the motion to within acceptable standards set in the AISC Steel Design Guide Series #11. This study must show compliance with all criteria for controlling annoying floor movement in all spaces in the building that are affected by walking excitation (such as classrooms and offices adjacent to a corridor) or rhythmic excitation as typically occurs in a gymnasium and/or an auditorium stage area. The analysis must also verify that there is no potential for a resonance condition.

B. In compliance with Design Requirement 3.3.1, a vibration analysis is required to be submitted along with each proposed framing layout indicating their adequacy against all walking and/or rhythmic excitations.

C. Mechanical equipment that can produce objectionable vibrations in any portion of structure utilized by students and staff shall be isolated to minimize the transmission of such vibrations to the structure in accordance with ASCE 7-**16**, Section C.1.3 **of the commentary**. Also, use the service of an acoustical consultant to investigate and make recommendation for induced vibrations/noise on the structure from exterior sources such as trains.

3.1 Design

3.1.5 Miscellaneous Structural Drawing Requirements

Description/Design Approach:

A. The following items shall be shown, coordinated with or taken into account on the Architectural Drawings as well as other trades:

1. Steel Attachments/Splices: Location and depth of walls and chases at steel cross bracing and columns needs to account for the splices/attachments and their bolt lengths with associated fireproofing, as it results in a substantially larger depth than the member measurement itself and is many times not accounted for in chase depths and needs to be coordinated with the Architect.

3.2 Foundations

3.2.1 Waterproofing Systems for Foundations

Description/Design Approach:

1. The preferred method of waterproofing for buildings subject to hydrostatic pressure is by positive-side application, consisting of a sheet membrane waterproofing system. The membrane shall extend up the entire height of the wall to just below the grade. Provide a mud-mat working surface to facilitate installation of the waterproofing at horizontal applications. Refer to Specification Section 07115 for materials. As the system must typically also act as an environmental barrier, the waterproofing details and specifications are to be given to the I&EH department to review to verify the system design is also sufficient to act as an environmental barrier.

2. All foundation construction joints (walls, slabs, etc) regardless of water conditions are to have a gasket type waterstop as a minimum and these shall be shown on the drawings. For habitable spaces (those occupied by other than maintenance personnel) subject to hydrostatic pressure, provide acrylate ester injectible hose-type waterstop system for all construction joints that are within the water table.

3. Where the building is situated such that the main portion of the building is not in the potential water table zone but deeper pits (elevator, mechanical, etc) are, a combination waterproofing and environmental barrier system by the environmental barrier manufacturer may be accepted in lieu of a full membrane waterproofing. All tie-in and overlaps between materials must be verified as compatible by the manufacturers of those materials.

4. Depending on the potential for infiltration from perched or surface water, the design team and A&E staff shall determine if waterproofing membranes or upgraded environmental barrier systems are to be used. A meeting is to be held by the 60% Construction Document specifically to review the geotechnical report and potential issues.

5. Surfaces subject to constant water, such as sump pits, are to have a waterproofing application consisting of a “crystalline” type waterproofing on the interior side. This is in addition to the positive side application required for high water table.

3.2 Foundations

3.2.2 Guidelines for Foundation and Slab Design

Description/Design Approach:

A. The building superstructure is to bear on cast-in-place concrete foundations, either footings or pile caps, with concrete walls or grade beams supporting exterior walls and retaining earth. The foundation design, including the method of support for utilities, is to be based on the recommendations of a geotechnical engineer. A geotechnical report is required to be filed and the foundation designed as per the recommendations in such report as per Section BC 1803.6.1 of the 2022 NYC Building Code.

B. Exterior foundation wall and slab protection treatment is based on the existing soil/water conditions and SCA technical requirements. For all conditions, provide a drainage panel on the exterior of all walls to the bottom of footing to reduce build-up of hydrostatic pressure from saturated soils. Where not subject to hydrostatic pressure, provide perforated pipe at the footing level connected to the storm system (through a readily accessible silt and sand interceptor and subject to DEP approval as per Section PC 1111 of the 2022 NYC Plumbing Code) or a drywell system by gravity if the existing soil at the footing level is of low permeability. Provide membrane systems as follows:

1. High Water Table/Perched Water Condition: Where the building is subject to hydrostatic head, follow DR 3.1.1, Guidelines for New Foundation Design - High Water Table or Surface/Perched Water. If the geotechnical investigation reveals the potential for perched water, the condition must be carefully studied and the design of the structure may need to be treated as a high water table condition, which could also impact the SSDS system. If there is potential for transient water to be on the site, discuss with A&E the need to upgrade the environmental barrier to a thicker placement or potentially a membrane waterproofing installation. Refer to DR 3.1.1.

2. SSDS System: For projects requiring a sub-slab depressurization system with an environmental barrier on the walls and slabs and waterproofing is not needed, the IEH department will recommend the membrane system to be utilized and provide the design documents. Careful coordination is required if both an environmental and a separate waterproof membrane are to be installed at different sections of the foundation system; in such cases the interface of the two membranes must be approved by the material manufacturers to avoid a design where two adjoining materials are incompatible. Such interfaces are to be avoided. Provide gasket type waterstops at all joints in slab and walls.

3. All other cases: Where there is no requirement for an environmental membrane on the foundation wall, utilize a sheet membrane waterproofing installed to below the slab level, typically to 1 foot below the top of footing. Regardless of water level, provide gasket type waterstops at all joints in the slabs and walls. Refer to Specification Section 07115 for materials

C. Refer to Section BC 1809 for shallow foundation and Section BC 1810 for deep foundation design and construction requirements. Foundation walls shall be designed to support the weight of the full hydrostatic pressure of un-drained backfill unless a drainage system is installed in accordance with Sections BC 1805.4.2 and 1805.4.3. Follow Section BC 1809.6 for requirements for footings and foundations of structures assigned to Seismic Design Category C. Where a structure utilizing

deep foundations is assigned to Seismic Design Category C in accordance with Section BC 1613, individual pile caps or piles shall be interconnected by ties. Refer to Section BC 1810.9.1 for seismic ties design requirements.

D. For design of the foundation walls, perform a comparison of the cost effectiveness of a deep-grade beam versus walls with continuous footings. Since the footings should rest on a suitable soil, some of the wall footings may become very deep requiring additional excavation. In this case, it may be more economical if the walls are supported by piers at the location of column footings or pile caps.

E. The decision to support slabs resting on grade structurally or to have the slab supported solely by the soil is to be based on the geotechnical report. Slabs on grade are to be designed, with the following minimum requirements:

1. Non-structurally supported slab-on-grade

   a. Basement/Cellar slabs are to be five inches minimum with a minimum reinforcement of 6x6-W2.9xW2.9 welded wire fabric, placed 1" from the surface. The reinforcement and thickness is to be increased if required by design considerations. The slab shall bear on a vapor barrier and a minimum 6" crushed stone base, or the environmental barrier over the open graded aggregate where such system is utilized per IEH requirements **(typical of most new buildings)**. Provide additional reinforcement at reentrant corners and joints as required to minimize cracking. Thicken slab at all masonry partitions. Indicate any required control joints on the Drawings.

   b. Pipe & Duct and Crawl space slabs are to be 3½" minimum with a minimum of 6x6-W2.9xW2.9 welded wire fabric. The slab shall bear on a vapor retarder and 4" crushed stone base. Provide additional reinforcement at reentrant corners and joints as required to minimize cracking. Indicate any required control joints on the Drawings.

2. Structurally supported slab-on-grade

   Slabs are to be of thickness and reinforcement as required by design considerations, with the minimum reinforcement following recommendations of ACI 318. Bottom reinforcement is to have 2" clear minimum from grade and top reinforcement 1" clear from top of slab. The slab shall bear on a vapor barrier and 6" minimum of crushed stone base, or the environmental barrier over the open graded aggregate where such system is utilized per IEH requirements. Provide additional reinforcement at reentrant corners as required to minimize cracking.

F. Coordinate with the project architect for foundation insulation to be installed below slabs placed on grade. Refer to DR 1.3.2.2.

G. When provided for the project, Foundation Drawings shall refer to the Environmental Drawings provided by the I&EH department that clearly details the passive/active vapor barrier/venting system on the Drawings. The foundation sections shall be coordinated such that the design facilitates the installation of the systems.

H. If the areas that require backfilling are narrow and will be difficult to provide proper compaction, specify backfilling with crushed stone and proofrolling.

I. Obtain utility company design requirements for vaults after providing the utility company with all required geotechnical data so the design can be incorporated into the Contract Documents.

J. The designer and geotechnical engineer are to investigate the protection of adjacent properties and structures, as well as those of the school property, to ensure that a feasible scheme is possible. The Geotechnical Engineer is required to create an Evaluation Report assessing the condition of the existing buildings and subsurface conditions of the adjoin properties and file such report as per Section BC 1817.3, which is to be included with the Contract set. Design of the Method of Support (MOS) and who is to provide such design shall be determined during the early part of the design.

1. If the Contractor is to be responsible for the final design of the underpinning/shoring/bracing scheme and for filing such as is indicated in Section 02200, a schematic scheme is to be indicated on the Drawings with adequate notes to ensure the Contractor is aware of all issues to be considered. As an example, if due to site restrictions on adjoining properties, the adjoining property cannot be excavated or accessed; or shoring can be only installed on the lot line, the Contract Documents must be clear to show the foundation is integrated into the shoring scheme. Also, schematic underpinning sections should state bracing is required if the height of such underpinning required by the project would be impractical without it and fail. The Contractor's engineer is responsible to review the Evaluation Report and if they believe it is not sufficient or want to design a different way, they are required to submit a new Evaluation Report, with back-up construction documents, as per Section BC 1817.5.3.

2. If the SCA's engineer is to be responsible for design and filing, the full set of documents based on the recommendations in the Evaluation Report are to be included with the Contract set and Section 02200 edited accordingly. If the work involves underpinning or alternate means of support, the SCA's Engineer is to develop the monitoring plan per Section BC 1817.9.

K. Since underpinning of gas utility lines will not be accepted/permitted by utility companies, it is required to investigate and coordinate excavations to be a minimum of 10' away from gas lines or arrangements must be made for their relocation.

3.2 Foundations

3.2.3 Concrete Reinforcement

Description/Design Approach:

Reinforcing bars are to conform to the requirements of ASTM A615, Grade 60, unless higher strength bars are needed by design considerations.

Wire mesh shall conform to ASTM A185.

Reinforcement to be welded shall conform to the requirements of ASTM A706.

Reinforcement for concrete exposed to the elements, such as exterior framed slabs, exposed face of retaining walls, **parapet concrete back up,** curbs, etc. are to be epoxy coated or galvanized.

3.3 Superstructure

3.3.1 Economic Analysis of Structural Framing Systems

Description/Design Approach:

A. **While structural steel-framed superstructures have been the typical system used in the SCA, the use of a concrete-framed superstructure is being used where it is an advantage to the project. The "Structural System Selection Matrix" will typically determine which system is suitable and the biggest advantage in terms of cost and constructability for a particular site**

B. After the determination of the superstructure design from the Structural System Selection Matrix, as part of the schematic design submittal the Structural Engineer shall propose and submit alternative framing layouts for a typical bay as well as for a long span bay, with discussion as to which layout is the most economical. The vibration analysis of each layout should also be submitted indicating the adequacy against walking and/or rhythmic excitations. In addition, the proposed location of the lateral load-resisting frames is to be indicated on the plans for each scheme.

C. As part of the **Design Development** submission, provide examination of alternative methods for supporting of exterior masonry, **if selected as part of the Exterior Envelope Selection matrix.** This is to avoid the need for diagonal struts to brace the wall/lintel assembly.

3.3 Superstructure

3.3.2 Structural Floor and Framing Systems

Description/Design Approach:

A. The selection of the superstructure framing systems (structural steel or reinforced concrete) will typically be determined from the use of the Structural System Selection Matrix. Refer to DR 3.3.1.

1. Structural Steel Framing

a. Depending on compatibility with architectural and engineering requirements including vibration, the structural floor system shall be a 6 1/4-inch composite slab consisting of 3" galvanized metal decking with 3 1/4" lightweight structural concrete topping to be supported on composite structural steel beams framing into steel columns. The designer shall include in the design an additional 1.5" of concrete to account for beam and deck deflections in both the steel design and design of the deck. Designer should specify the grade (minimum yield strength) of the deck and modify the specifications and drawings accordingly. Gage of metal deck shall be sufficient to sustain the wet-concrete weight and construction loads without shoring. Where small depressions are required, reducing the deck to 2" in depth should be investigated in lieu of depressing the entire slab-deck assembly. If the spacing of the filler beams allows and/or the height of the building can be reduced, the use of 2" in lieu of 3" metal deck should be considered. In compliance with Design Requirement 3.3.1, a vibration analysis is required to be submitted for each proposed steel framing layout indicating their adequacy against walking and/or rhythmic excitations.

b. The design shall also take into account the need to meet acoustic requirements, which may entail the use of thicker slabs or double slab systems. Where appropriate, the use of acoustic deck may be researched and utilized.

c. The framing is to be designed such as to reduce the steel piece count and tonnage to the greatest extent possible while complying with serviceability and vibration requirements. The spacing of the filler beams should be within the 10'± range in order to utilize a three-span condition for the deck. Where the building configuration is such that the steel cannot be reasonably spaced to that criteria, the deck may span for 12'± provided the deflection on a two-span condition does not exceed the manufacturer's recommended limits. The proposed layout shall be discussed with the A&E structural unit and DCIM Structural Reviewer, with back-up information or calculations to indicate adequacy for review and acceptance. Refer to DR 3.3.1 for requirements for alternate framing schemes. Where the metal-deck layout requires the use of a single-span, shoring should be indicated if the use of a thicker deck would have adverse cost effect or would negatively affect the progress of the construction work.

d. Obtain size and location of miscellaneous steel members such as elevator hoist beams from other disciplines and provide on the drawings. Coordinate the location and size of all openings with each trade.

e. Structural-steel members shall be Grade 50 steel conforming to ASTM A992. The use of open web joists for floor framing is not permitted.

f. The Superstructure Notes from the Standard Details specify that bolted connections are to be "Slip Critical". Connections that are not required to be slip critical shall be specifically shown on the plans as "bearing type connection".

g. The camber to be indicated on the drawings is to be 2/3 of the pre-composite dead load deflection to account for the inherent stiffness of the structural connections. The camber for members between columns or between columns and girders may be somewhat less due to greater resistance to movement by these more rigid elements. As per AISC recommendation, cambers less than ¾" are not to be specified; thus, a larger size beam might be more economical to control the deflection.

h. While columns, beams and other structural members customarily shall have sprayed fireproofing, the standard metal deck system is to meet the required fire-rating without added fire protection to the underside of the metal deck. Areas required to have a higher fire-resistance rating or areas where the thickness of the slab is reduced due to a floor depression (thus reducing the fire-resistance rating of the assembly) may have sprayed fireproofing applied to the deck. Only cementitious sprayed fireproofing shall be used to provide fireproofing of steel beams, columns, and deck. For specific areas exposed to public view where the regular cementitious sprayed fireproofing is not appropriate, a decorative intumescent fire-resistive coating is to be used.

i. The structural steel floor framing systems shall be capable of sustaining the superimposed loads with a maximum deflection of L/360. Structural systems that directly or indirectly brace or support masonry shall be capable of sustaining the masonry cladding (and other masonry exposed to view) and live loads with a maximum deflection of L/600.

2. Reinforced Concrete Framing

a. Reinforced concrete slabs shall be either one-way or two-way framed systems. One-way framed system provide more flexibility when laying out openings. Refer to DR 3.3.1 for requirements for alternate framing schemes, as an analysis to determine which method works the most economical for the design of the building is required.

b. The design shall also take into account the need to meet acoustic requirements, which may entail the use of a double slab systems.

c. The structural floor framing systems shall be capable of sustaining the superimposed loads with a maximum deflection of L/480, taking into account the long-term and creep deflection of concrete. Structural systems that directly or indirectly brace or support masonry shall be capable of sustaining the masonry cladding (and other masonry exposed to view) and live loads with a maximum deflection of L/600.

B. Buildings and other structures, including all components and cladding, shall be designed and constructed to resist the effects of wind in accordance with requirements of Section BC 1609 of the **2022** NYC Building Code. Also, every structure and portion thereof shall be designed and constructed to resist the effects of earthquake motions as required in Section BC 1613. Braced frames shall be provided for seismic and wind resistance; locations shall be coordinated with the architecture of the building. The maximum floor-to-floor drift due to wind loads is limited to 1/400 of the floor-to-floor height. The drift due to seismic loads shall be as per the building code. Structural lateral and vertical force resisting systems utilized for the project shall be indicated on construction documents, with clear indication of the design load **that** governs.

C. The following code requirements shall be evaluated and implemented where applicable:

1. Structures carrying live load that induce impact shall include allowance in accordance with Section BC **1607.10**.
2. Refer to Chapter C2 of ASCE 7-**16** for description of self-straining forces to be considered in structural design, which shall be included in load combinations required by Section BC 1605.
3. All structures shall be designed to satisfy Structural Integrity Requirements of Sections BC 1**615** through 1617.
4. Structural columns that are directly exposed to vehicular traffic shall be designed for vehicular impact based on requirements of the Section BC **1616.4**.
5. In buildings with gas piping operating at pressures in excess of 15 psi, all key elements and their connections shall be designed to resist a potential gas explosion, in accordance with requirements of the Section BC **1616.5**.

D. Refer to Sections BC 1603.1.1 through BC 1603.1.**10** for design loads and other information related to structural design, which shall be indicated on the construction documents.

3.3 Superstructure

3.3.3 Structural Framing Systems for Roof Areas

Description/Design Approach:

A. The structural framing of the roof deck will typically match that of the system selected for the floor framing. However, for spaces with long spans, a steel-framed roof will many times be utilized if feasible regardless of the remaining superstructure composition.

1. Structural Steel Roof Framing

a. Depending on compatibility with architectural and engineering requirements, the structural roof system shall be a minimum $6^1/_4$-inch composite slab consisting of 3" galvanized metal decking with $3^1/_4$" lightweight structural concrete topping supported on composite structural steel beams framing into steel columns. In addition to the structural slab and any topping slab, the designer shall include in the design an additional 1.5" of concrete to account for beam and deck deflections in both the steel design and design of the deck. Designer should specify the grade (minimum yield strength) of the deck and modify the specifications and drawings accordingly. Gage of metal deck shall be sufficient to sustain the wet-concrete weight and construction loads without shoring. If the spacing of the filler beams allows and/or the height of the building can be reduced, the use of 2" in lieu of 3" metal deck should be considered.

b. The design shall take into account the need to meet acoustic requirements, which may entail the use of thicker slabs or double slab systems. Where appropriate, the use of acoustic deck may be researched and utilized.

c. The framing is to be designed such as to reduce the steel piece count and tonnage to the greatest extent possible while complying with all serviceability requirements. The spacing of the filler beams should be within the 10'± range in order to utilize a three-span condition for the deck. Where the building configuration is such that he steel cannot be reasonably spaced to that criteria, the deck may span for 12'± provided the deflection on a two-span condition does not exceed the manufacturer's recommended limits. The proposed layout shall be discussed with the A&E structural unit, with back-up information or calculations to indicate adequacy for review and acceptance. Refer to DR 3.3.1 for requirements for alternate framing schemes. Where the metal-deck layout requires the use of a single-span, shoring should be indicated if the use of a thicker deck would have adverse cost effect or would negatively affect the progress of the construction work.

d. The camber to be indicated on the drawings is to be 2/3 of the pre-composite dead load deflection to account for the inherent stiffness of the structural connections. The camber for members between columns or between columns and girders is to be somewhat less due to greater resistance to movement by these more rigid elements. As per AISC recommendation, cambers less than 3/4" are not to be specified; thus, a larger size beam might be more economical to control the deflection.

e. Steel roof deck without concrete is acceptable for barrel roof type construction. Ensure that adequate details for attaching hung ceilings are provided.

f. While columns, beams and other structural members customarily shall have sprayed fireproofing, the standard metal deck system is to meet the required fire classification rating without added fire protection to the underside of the metal deck. Areas with higher fire-resistance rating may have sprayed fireproofing applied to the deck. Only cementitious fireproofing shall be used to provide fireproofing of steel beams, columns, and deck. For specific areas exposed to public view where the regular cementitious sprayed fireproofing is not appropriate, a decorative intumescent fire-resistive coating is to be used.

g. Structural steel members shall be Grade 50 steel conforming to ASTM A992. The use of open web joists is permitted for roofs not requiring a fire-resistance rating.

h. The roof framing systems shall be capable of sustaining the superimposed loads with a maximum deflection of L/240. Structural systems that directly or indirectly brace or support masonry cladding (and other masonry exposed to view) shall be capable of sustaining the masonry and live loads with a maximum deflection of L/600.

2. Reinforced Concrete Framing

a. Reinforced concrete slabs for the roof framing shall be either one-way or two-way framed systems and will match what was done for the floor framing.

b. The design shall take into account the need to meet acoustic requirements, which may entail the use of double slab systems.

c. For roof framing of long spans over PA spaces, a structural steel and metal deck roof system is to be used.

d. The roof framing systems shall be capable of sustaining the superimposed loads with a maximum deflection of L/240, taking into account the long-term and creep deflection of concrete. Structural systems that directly or indirectly brace or support masonry cladding (and other masonry exposed to view) shall be capable of sustaining the masonry and live loads with a maximum deflection of L/600.

B. Pitching of the roof is to be achieved by providing two pours, with the structural deck placed level and a second pour of the same structural concrete providing the required pitch. Details shall indicate the two pours and account for a minimum thickness of the roof fill required at roof drains (typically 1.5” for concrete). The plans shall show the intended finished concrete elevations at low and high spots to provide the required pitch to drain. The drawings shall indicate the use of concrete repair mortar to provide crickets where required to get the water flow around obstructions.

C. Refer to Sections BC **1607.13**, BC 1608 and BC **1609.5** of the **2022** NYC Building Code **and Chapter 7 of ASCE 7-16** for roof loads design requirements.

3.3 Superstructure

3.3.4 Exterior Masonry Support Systems

Description/Design Approach:

A. Provide relieving angles at each story height. For single multi-story spaces such as gymnasiums, supports may be provided from foundation wall up to 30 feet maximum. The design and detailing for these multiple story conditions is to be engineered to ensure masonry will not crack.

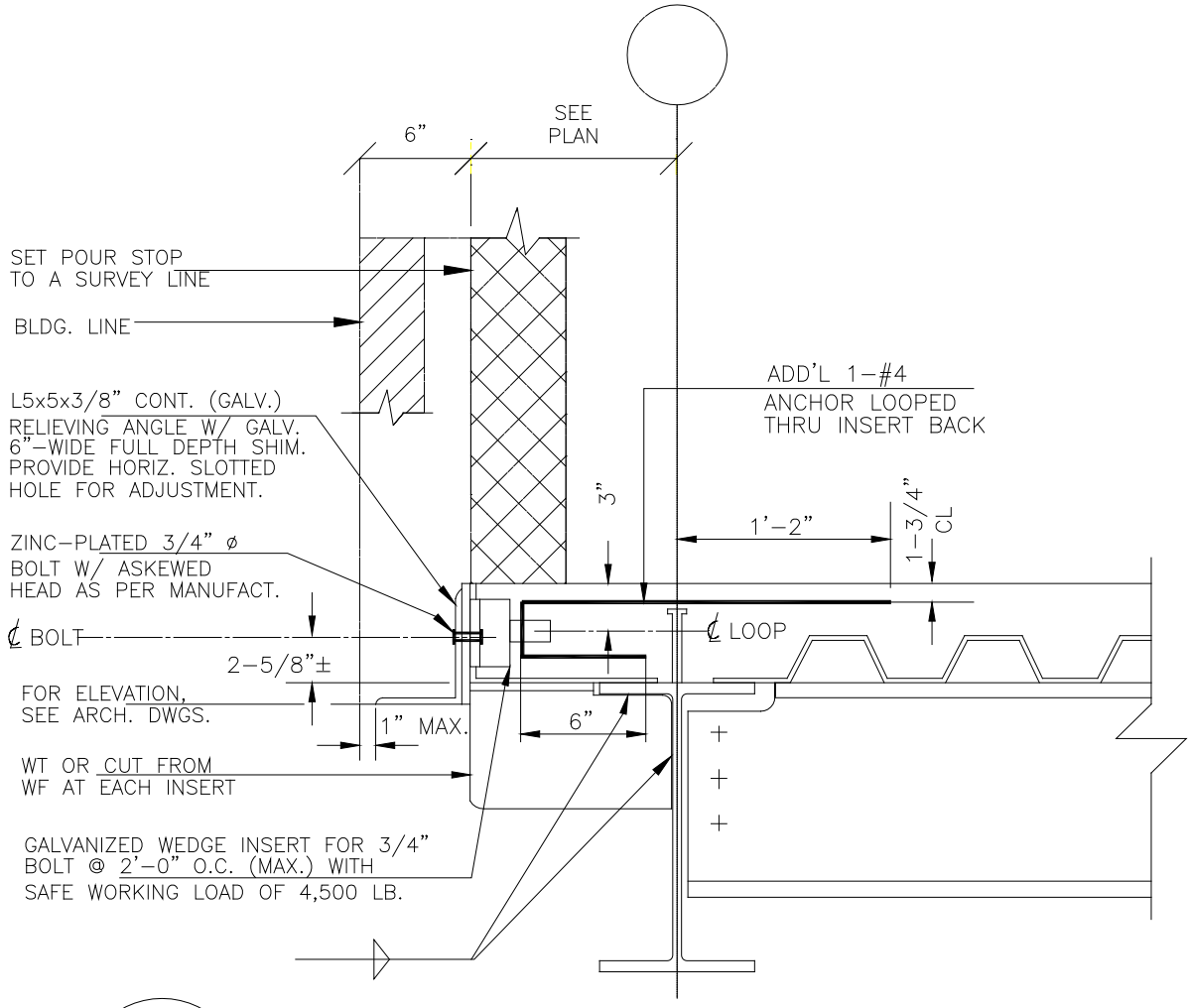
B. For walls with intermittent windows, provide a relieving angle supported at the floor level from wedge inserts cast in the floor slab. Provide a hung lintel assembly or bond beam system over the windows openings. The attached conceptual sketches provide a general guide of possible detailing. Actual conditions may allow simpler and less expensive designs depending on geometry of the construction. For walls with the majority of the length being windows, provide a continuous hung lintel support system. The jointing in the masonry shall be carefully coordinated with the relieving angle locations to ensure cracks do not develop due to irregular brick panel shapes and lengths.

C. Hung lintel assembly is to be designed such to avoid where possible the need for diagonal struts to brace the wall/lintel assembly.

D. Where the structural steel beam or wall is required to be fire protected, the **bottom flange of the lintels, shelf angles, and plates spanning less than 6'-4" is not required to be fire-protected whether part of the primary structural system or not per** Section BC 704.11 of the **2022** NYC Building Code. **The bottom flange of lintels, shelf angles, and plates not part of the structural system, such as metal lintel assembly, need not be fire protected regardless of span**.

E. Relevant Conceptual Sketches:

1. Typical Edge of Slab Detail at Relieving Angle Sketch SK1 dated 7/01/09.
2. Lintel Assembly at Wall Opening Sketch SK2 dated 7/01/09.
3. Lintel Assembly at Wall Opening Sketch SK3 dated 7/01/09.

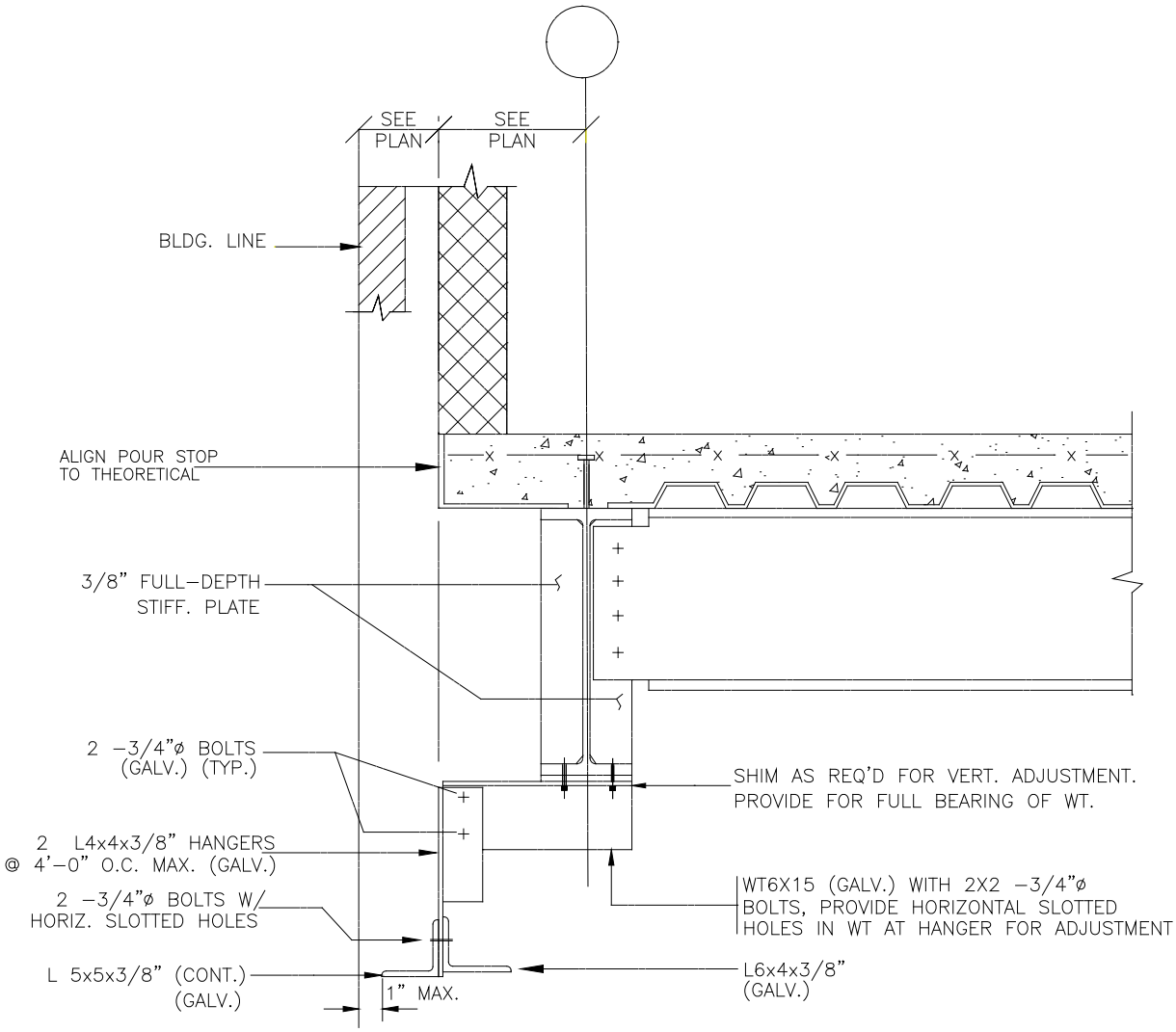


SK1 CONCEPTUAL EDGE OF SLAB DETAIL AT RELIEVING ANGLE

DATED: 07/01/09 N.T.S.

1. INSERT DIMENSIONS AND LOCATION ARE BASED ON HOHMAN AND BARNARD HW340, WITH THEORETICAL BOLT LOCATION AT THE CENTERLINE OF THE "E" DIMENSION.
2. THIS DETAIL SHOWS THE REQUIRED REBAR FOR INSERT LOCATION ONLY.
3. USE HORSESHOE SHIM OF FULL DEPTH FOR ADJUSTMENT.
4. REFER TO TYPICAL SLAB CONSTRUCTION DETAIL FOR WALL/SLAB REINFORCEMENT.
5. CANTILEVERING OF ANGLES FROM INSERT AT SPLICES, CORNERS, ENDS SHALL NOT EXCEED 1'-0". PROVIDE 1/2" CLEAR BETWEEN PIECES AT SPLICE LOCATIONS.
6. DETAIL TO BE MODIFIED BASED ON ACTUAL DIMENSIONS AND CAN BE SIMPLIFIED BASED ON ACTUAL CANTILEVERING CONDITION.

Requirement Applies to: ✔ **New Construction** **Major Modernizations** **Capital Improvement Projects**

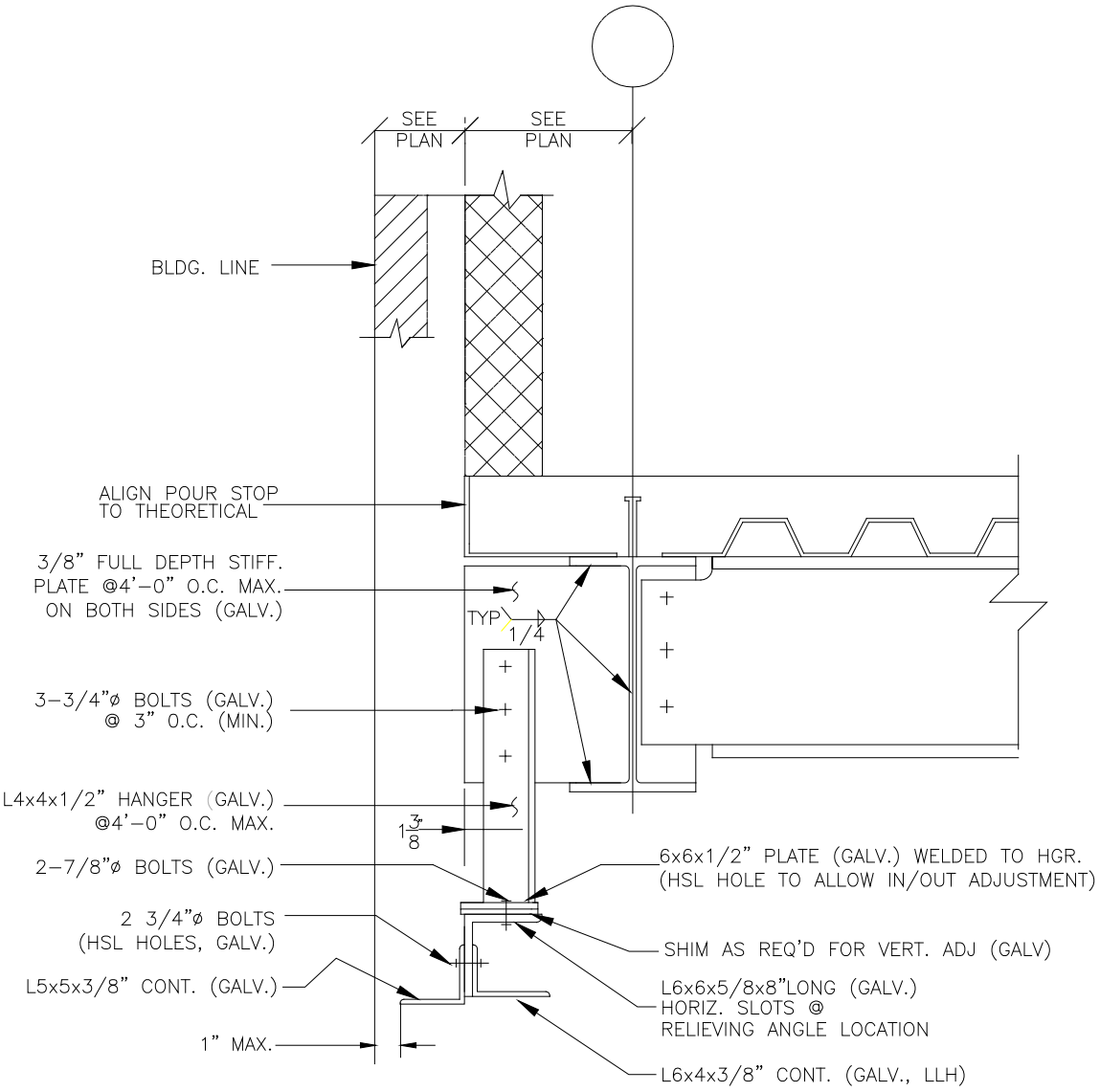


SK2 CONCEPTUAL LINTEL ASSEMBLY AT WALL OPENING

DATED: 07/01/09 N.T.S.

1. REFER TO TYPICAL SLAB CONSTRUCTION DETAIL FOR WALL/SLAB REINFORCEMENT.
2. DETAIL TO BE MODIFIED BASED ON ACTUAL DIMENSIONS AND CAN BE SIMPLIFIED BASED ON ACTUAL CONDITION.

Requirement Applies to: ✔ **New Construction** **Major Modernizations** **Capital Improvement Projects**



SK3 CONCEPTUAL LINTEL ASSEMBLY AT WALL OPENING

DATED: 07/01/09 N.T.S.

1. REFER TO TYPICAL SLAB CONSTRUCTION DETAIL FOR WALL/SLAB REINFORCEMENT.
2. DETAIL TO BE MODIFIED BASED ON ACTUAL DIMENSIONS AND CAN BE SIMPLIFIED BASED ON ACTUAL CONDITION.