Steel Building – Exterior Wall Interface Issues

SEAC/RMSCA Steel Liaison Committee

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DISCLAIMER

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ABSTRACT
One of the most time consuming and problematic issues with structural steel buildings is accounting for the various exterior wall systems. This paper will discuss and present practical solutions for interfacing the structural steel frame system with different exterior wall systems. Engineering, serviceability, constructability, and economic considerations will be discussed including recommendations for deflection limits for interfacing with metal stud, precast concrete, and curtain wall systems.

Introduction
The Steel Liaison Committee of SEAC/RMSCA has developed the following document to assist Architects, Consulting Structural Engineers, and Contractors in the design/detailing and budgeting/bidding of perimeter slab/deck edge conditions for steel buildings. The information included herein addresses the issues associated with the interface of the perimeter slab/deck edge with various types of exterior wall systems for commercial architectural building projects in the Colorado-Rocky Mountain Region. This document attempts to incorporate the compiled requirements/desires of Architects, Consulting Structural Engineers, General Contractors, Steel Fabricators, Steel Erectors, and Exterior Wall Suppliers and associated construction tolerances for the steel frame and exterior wall systems in a coordinated and coherent manner.

The committee members represent firms from the disciplines of Consulting Structural Engineering, Steel Fabrication, Steel Erection, Steel Detailing, and Steel Joist/Metal Deck Manufacturing. Further input for this project was provided by members who represent firms from the disciplines of Architecture, General Contracting and Metal Stud, Drywall, Precast Concrete, Curtainwall/Storefront, and Brick/CMU/Stone Subcontracting and Engineering.

If sufficient coordination during the design and/or detailing process between the steel frame and exterior wall system configuration/tolerances is not completed, field modification of the steel frame (cutting and relocating of members) and/or exterior wall system (cutting/modifying of members) may be required, resulting in schedule delays and cost overruns. This document attempts to reduce the amount of confusion associated with this issue.

<u>Note: this document only addresses steel framed buildings with architectural metal stud, precast concrete, curtainwall/storefront, or brick/masonry/stone exterior wall systems – this document does not address structural precast concrete or structural masonry bearing wall buildings with steel floor and/or roof framing. Proprietary steel slab/deck edge framing and exterior wall systems are not addressed by this document. Further, this document is only intended for procedures and conditions typically practiced and experienced by the local design and construction industry for the Colorado-Rocky Mountain Region.</u>

<u>Note: this document is intended to be used as merely a guide and shall not be used in situations where information contained herein is in or believed to be in conflict with governing building codes, material design and/or construction codes, the fundamental principles of structural engineering, design and/or construction standard of practice, and/or unique circumstances that pertain to a particular project type and/or location.</u>

The committee welcomes comments and suggestions on how to improve this document – please forward such correspondence to the Structural Engineers Association of Colorado – Steel Liaison Committee.

Abbreviations

The following abbreviations are used from hereon in this document:

- “**AOR**” for “Architect”
- “**EOR**” for “Consulting Structural Engineer”
- “**Design Documents**” for “Construction Drawings and Project Specifications”
- “**steel edge member**” for “perimeter floor/roof, slab/deck, edge steel angle/bent plate”
- “**HDAS**” for “headed anchor studs”
- “**DAS**” for “deformed anchor studs”

Items of Note

- **STEEL FRAME - WALL SYSTEM “GAP”:** It is important for the AOR and EOR to specify on the Design Documents an appropriate “gap” (dgap) between the steel frame and the exterior wall system. In most instances, many of the problems encountered in exterior wall system to steel frame construction can be eliminated or greatly reduced if this issue is adequately addressed. The “gap” (dgap) however, should not be specified as too large as this causes problems with design of the connection between the steel frame and exterior wall system, creates inflated costs for fire-safing, creates “openings” in the floor between the outside face of the steel edge member and the inside face of the exterior wall system that are difficult to fill with common flooring systems, and decreases the usable versus total square footage ratio for the building. A common specified “gap” is 3/4” or 1/2” for most exterior wall systems. Note: the “gap” (dgap) values specified in this document must be used in conjunction with the “overlap” (do) values specified in this document – see boxed note in FIGURES 1.1 and 1.3b.
- **STEEL FRAME “OVERLAP”:** It is important for the EOR to specify on the Design Documents sufficient “overlap” (do) of the steel edge member to spandrel beam/girder to allow for adequate field adjustment of the steel edge member to absorb steel column starting point and plumb tolerances. Note: the “overlap” (do) values specified in this document must be used to allow correct use of the “gap” (dgap) values specified in this document – see boxed note in FIGURES 1.1 and 1.3b.
- **DESIGN SCOPE:** It is important for Architects and Consulting Structural Engineers to specify on the Design Documents who is responsible for what aspect of the design of the connections from the exterior wall system to the steel frame.
- **CONSTRUCTION SCOPE:** It is important for General Contractors to fully coordinate who is responsible for what components of the connections from the exterior wall system to the steel frame prior to commencement of detailing.
- **EXPERIENCED INPUT**: The Architect, Consulting Structural Engineer, and General Contractor are encouraged to seek guidance/input from reputable/experienced Steel Fabricators/Erectors and Exterior Wall Suppliers during preparation of the Construction

Drawings and Project Specifications, so that efficiency and cost effectiveness can be incorporated.

1 – Steel Framing Slab/Deck Edge Concerns

- Assumptions:
  - The Steel Erector connects the spandrel beam/girder ends to columns/girders and then snaps a straight line along the beam for placement of the steel edge member. Prior to installation of the exterior wall system, the building is plumbed within AISC tolerances.
  - The Steel Fabricator fabricates the steel edge member and associated kickers, brackets, etc. (as required) in the shop and delivers these to the field loose (not connected to the spandrel beams/girders or columns).
  - The Steel Erector welds/bolts the steel edge member and associated kickers, brackets, etc. (as required) to the spandrel beams/girders in the field.
- Tolerances:
  - A graphic depiction of the steel tolerances issues associated with slab/deck edge construction is given in FIGURES 1.1 and 1.2.
  - A graphic depiction of the tolerances for steel framed buildings and charts specifying steel frame tolerances vs. height of building are given in FIGURES 1.3a, 1.3b, and 1.3c.
  - The tolerances defined herein are for a 40 ft bay with a spandrel beam/girder flange width of 6” or greater – this governs the edge spandrel beam/girder tolerance (‘de’) that is calculated: (1/8)*(40 ft)/(10) = 0.5”.
  - Total Steel Frame Tolerance: The tolerances specified herein for the steel slab/deck edge construction are cumulative from mill and erection procedures. Mill and erection tolerances are cumulative because the Steel Erector has no method of correcting them in the field. Fabrication tolerances, however, are not typically cumulative with erection tolerances because the Steel Erector typically can adjust for them during the erection of the building. The tolerances herein have been taken from current AISC documents. <u>Typically, project specifications reference these documents and/or define specific tolerances required for the project.</u>
  - Steel Mill Tolerances: Mill tolerances account for imperfections in the cross-sectional shape/dimensions, straightness, sweep, camber, etc. of steel members incurred during the milling process.
  - Steel Fabrication Tolerances: Fabrication tolerances account for imprecisions and inaccuracies in steel members incurred during the cutting, drilling, welding, cambering, etc. of steel members in the shop.
  - Erection Tolerances: Erection tolerances account for variations in the erected location of column- to-beam intersection points and the alignment of members from theoretical locations of column- to-beam intersection points and member alignments defined in the Design Documents.
  - The steel tolerances dictate how much the steel frame can be “out” from the theoretical location. This is used along with the exterior wall system tolerances which dictate how much the exterior wall system can be “in” from the theoretical position to provide the amount of “gap” (dgap) required between the steel edge member and the inside face of

the exterior wall system. Note: the “gap” (dgap) values specified in this document must be used in conjunction with the “overlap” (do) values specified in this document – see boxed note in FIGURES 1.1 and 1.3b.

  - The steel tolerances dictate how much the steel frame can be “in” from the theoretical location. This is used along with the exterior wall system tolerances which dictate how much the exterior wall system can be “out” from the theoretical position to define the amount of “eccentricity” required for design of the steel and exterior wall system framing members. Note: the “gap” (dgap) values specified in this document must be used in conjunction with the “overlap” (do) values specified in this document – see boxed note in FIGURES 1.1 and 1.3b.

- Construction:
  - A graphic depiction of the steel fabrication and erection construction/fit-up/sequencing issues associated with slab/deck edge construction are given in FIGURES 1.4-1 and 1.4-2. Note that the relative efficiency of fabrication and/or erection decreases from FIGURE 1.4-1a to FIGURE 1.4- 1d and from FIGURE 1.4-2a to FIGURE 1.4-2d.
  - A spandrel beam/girder with adequate flange width must be provided to allow sufficient connection of the HDAS and steel edge member to the spandrel beam/girder. AISC provides minimum required flange widths to allow for HDAS to be offset from the beam/girder web.
  - Angles are easier to work with in fabrication and erection more cost effective than bent plates. Note that plates above 1/4” can have a potential for cracking during the bending process – the thicker the plate, the more potential for cracking.
  - Gage metal (thinner than 3/16”) is easier to work with in fabrication and erection and more cost effective than plate (3/16” thick or greater). Gage metal however, is typically not suitable for conditions in which it must transfer the exterior wall weight to the steel frame.
  - HDAS are more cost effective to purchase and install than DAS. Shop installation of HDAS and DAS is more cost effective than field installation. Field installation of DAS can add significant cost.
  - No camber for dead load of the perimeter spandrel beam/girder is preferred (if possible) to avoid problems with the camber not coming out and/or coming out too much during pouring of the slab on metal deck.
- Engineering:
  - A graphic depiction of the steel engineering issues associated with slab/deck edge construction is given in FIGURES 1.5-1 and 1.5-2.
  - It is beneficial for the Design Documents to illustrate the eccentricities that the steel frame is designed for and/or the eccentricities that the exterior wall system must be designed for.
  - Typically the concrete slab on metal deck and associated reinforcing is designed to carry the weight of the exterior wall system from the steel edge member to the steel spandrel beam/girder centerline. The steel edge member is typically designed to carry the wet weight of the concrete slab on metal deck to the steel spandrel beam/girder centerline.

- Eliminating extended slab edges by moving column lines outward can greatly reduce the cost of construction of the steel frame.
- The Design Documents should clearly define which pieces of steel (i.e. beams/girder, columns, braced frame members, kickers, connection plates, etc.) require fireproofing. This may have cost implications for exterior wall contractors as connecting to the fireproofed structure requires additional preparation.

- Slab/Deck Closure vs. Exterior Wall Support:
  - For situations where the edge of slab/deck is not required to carry the weight of the exterior wall system, lighter material such as gage metal in lieu of plate can be specified for the steel edge member.
  - In some scenarios, the edge of the slab/deck may serve as only a pour stop for the concrete and a separate steel member may be provided to support the exterior wall system from steel column to steel column. In such scenarios, lighter material such as gage metal in lieu of plate can be specified for the steel edge member.
- Fire-safing:
  - The amount and locations of fire-safing required depends on the fire rating of the building and the requirements of the governing jurisdiction.
  - The cost of fire-safing can be as high as 50% of the cost of the insulation required for the building if excessive gaps between the steel edge member and the exterior wall system are specified. The cost of providing fire-safing between the steel edge member and the exterior wall system can be significant - the cost of fire-safing is proportional to the size of the gap between the steel edge member and the exterior wall system. It is important to specify where slab edge fire-safing is required and not specify it as a substitution for a thermal break.

2 – Metal Stud Exterior Wall System

- Assumptions:
  - Consistent building gridline and elevation benchmark controls provided throughout the construction and to all trades.
  - The steel structure is fully connected and plumbed with sufficient temporary bracing or the primary lateral force resisting system in place.
  - The Metal Stud Contractor connects their product to applicable perimeter steel frame that has been erected within tolerances indicated in FIGURES 1.1 to 1.3.
  - The Metal Stud Contractor attaches directly to the steel edge member via welds or screws/anchors.
- Tolerances:
  - Deflection tolerances for metal stud wall systems are determined by the finished being applied to them. For metal panels or EIFS systems, deflection of L/240 should be included. For plaster and thin brick veneers, deflection of L/360 and for masonry, L/600.
  - A graphic depiction of metal stud wall system tolerance issues is given in FIGURES 2.1a and 2.1b.
- Construction:

- A graphic depiction of metal stud wall system construction/fit-up/sequencing issues are given in FIGURES 2.2-1, 2.2-2, and 2.2-3.
- Tolerances for steel members are less restrictive than for metal studs. This must be taken into consideration when locating steel members within metal stud wall systems (i.e. for header, jamb, lintel, lateral support, etc. support) – a 6" wide steel member does not typically fit well within a 6" metal stud wall system.
- Using heavier metal studs (within reason) and eliminating the number of pieces (i.e. kickers, stiffeners, etc.) is typically more efficient and cost effective.
- Avoiding intermittent kickers and connections between beams (if possible) is efficient and cost effective.
- Metal Stud Contractors typically have little problem with installation if a sufficient gap is provided between the steel edge member and the inside face of the metal stud system. Connection clips are required to achieve the connection and allow for adjustment during construction of the metal stud wall system.
- Metal Stud Contractors virtually always have problems when a gap between the steel edge member and the inside face of metal stud is not provided – direct connection from the metal studs to the steel edge member are required. Zero tolerance conditions should never be designed unless final dimensions or profiles are not important to the designer (i.e. a solar panel support frame).In some instances, the Metal Stud Contractor may clamp the steel edge member in place and then the Steel Erector comes back and completes the weld to the spandrel beam/girder. This arrangement is not preferred by Metal Stud Contractors or Steel Erectors due to the inconvenience of stopping and starting of work while the other trade is performing their work and is thus, not recommended.
- It is common practice for the Metal Stud Contractor to design the metal stud wall system. If this is the case, all design parameters, including parapet loads and zone 5 areas per ASCE 7, shall be furnished by the EOR. Depending on the governing jurisdiction, fire-safing may be required from the outside face of the steel edge member or to the outside face of the metal stud wall system.
- CASE A – Balloon Framing (metal studs run by structure) – STICK BUILT SYSTEMS (metal studs are individually installed to the structure in the field):
    - Metal Stud Contractors prefer to attach to the vertical face of the steel edge member – member of at least 1/4" in thickness is desired.
    - Typically, connection clips that deliver the wall weight to the face of the steel edge member or slip vertically are provided.
    - The Design Documents should clearly specify the requirements for connection clips, including dead load, lateral load, deflection and seismic requirements, so that there is no question of intent during budget pricing or bidding.
    - The capability for allowing vertical slip in the metal stud wall system at some location between each floor is required to ensure that the relative deflections of floors do not load/crush the metal stud wall system.
- CASE A – Balloon Framing – PANELIZED SYSTEMS (metal studs are installed to the structure as panels in the field)

        - Metal Stud Contractors may attach to an embed plate placed on top of the slab at the perimeter steel frame. There are several products in the market to accomplish this. Often the embed plate is required to be recessed into the slab so that it can be hidden under the flooring system.
        - Typically, a clip connects the metal stud wall to the embed plate.
        - The capability for allowing vertical slip in the metal stud wall system between panels is required to ensure that the relative deflections of floors do not load/crush the metal stud wall system.
    - CASE B – Non-Load Bearing Framing (metal studs run in between structural levels):
        - Metal Stud Contractors prefer to attach to the top of slab and bottom of steel edge member with screws/anchors.
        - The capability for allowing vertical slip in the metal stud wall system at the underside of the steel edge member is required to ensure that the relative deflections of floors do not load/crush the metal stud wall system. This can be achieved using slotted tracks, deflection clips, or multiple track systems.
    - CASE C – Strip Panels (metal stud panels hung from the slab edge and kicked back to steel frame
        - for strip window systems) – CLIPPED CONNECTIONS:
        - Metal Stud Contractors prefer to attach to the vertical face of the steel edge member – member of at least 1/4" in thickness is desired.
        - Typically, connection clips that deliver the wall weight to the face of the steel edge member or slip vertically are provided.
        - The lateral load is resisted at the bottom track – box headers are not applicable.
        - If a kicker frames to the bottom flange of an adjacent beam, the beam shall be designed to resist this lateral load.
        - The Design Documents should clearly specify the requirement for connection clips so that there is no question of intent during budget pricing or bidding.
        - The window system shall be designed to accommodate the vertical slip due to the relative deflections of the floors above and below. Care shall be taken to add control joints at the transitions between strip windows and adjacent full height balloon or infill framing.
- Engineering:
    - A graphic depiction of metal stud wall system engineering issues is given in FIGURES 2.3-1, 2.3- 2, and 2.3-3.
    - The metal stud system can be either designed by either the EOR or the Metal Stud Contractor. If the Metal Stud Contractor is to design the system, sufficient design criteria (a performance specification) must be specified in the Design Documents by the AOR and/or EOR, i.e.:
    - An assumption of stick-built or panelized construction is typically shown in project details.
    - Metal stud width/depth. If metal studs are a deferred design, EOR may give a minimum gage and spacing and require the design to meet design load criteria given on the documents.

- Allowable locations of kickers or intermediate horizontal support between floor/roof levels and allowable connection points to structural framing as applicable/allowed.
- Procedure for installing kickers – i.e. installing after floor/roof dead load is in place to avoid "kicking" out of exterior wall during inducing dead loads as applicable/allowed.
- Vertical (dead) load of wall.
- Horizontal (wind) load applied to wall or governing code criteria sufficient to derive loads.
- Allowable vertical and horizontal deflection criteria.
- Since the AOR and EOR are not as familiar with the intricacies of metal stud system construction, this procedure allows for value engineering ideas to be implemented, saving time and costs for the project. To take advantage of these value engineering ideas, a certain level of design control must be given to the Metal Stud Contractor, i.e.:
    - Choice of using heavier metal studs or providing kickers, stiffeners, etc. as applicable/allowed.
    - Choice of metal stud thickness and spacing.
    - Choice of connection types.
- CASE A – Balloon Framing (metal studs run by structure) – STICK BUILT SYSTEMS (metal studs are individually installed to the structure in the field):
    - The connection clips must be designed to deliver the wall weight to the face of the steel edge member or be designed to slip vertically.
    - The Design Documents should clearly specify the requirement for connection clips so that there is no question of intent during budget pricing or bidding.
    - The metal stud system must have capability for allowing vertical slip at some location between each floor to ensure that the relative deflections of floors do not load/crush the metal stud wall system.
- CASE A – Balloon Framing – PANELIZED SYSTEMS (metal studs are installed to the structure as panels in the field):
    - The connections must be designed to deliver the wall weight to the face of the steel edge member.
    - The capability for allowing vertical slip in the metal stud wall system between panels is required to ensure that the relative deflections of floors do not load/crush the metal stud wall system.
- CASE B – Infill Framing (metal studs run in between structural levels):
    - The metal stud system must have capability for allowing vertical slip at the underside of the steel edge member to ensure that the relative deflections of floors do not load/crush the metal stud wall system.
- CASE C – Strip Panels (metal stud panels hung from the slab edge and kicked back to steel frame – for strip window systems) – CLIPPED CONNECTIONS:
    - The connection clips must be designed to deliver the wall weight to the face of the steel edge member or be designed to slip vertically.
    - The Design Documents should clearly specify the requirement for connection clips so that there is no question of intent during budget pricing or bidding.

- The metal stud system must have capability for allowing vertical slip at the top of the strip window to ensure that the relative deflections of floors do not load/crush the metal stud wall system.
- CASE C – Strip Panels – EMBED PLATE CONNECTIONS:
  - The strong-back member and associated connections that connects the metal stud wall must be designed to deliver the wall weight to the face of the steel edge member.
  - The metal stud system must have capability for allowing vertical slip at the top of the strip window to ensure that the relative deflections of floors do not load/crush the metal stud wall system.

3 – Precast Concrete Exterior Wall System

- Assumptions:
  - The steel structure is fully connected and plumbed with sufficient temporary bracing or the primary lateral force resisting system in place.
  - The slab on metal decks are poured and cured prior to installation of precast concrete pieces to the steel frame.
  - The Precast Concrete Supplier connects their product to applicable perimeter steel frame that has been erected within tolerances indicated in FIGURES 3.1 to 1.3.
  - The precast concrete piece to steel frame connections are designed by the EOR or Precast Concrete Supplier.
- Tolerances:
  - A graphic depiction of precast concrete system tolerance issues is given in FIGURES 3.1a and 3.1b.
  - For 1 story buildings where the weight of the precast concrete is carried by the building foundation (precast concrete is not carried by the steel frame), a 2" gap is typically provided between the outside face of the steel edge member and the inside face of the precast concrete piece.
- Construction:
  - A graphic depiction of precast concrete system construction/fit-up/sequencing issues is given in FIGURES 3.2-1, 3.2-2a, 3.2-2b, and 3.2-3.
  - The Design Documents should require that a pre-detailing meeting be held with the following parties being present: AOR, EOR, General Contractor, Steel Fabricator/Detailer/Erector, and Precast Concrete Supplier Fabricator/Detailer/Erector. Issues concerning steel/precast concrete plan and elevation locations, cambers and sweeps, tolerances, embed plate/insert/anchor locations and orientations, connection piece scope of works, field weld procedures, erection sequencing, and temporary bracing/shoring should be discussed.
  - The Design Documents should require that the General Contractor distribute all precast concrete system shop drawings to the Steel Fabricator and Steel Erector and all steel shop drawings to the Precast Concrete Supplier for purposes of coordination between trades. Alternatively, both parties may submit 3D / BIM models to the GC for model

coordination and clash detection. Proper and timely coordination between trades can decrease or eliminate costly field fixes.

- Making embed plates larger (within reason) is more efficient and cost effective than having to provide field fixes for undersized embed plates.
- CASE A – For buildings of 1 to 2 stories where the weight of the precast concrete is carried by the building foundation (precast concrete is not carried by the steel frame):
    - The connection from precast concrete to steel structure shall accommodate story drift through sliding or flexing connections.
    - For connections accommodating drift using a sliding mechanism the length to diameter ratio of the rod shall be 4 or less and holes or slots shall be proportioned to accommodate the full in-plane design story drift.
    - Connections accommodating drift using flexing connections shall satisfy the requirements of ASCE 7-16, Section 13.5.3.
- CASE B – For buildings of 2 stories or more where the weight of the precast concrete is carried by the steel frame (precast concrete does not rest on the building foundation) – Precast concrete pieces span from steel column to steel column:
    - Precast Concrete Suppliers typically prefer this scenario over supporting the precast concrete on the steel spandrel beam/girder.
    - Precast Concrete Suppliers typically prefer steel brackets (i.e. steel angle, stiffened angles, WT's, wide flanges, tubes, channels, etc.) to bear the precast concrete pieces on. Connection to the steel column flanges is typically preferred – connection to steel column webs introduces excessive eccentricities to the connection. Typically the order from most cost effective to least cost effective shape to be used for the steel bracket is: angles, channels, stiffened angles, WT's, wide flanges, and tubes.
    - If it can be coordinated, it is typically preferred by Precast Concrete Suppliers that the steel brackets be placed on the steel columns in the Steel Fabricator's Shop. Otherwise, the steel brackets are typically provided and installed by the Precast Concrete Supplier. It is typically more cost effective for the project as a whole to place the steel brackets on the steel columns in the Steel Fabricator's Shop – shop labor is typically more cost effective than field labor.
    - Steel brackets should be held down below the theoretical bearing elevation for the precast concrete pieces and shims provided to achieve the correct elevation in the field. This is significantly more cost effective than not allowing a shim gap for "slop" and having the field cut and reattach the steel bracket. Typically a 1" thickness of shims is acceptable.
    - 2" minimum bearing is required for the precast concrete piece to steel bracket.
    - Lateral support connections shall be detailed to accommodate the design live load deflection of the perimeter beams.
- CASE C – For buildings of 2 stories or more where the weight of the precast concrete is carried by the steel frame (precast concrete does not rest on the building foundation) – Precast concrete pieces are carried by the steel spandrel beam/girder:

- A continuous strong-back member (i.e. steel angle, tube, wide-flange, etc.) is typically preferred. Typically the order from most cost effective to least cost effective shape to be used for the continuous strong-back member is: steel angle, tube, and wide-flange.
- Two points of bearing to the supporting steel frame.
- Precast Concrete Suppliers typically prefer the bearing points to be located with the end 1/4 spans of the steel spandrel beam/girder to reduce the adverse effects of concrete slab on metal deck and steel spandrel beam/girder deflections.
- An edge of slab to face of panels gap of approximately 2" is common. This allows for the connection to the slab to be concealed in the furring space. For larger gaps, the interior furring may be required to be pushed inwards to conceal connections.
- Making embed plates larger (within reason) is more efficient than having to provide field fixes for undersized embed plates.

- Engineering:
  - A graphic depiction of precast concrete system engineering issues is given in FIGURES 3.3-1, 3.3-2a, 3.3-2b, and 3.3-3.
  - The Design Documents should clearly define the responsibility for designing the interfacing connections between the steel and precast concrete framing.
  - CASE A – For buildings of 1 to 2 stories where the weight of the precast concrete is carried by the building foundation (precast concrete is not carried by the steel frame):
    - The connection from precast concrete to steel frame should be designed and/or specified to slip vertically and be allowed to rotate with respect to the steel frame.
    - For connections accommodating drift using a sliding mechanism the length to diameter ratio of the rod shall be 4 or less and holes or slots shall be proportioned to accommodate the full in-plane design story drift.
    - Connections accommodating drift using flexing connections shall satisfy the requirements of ASCE 7-16, Section 13.5.3.
  - CASE B – For buildings of 2 stories or more where the weight of the precast concrete is carried by the steel frame (precast concrete does not rest on the building foundation) – Precast concrete pieces span from steel column to steel column:
    - The Design Documents should clearly specify the locations that it is assumed the precast concrete pieces will be supported from the steel frame.
    - The Design Documents should clearly specify the load and eccentricity for which the steel brackets were designed for (by the EOR) or must be designed for (by the Precast Supplier).
  - CASE C – For buildings of 2 stories or more where the weight of the precast concrete is carried by the steel frame (precast concrete does not rest on the building foundation) – Precast concrete pieces are carried by the steel spandrel beam/girder:
    - The Design Documents should clearly specify the locations that it is assumed the precast concrete pieces will be supported from the steel frame.

- The Design Documents should clearly specify the load and eccentricity for which the steel strong-back member is designed for (by the EOR) or must be designed for (by the Precast Supplier).
- Typically embed plates in the concrete slab on metal deck are designed by the EOR and embed plates in precast concrete are designed by the Precast Concrete Supplier.
- Up to 4” of gap from the inside face of the precast concrete piece to the face of the steel edge member can typically be accommodated by the Precast Concrete Supplier. For conditions with gaps greater than 4”, the slab edge should be extended outward.

4 – Curtainwall/Storefront Exterior Wall System

- Assumptions:
  - The steel structure is fully connected and plumbed with sufficient temporary bracing or the primary lateral force resisting system in place.
  - The Curtainwall/Storefront Supplier connects their product to applicable perimeter steel frame that has been erected within tolerances indicated in FIGURES 1.1 to 1.3.
  - All connections to steel edge members or embed plates in slabs are by the Exterior Wall Supplier.
- Tolerances:
  - A graphic depiction of curtainwall/storefront system tolerance issues is given in FIGURES 4.1- 1a, 4.1-1b, 4.1-2a, and 4.1-2b.
  - Typically, inconsistencies of the steel frame from floor to floor can be accommodated by the Curtainwall/Storefront Supplier if AISC tolerances are met for the steel frame.
  - Typically, Curtainwall/Storefront Suppliers prefer to have a minimum 1” and maximum 4” gap from backside of curtainwall to face of the steel edge member – a 1” gap works well for buildings of 10 stories or less.
  - Curtainwall/storefront systems are required to be installed within 1/16” +/- of vertical plumb in 20 ft vertical – this is non-cumulative from floor to floor.
- Construction:
  - A graphic depiction of curtainwall/storefront construction/fit-up/sequencing issues is given in FIGURES 4.2-1 and 4.2-2.
  - Storefront systems are typically more efficient and cost effective for heights up to 10 ft. Curtainwall systems are typically more efficient and cost effective for heights above 10 ft.
  - Typically, a 14 ft high curtainwall system is more efficient and cost effective than stacking two 7 ft high storefront systems.
  - If storefront systems are placed in front of and are run continuously by supporting steel frame, storefront systems have issues with “thermal break failure” whereby thermal leaks will occur through the wall system. It is recommended that storefront systems span in between supporting steel frame.
  - Rolling over or sweep of the steel edge member is typically not a problem for the Curtainwall/Storefront Supplier.

- Connections are typically located at each vertical mullion – typically spaced 5 ft on center +/- along the steel edge member.
    - Curtainwall anchors are typically 1/4" to 3/8" diameter (occasionally 1/2" diameter anchors are used for unconventional/heavy systems). The anchors are usually field welded by the Curtainwall Supplier to the mid-height of the vertical leg of the steel edge member.
    - Curtainwall Suppliers prefer to attach to the vertical face of the steel edge member – member of at least 1/4" in thickness is desired. An alternate option is attachment to an embed plate placed on top of the slab at the perimeter steel frame via an angle or plate – the embed plate should be at least 1/4" thick and 6" wide – a continuous embed plate in lieu of intermittent embed plates is desired.

- Engineering:
    - A graphic depiction of curtainwall engineering issues is given in FIGURE 4.3-1 and 4.3-2.
    - Curtainwall/storefront systems typically weigh 10 pounds per square foot.
    - Connections to perimeter steel frame are designed to account for the eccentricity from the curtainwall to the face of the steel edge member.
    - Curtainwall thicknesses are typically 6" for heights up to 13' +/- and 7-1/2" for heights up to 16' +/-.
    - Typically maximum lateral deflections due to wind loads of horizontal steel supports for curtainwall/storefront systems should be limited to L/175.
    - Typically maximum vertical live load deflections at the perimeter steel frame should be limited to 1/4".

5 – Precast ARCIS Panels Used as Rainscreens, Façade, or Accent Panels

- ARCIS is an architectural concrete panel that can be used as a rainscreen, façade or accent panel. They are precast concrete panels reinforced with stainless steel prestressing cables. Connections in the panel are made with stainless steel anchors attached directly to the prestressing strand and embedded in the panel. The panels typically span vertically between J-clips attached to steel studs or a similar structural wall system. Screws are used to fasten the panels in place and welding is not required.
- Tolerances:
    - Because ARCIS is a precast architectural product, the tolerances are governed by PCI MNL-117. The tight tolerance of the product forces the tolerances in the supporting system to be tight also. Amplitude in the supporting system will be reflected in the finished surface of the panels. So, the surface flatness should be limited to ±1/8".
    - To maintain consistency in the joint widths and maintain architectural intent, there is effectively zero tolerance and proper detailing should be used to allow for tolerance in the overall building system. ARCIS technical details have indicated that there is zero tolerance in dimension for the ARCIS system unless agreed upon in advance with the ARCIS manufacturer.
- Construction:

- The Design Documents should require that a pre-detailing meeting be held with the following parties being present: AOR, EOR, General Contractor, Steel Fabricator/Detailer/Erector, and Precast Concrete Supplier Fabricator/Detailer/Erector. Issues concerning steel/precast concrete plan and elevation locations, cambers and sweeps, tolerances, embed plate/insert/anchor locations and orientations, connection piece scope of works, field weld procedures, erection sequencing, and temporary bracing/shoring should be discussed.
- The Design Documents should require that the General Contractor distribute all precast concrete system shop drawings to the Steel Fabricator and Steel Erector and all steel shop drawings to the Precast Concrete Supplier for purposes of coordination between trades. Proper and timely coordination between trades can decrease or eliminate costly field fixes.
- Allowance for story drift and vertical live load deflections should be considered when sizing joints and detailing interfaces with other materials.
- The preferred delivery method is that the General contractors and subcontractors install the bracket support system and verify the system meets the specific tolerance for the project requirements.
- Flexing, drifting connections should be discussed with the EOR, AOR, and GC when the project warrants.

- Engineering:
  - The ARCIS panels are designed to be laterally supported by the steel.
  - The ARCIS panels are designed to be vertically supported by the steel.
  - The ARCIS panels are designed to transfer out of plane wind loads to the supporting steel system.

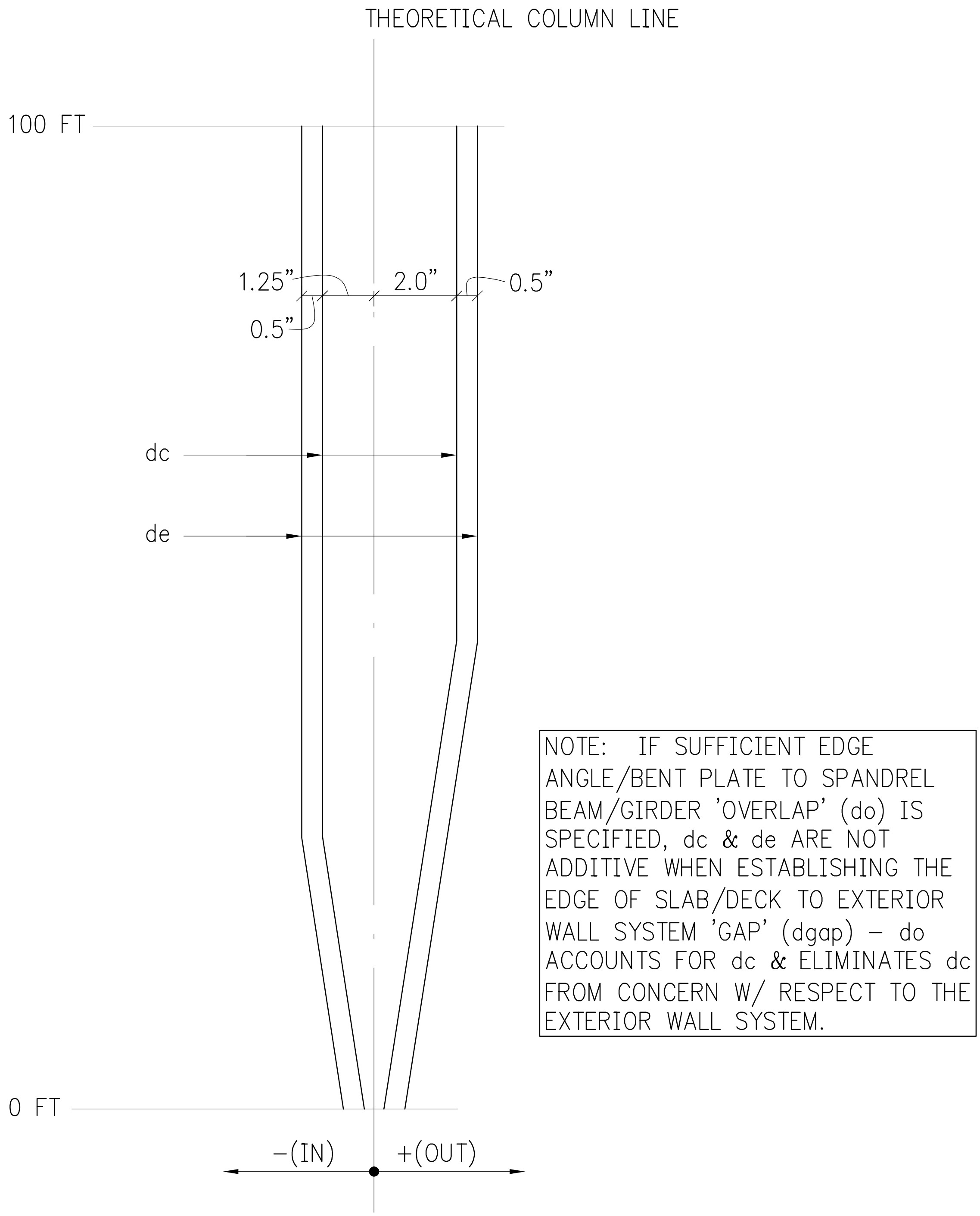
6 – Precast Insulated Wall Panels Designed for Blast Resistance

- Construction
  - Insulated precast panels that are 1 story in height shall be supported by the foundation and braced by the steel building frame.
  - Larger gaps between precast and steel frame are generally required by design to allow for the deflection of the panels during a design event.
  - Meeting early with the general contractor is helpful to outline the critical tolerances for foundation embeds can avoid costly repairs. Blast loading typically produces very high lateral loads on the panels and connections are critical.
- Engineering:
  - Connections at the top and bottom of panels shall be designed by the precast engineer with blast loading criteria given by the EOR or designated blast engineer. These are usually a specialty connection that requires larger than normal material sizes/thickness.
  - The insulated precast panels are not a part of the steel frame lateral system.
  - Multi-Story panels should be avoided due to the large reactions that occur during a blast event.

- Connections at the top of the panels can allow for horizontal slip to allow movement from thermal expansion/contraction. Panels should also be able to move independently of the lateral system.

Steel Building – Exterior Wall Interface Issues

Index of Details and Tables



NOTES:

dc = dc1 (COLUMN STARTING POINT TOLERANCE) + dc2 (COLUMN PLUMB TOLERANCE)

de = EDGE SPANDREL BEAM/GIRDER OR ANGLE/BENT PL SWEEP TOLERANCE

SEAC

FIGURE 1.1 : STRUCTURAL STEEL TOLERANCES (dc & de ADDITIVE)

STRUCTURAL STEEL BUILDING – EXTERIOR WALL INTERFACE ISSUES

RMSCA

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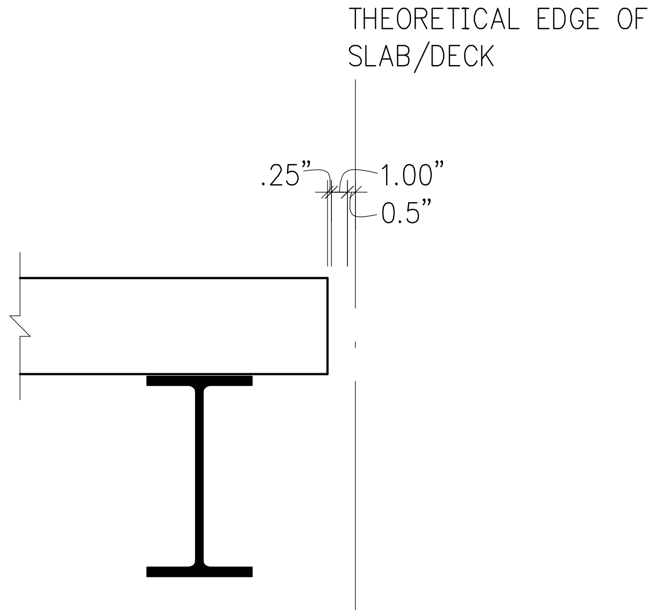
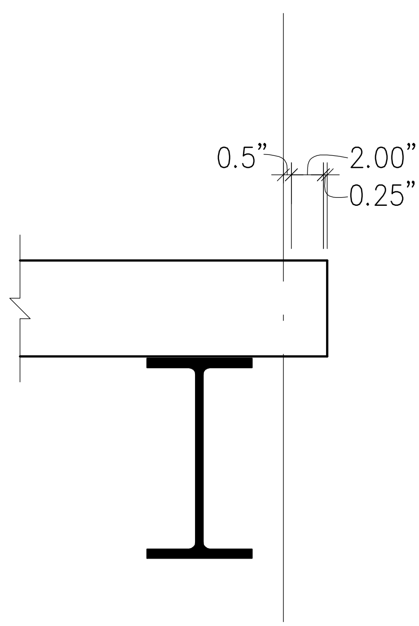


(IN) CONDITION

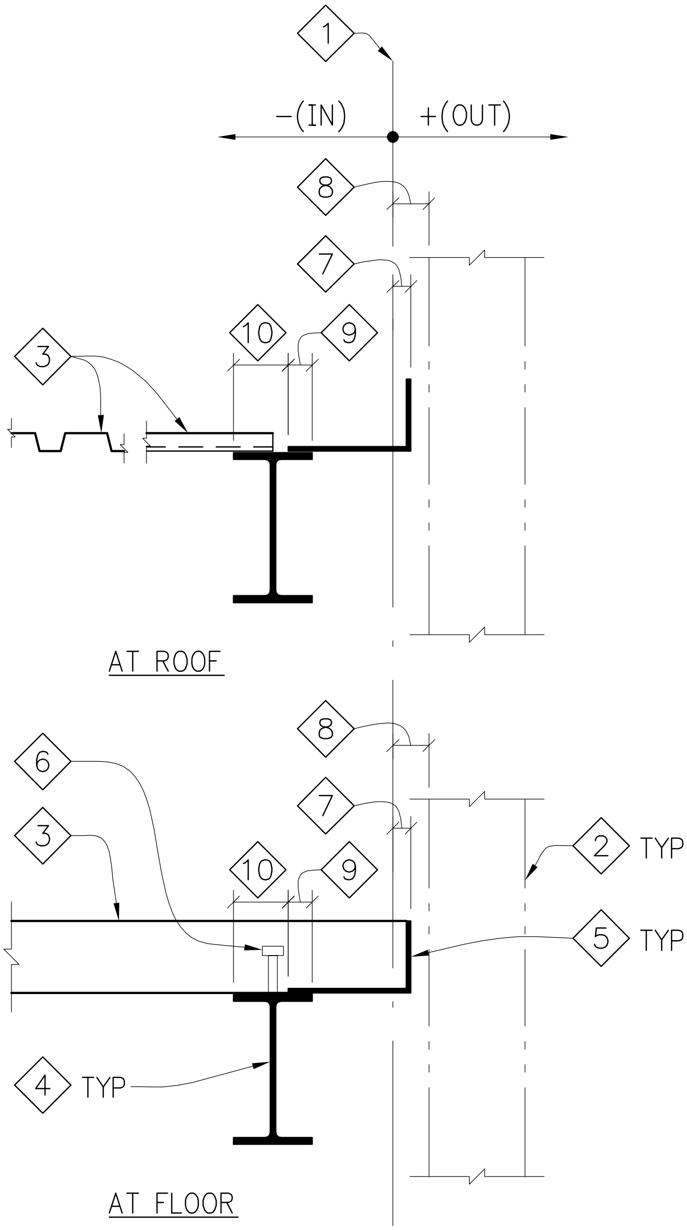
H = 100ft
BAY = 40ft



NOTE: IF SUFFICIENT EDGE ANGLE/BENT PLATE TO SPANDREL BEAM/GIRDER 'OVERLAP' (do) IS SPECIFIED, dc & de ARE NOT ADDITIVE WHEN ESTABLISHING THE EDGE OF SLAB/DECK TO EXTERIOR WALL SYSTEM 'GAP' (dgap) – do ACCOUNTS FOR dc

(OUT) CONDITION

SEAC	FIGURE 1.2 : STRUCTURAL STEEL TOLERANCES (dc & de ADDITIVE)	RMSCA ROCKY MOUNTAIN STEEL CONSTRUCTION ASSOCIATION
	STRUCTURAL STEEL BUILDING – EXTERIOR WALL INTERFACE ISSUES	



NOTES:

1. THEORETICAL EDGE OF SLAB/DECK.
2. EXTERIOR WALL SYSTEM.
3. SLAB/DECK.
4. SPANDREL BEAM/GIRDER.
5. EDGE ANGLE/BENT PLATE, 1/4" THICK MINIMUM
6. HDAS (3/4"ø IS TYPICAL SIZE).
7. SEE FIGURE 1.1 FOR +/− TOLERANCES. INCLUDES THE CUMULATIVE TOTAL CONSIDERING MILL, FABRICATION, & ERECTION PROCEDURES FOR COLUMN PLUMB 'dc' & EDGE SWEEP 'de'.

COLUMN PLUMB	EDGE SWEEP
dc+ (OUT)	de+ (OUT)
dc− (IN)	de− (IN)

8. EDGE OF SLAB/DECK TO INSIDE FACE OF EXTERIOR WALL SYSTEM SPECIFIED 'GAP' REQUIRED: dgap = (ds+)+(dw−)
   WHERE: ds = de
   SEE FIGURE 1.3b FOR CHART.
   SEE EXTERIOR WALL SYSTEM FIGURES FOR 'dw' VALUES.
9. EDGE ANGLE/BENT PLATE TO SPANDREL BEAM/GIRDER SPECIFIED 'OVERLAP' REQUIRED:
   do = (dc+) + dd
10. SPECIFIED 'WIDTH' REQUIRED ON SPANDREL BEAM/GIRDER FLANGE TO ALLOW FOR SUFFICIENT 'OVERLAP' & SPACE FOR HDAS/DECK CONNECTIONS:
    df = do + dh
    WHERE: dh = SPACE REQUIRED ON SPANDREL BEAM/GIRDER FLANGE FOR HDAS/DECK.

SEAC	**FIGURE 1.3a : STRUCTURAL STEEL TOLERANCES** STRUCTURAL STEEL BUILDING − EXTERIOR WALL INTERFACE ISSUES	RMSCA ROCKY MOUNTAIN STEEL CONSTRUCTION ASSOCIATION

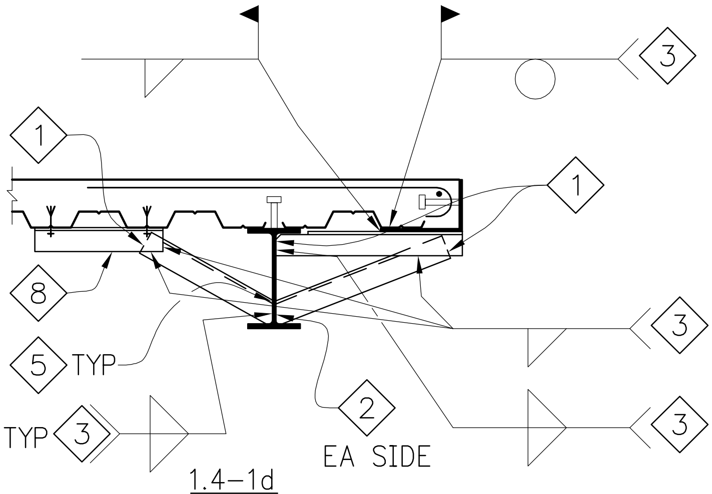
HEIGHT (ft)	dc1 (in)		dc2 (in)		dc (in)		de (in)	
	−(IN)	+(OUT)	−(IN)	+(OUT)	−(IN)	+(OUT)	−(IN)	+(OUT)
10	0.25	0.25	0.24	0.24	0.49	0.49	0.5	0.5
20	0.25	0.25	0.48	0.48	0.73	0.73	0.5	0.5
30	0.25	0.25	0.72	0.72	0.97	0.97	0.5	0.5
40	0.25	0.25	0.96	0.96	1.21	1.21	0.5	0.5
50	0.25	0.25	1.00	1.20	1.25	1.45	0.5	0.5
60	0.25	0.25	1.00	1.44	1.25	1.69	0.5	0.5
70	0.25	0.25	1.00	1.68	1.25	1.93	0.5	0.5
80	0.25	0.25	1.00	1.92	1.25	2.17	0.5	0.5
90	0.25	0.25	1.00	2.00	1.25	2.25	0.5	0.5
100	0.25	0.25	1.00	2.00	1.25	2.25	0.5	0.5

NOTES:
dc1 = COLUMN STARTING POINT TOLERANCE
dc2 = COLUMN PLUMB TOLERANCE
dc = dc1 + dc2 (dc1 = 0.125" SPECIFIED IN THE PROJECT SPECIFICATIONS IN COMMON)
de = EDGE SPANDREL BEAM/GIRDER OR ANGLE/BENT PLATE SWEEP TOLERANCE (ASSUMING 40ft BAY WITH SPANDREL BEAM/GIRDER FLANGE WIDTH 6" OR GREATER)

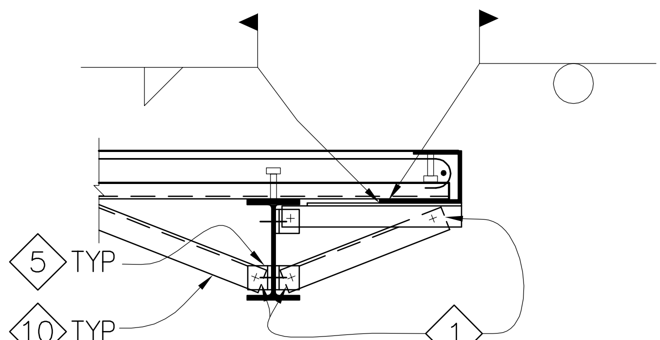
NOTE: IF SUFFICIENT EDGE ANGLE/BENT PLATE TO SPANDREL BEAM/GIRDER 'OVERLAP' (do) IS SPECIFIED, dc & de ARE NOT ADDITIVE WHEN ESTABLISHING THE EDGE OF SLAB/DECK TO EXTERIOR WALL SYSTEM 'GAP' (dgap) – do ACCOUNTS FOR dc & ELIMINATES dc FROM CONCERN W/ RESPECT TO THE EXTERIOR WALL SYSTEM.

HEIGHT (ft)	dd (in)	do (in)	dh (in)	df (in)
10	1.00	1.49	2.00	3.49
20	1.00	1.73	2.00	3.73
30	1.00	1.97	2.00	3.97
40	1.00	2.21	2.00	4.21
50	1.00	2.45	2.00	4.45
60	1.00	2.69	2.00	4.69
70	1.00	2.93	2.00	4.93
80	1.00	3.17	2.00	5.17
90	1.00	3.25	2.00	5.25
100	1.00	3.25	2.00	5.25

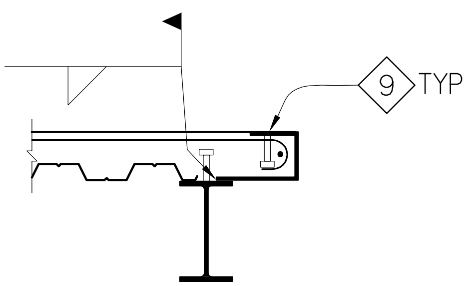
NOTES: dd = RECOMMENDED DESIGN OVERLAP OF EDGE ANGLE/BENT PLATE TO SPANDREL BEAM/GIRDER
do = (dc+) + dd (SEE FIGURE 1.3b for dc+)
dh = SPACE REQUIRED ON SPANDREL BEAM/GIRDER FOR HDAS/DECK
df = do + dh



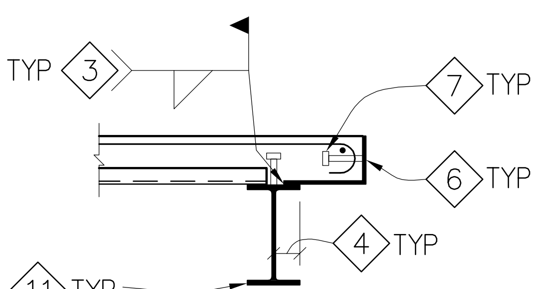
1.4–1d



1.4–1c



1.4–1b



1.4–1a

NOTES:

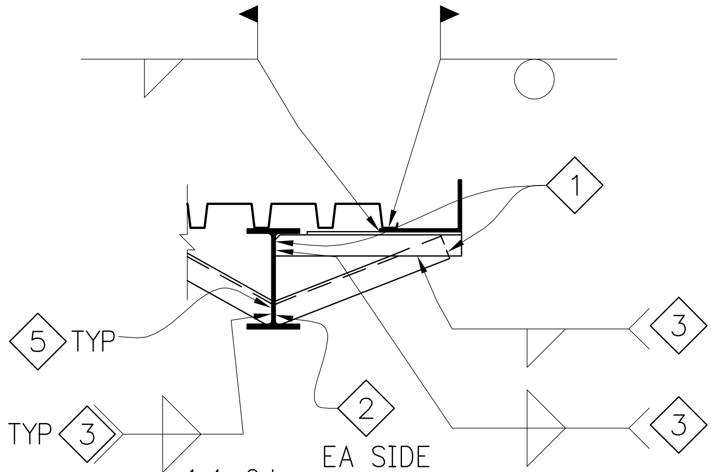
1. SQUARED ENDS OF PIECES FACILITATE EASE OF FABRICATION.
2. CONNECTION OF PIECES TO ONE SURFACE FACILITATES EASE OF FABRICATION AND/OR ERECTION.
3. DOWN OR SIDE WELDS IN LIEU OF OVERHEAD (FROM UNDERNEATH) WELDS FACILITATE EASE OF FABRICATION AND/OR ERECTION.
4. SUFFICIENT SPACE (SPANDREL BEAM/ GIRDER FLANGE WIDTH) MUST BE PROVIDED FOR CONNECTION OF HDAS/ DECK & ANGLE/BENT PLATE TO BEAM & SUFFICIENT 'OVERLAP' OF ANGLE/ BENT PLATE TO SPANDREL BEAM/GIRDER. SEE AISC SPECIFICATION FOR MINIMUM BEAM WEB THICKNESS REQUIRED TO ALLOW HDAS TO BE OFFSET FROM BEAM WEB.
5. ALLOWANCE OF WELDED OR BOLTED CONNECTIONS ALLOW CUSTOMIZED FABRICATION EFFICIENCIES.
6. ANGLES PROVIDE EASE OF FABRICATION IN LIEU OF BENT PLATES. GAGE METAL IS MORE COST EFFECTIVE THAN PLATE. PROVIDED BY STEEL FABRICATOR/ERECTOR.
7. HDAS PROVIDE EASE OF FABRICATION IN LIEU OF DAS. BY STEEL FABRICATOR.
8. CONNECTION OF KICKER PERPENDICULAR TO DECK SPAN VIA ANGLE, WT, OR BUILT-UP PLATE SECTION W/ ANCHORS INTO SLAB FACILITATES EASE OF FABRICATION & ERECTION OVER SKEWING KICKER TO BE WELDED TO ADJACENT BEAM. BY STEEL FABRICATOR/ERECTOR.
9. EMBED PLATE BY STEEL FABRICATOR.
10. KICKERS BY STEEL FABRICATOR/ ERECTOR.
11. NO CAMBER OF THE SPANDREL BEAM/ GIRDER IS PREFERRED (IF POSSIBLE) TO HELP CONTROL ISSUES OF FLOOR LEVELING AT THE BUILDING PERIMETER.

SEAC

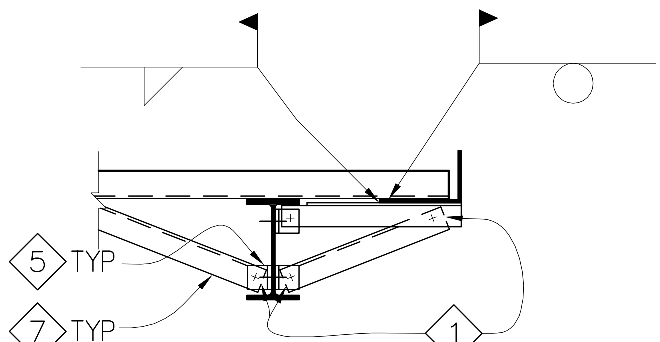
FIGURE 1.4-1 : STRUCTURAL STEEL CONSTRUCTION ISSUES - FLOOR

STRUCTURAL STEEL BUILDING – EXTERIOR WALL INTERFACE ISSUES

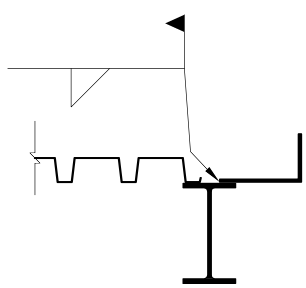
RMSCA
ROCKY MOUNTAIN STEEL CONSTRUCTION ASSOCIATION



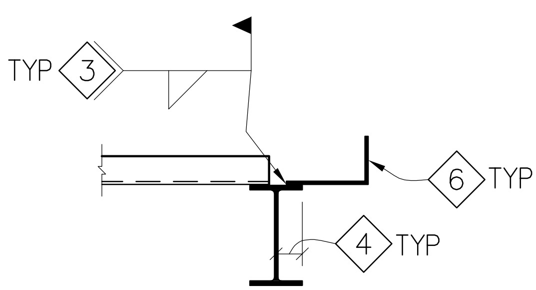
1.4–2d



1.4–2c



1.4–2b

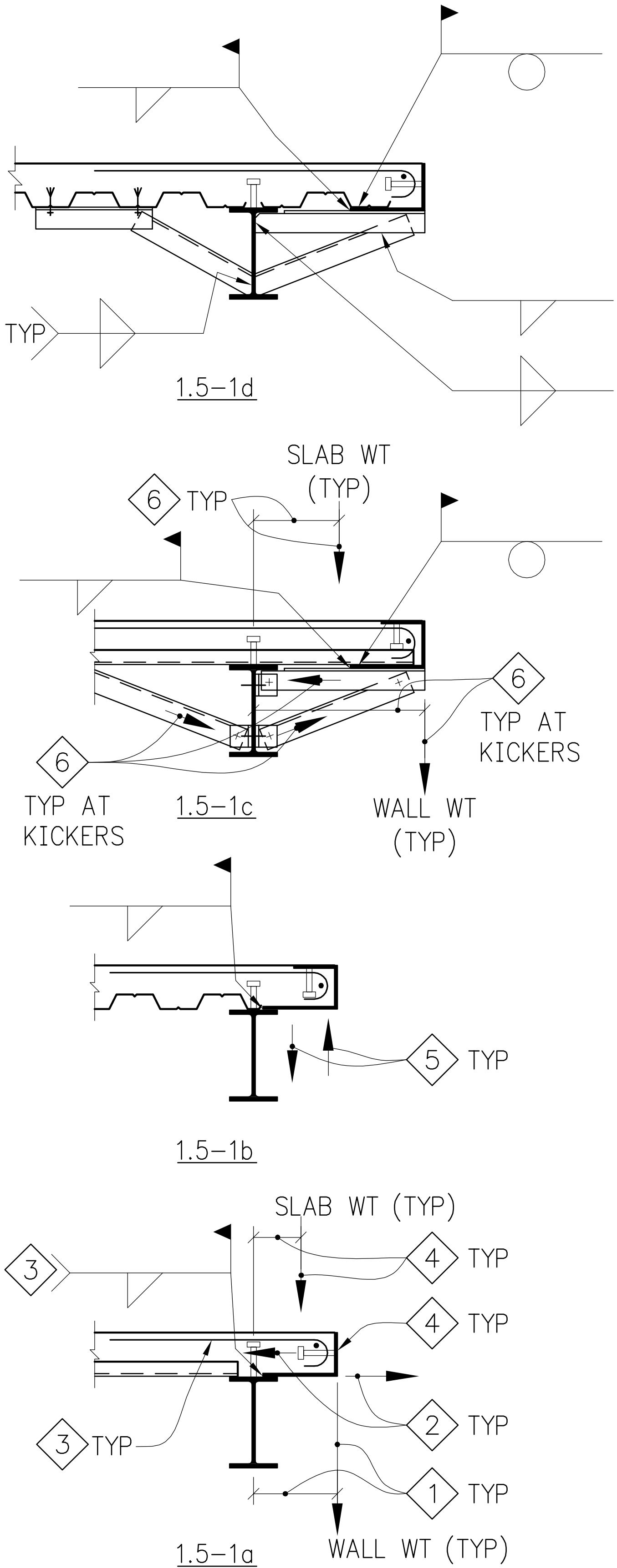


1.4–2a

NOTES:

1. SQUARED ENDS OF PIECES FACILITATE EASE OF FABRICATION.
2. CONNECTION OF PIECES TO ONE SURFACE FACILITATES EASE OF FABRICATION AND/OR ERECTION.
3. DOWN OR SIDE WELDS IN LIEU OF OVERHEAD (FROM UNDERNEATH) WELDS FACILITATE EASE OF FABRICATION AND/OR ERECTION.
4. SUFFICIENT SPACE (SPANDREL BEAM/ GIRDER FLANGE WIDTH) MUST BE PROVIDED FOR CONNECTION OF ANGLE/ BENT PLATE TO BEAM.
5. ALLOWANCE OF WELDED OR BOLTED CONNECTIONS ALLOW CUSTOMIZED FABRICATION EFFICIENCIES.
6. ANGLES PROVIDE EASE OF FABRICATION IN LIEU OF BENT PLATES. GAGE METAL IS MORE COST EFFECTIVE THAN PLATE. BY STEEL FABRICATOR/ERECTOR.
7. KICKERS BY STEEL FABRICATOR/ ERECTOR.

SEAC	**FIGURE 1.4-2 : STRUCTURAL STEEL CONSTRUCTION ISSUES - ROOF**	RMSCA ROCKY MOUNTAIN STEEL CONSTRUCTION ASSOCIATION
	STRUCTURAL STEEL BUILDING – EXTERIOR WALL INTERFACE ISSUES	



NOTES:

1. SEE EXTERIOR WALL SYSTEM SKETCHES. EXTERIOR WALL SYSTEM DESIGNED FOR ECCENTRICITY FROM EXTERIOR WALL SYSTEM CENTER OF GRAVITY TO EDGE OF SLAB.

2. FOR EXTERIOR WALL SYSTEM CONNECTIONS TO FACE OF EDGE OF SLAB: DESIGN ANGLE/BENT PLATE, HDAS/DAS, AND CONNECTIONS FOR EXTERIOR WALL SYSTEM WEIGHT APPLIED AT CORRESPONDING ECCENTRICITY TO EDGE OF SLAB.

3. DESIGN SLAB REINFORCING TO TAKE EXTERIOR WALL SYSTEM WEIGHT APPLIED AT CORRESPONDING ECCENTRICITY TO BEAM CENTERLINE.

4. DESIGN EDGE OF SLAB ANGLE/BENT PLATE & CONNECTIONS FOR SLAB WET CONCRETE WEIGHT APPLIED FROM CENTER OF MASS BEYOND THE BEAM FLANGE TO THE BEAM CENTERLINE.

5. FOR EXTERIOR WALL SYSTEM CONNECTIONS TO EMBED PLATES IN TOP OF SLAB: DESIGN ANGLE/BENT PLATE, HDAS/DAS, AND CONNECTIONS FOR EXTERIOR WALL SYSTEM WEIGHT APPLIED AT CORRESPONDING ECCENTRICITY TO EDGE OF SLAB.

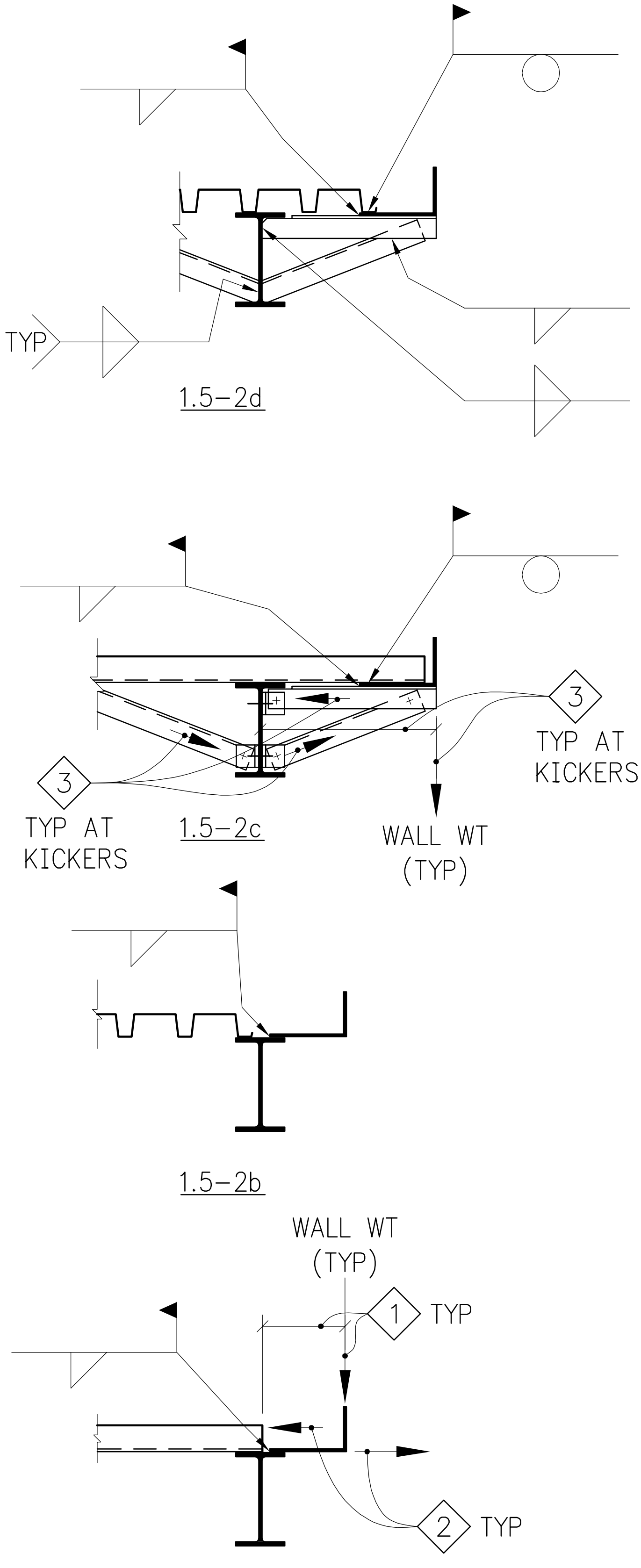
6. KICKERS AND CONNECTIONS DESIGNED FOR EXTERIOR WALL SYSTEM + SLAB WET CONCRETE WEIGHT APPLIED AT CORRESPONDING ECCENTRICITY TO BEAM CENTERLINE.

SEAC

FIGURE 1.5-1 : STRUCTURAL STEEL ENGINEERING ISSUES - FLOOR

STRUCTURAL STEEL BUILDING – EXTERIOR WALL INTERFACE ISSUES

RMSCA
ROCKY MOUNTAIN STEEL CONSTRUCTION ASSOCIATION



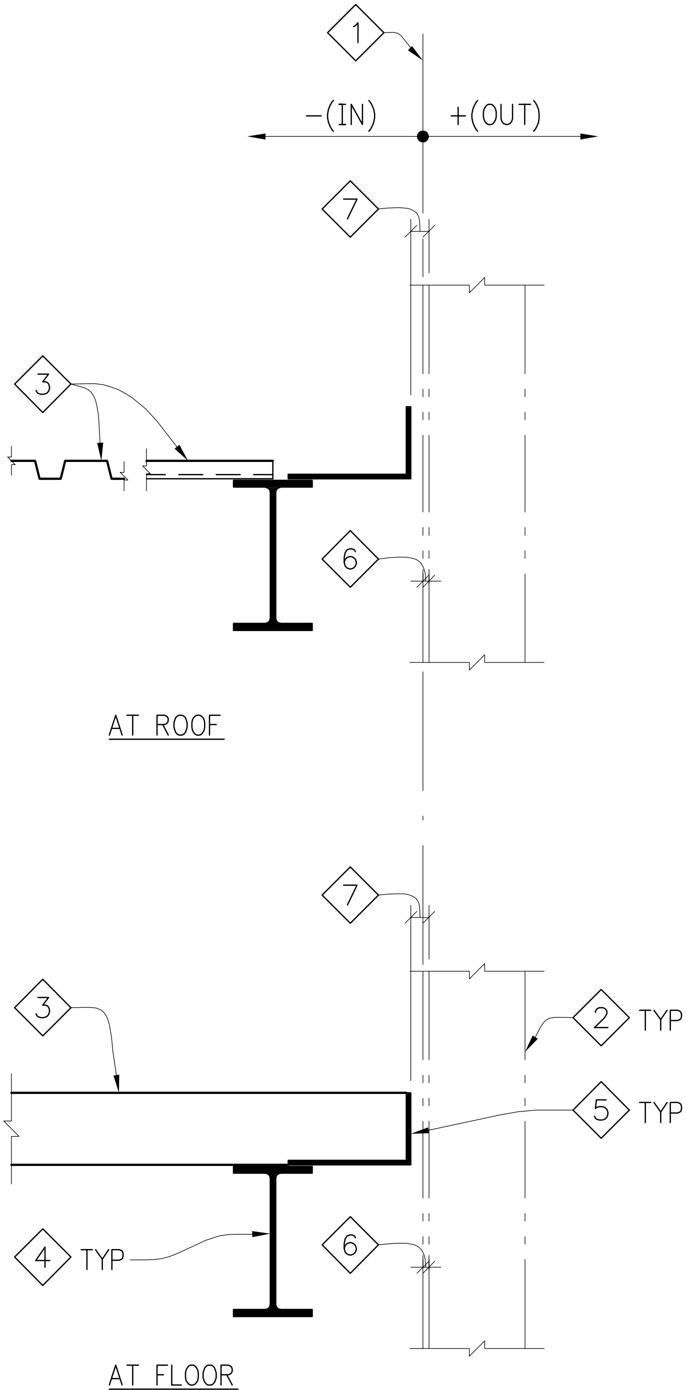
NOTES:

1. SEE EXTERIOR WALL SYSTEM SKETCHES. EXTERIOR WALL SYSTEM DESIGNED FOR ECCENTRICITY FROM EXTERIOR WALL STYSTEM CENTER OF GRAVITY TO EDGE OF DECK.

2. DESIGN ANGLE/BENT PLATE, HDAS/DAS, AND CONNECTIONS FOR EXTERIOR WALL SYSTEM WEIGHT APPLIED AT CORRESPONDING ECCENTRICITY TO EDGE OF SLAB.

3. KICKERS AND CONNECTIONS DESIGNED FOR EXTERIOR WALL SYSTEM WEIGHT APPLIED AT CORRESPONDING ECCENTRICITY TO BEAM CENTERLINE.

SEAC	**FIGURE 1.5-2 : STRUCTURAL STEEL ENGINEERING ISSUES - ROOF** STRUCTURAL STEEL BUILDING – EXTERIOR WALL INTERFACE ISSUES	RMSCA ROCKY MOUNTAIN STEEL CONSTRUCTION ASSOCIATION



NOTES:

1. THEORETICAL INSIDE FACE OF METAL STUD SYSTEM.
2. METAL STUD SYSTEM.
3. SLAB/DECK.
4. SPANDREL BEAM/GIRDER.
5. EDGE ANGLE/BENT PLATE.
6. METAL STUD SYSTEM ± TOLERANCE. SEE FIGURE 2.1b FOR CHART.
7. EDGE OF SLAB/DECK TO INSIDE FACE OF METAL STUD SYSTEM GAP 'dgap' REQUIRED:

   dgap = (ds+) + (dw−).

   SEE FIGURE 2.1b FOR CHART.

SEAC

FIGURE 2.1a : METAL STUD TOLERANCES

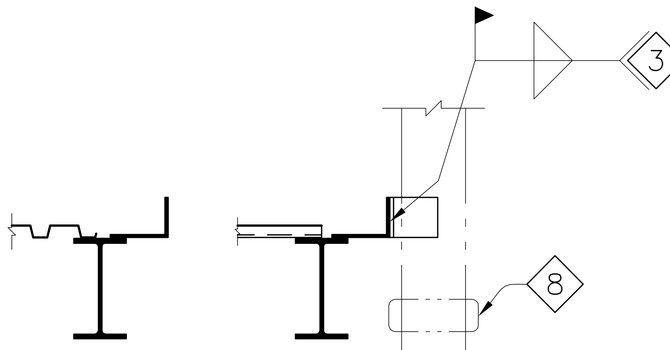
STRUCTURAL STEEL BUILDING – EXTERIOR WALL INTERFACE ISSUES

RMSCA

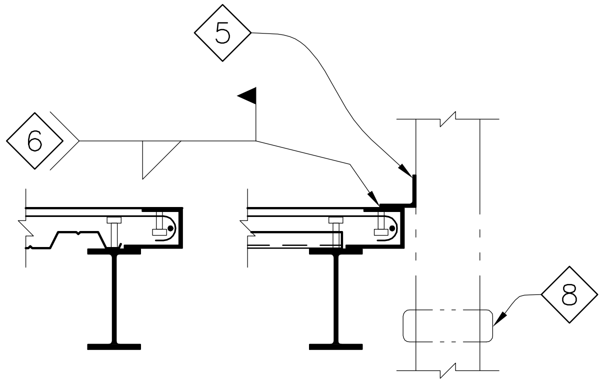
ROCKY MOUNTAIN STEEL CONSTRUCTION ASSOCIATION

HEIGHT (ft)	ds (in)		dw (in)		dgap (in)	e (in)
	−(IN)	+(OUT)	−(IN)	+(OUT)		
10	0.5	0.5	0.13	0.13	0.63	1.25 + c
20	0.5	0.5	0.13	0.13	0.63	1.25 + c
30	0.5	0.5	0.13	0.13	0.63	1.25 + c
40	0.5	0.5	0.13	0.13	0.63	1.25 + c
50	0.5	0.5	0.13	0.13	0.63	1.25 + c
60	0.5	0.5	0.13	0.13	0.63	1.25 + c
70	0.5	0.5	0.13	0.13	0.63	1.25 + c
80	0.5	0.5	0.13	0.13	0.63	1.25 + c
90	0.5	0.5	0.13	0.13	0.63	1.25 + c
100	0.5	0.5	0.13	0.13	0.63	1.25 + c

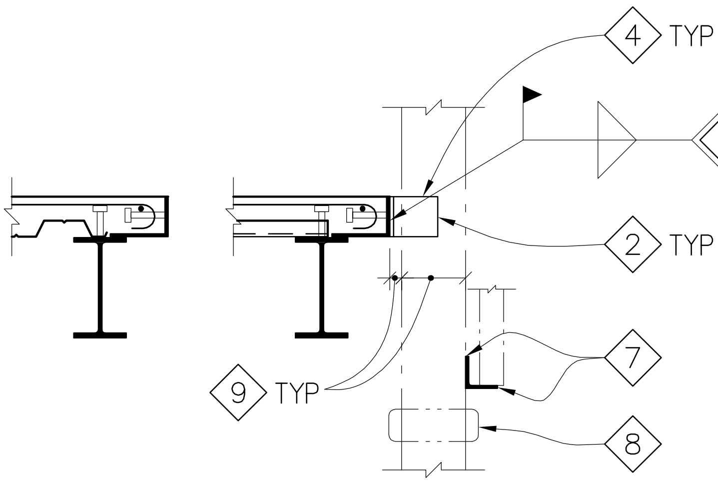
NOTES: ds = de (VALUES TAKEN FROM CHART IN FIGURE 1.3b)
dw = EXTERIOR WALL SYSTEM TOLERANCE
dgap = (ds+) + (dw−)
dgap = 0.75" IS COMMON SPECIFIED 'GAP'
e = ds + dgap + c
SEE FIGURES 2.3 FOR GRAPHIC DEPICTION OF 'e' & 'c'



AT ROOF



AT FLOOR – PANELIZED METAL STUDS



AT FLOOR – STICK BUILT METAL STUDS

NOTES:

1. SEE FIGURES 1.4 FOR STEEL FRAMING NOTES.
2. METAL STUD CLIP BY METAL STUD SUPPLIER. CLIP IS EITHER DESIGNED TO DELIVER THE WALL WEIGHT TO THE EDGE ANGLE/BENT PLATE OR IS DESIGNED TO SLIP VERTICALLY.
3. CLIP EITHER FIELD WELDED OR SCREW /ANCHOR FASTENED TO EDGE ANGLE/ BENT PLATE BY METAL STUD WALL SUPPLIER.
4. CLIP/SUPPORT ANGLE TO METAL STUD BY METAL STUD SUPPLIER.
5. CONTINUOUS STRONGBACK ANGLE SUPPLIED BY STEEL FABRICATOR & INSTALLED BY METAL STUD SUPPLIER.
6. SUPPORT STRONGBACK ANGLE TO SLAB/FRAME BY METAL STUD SUPPLIER.
7. BRICK LEDGER ANGLES ARE SUPPLIED BY STEEL FABRICATOR. STEEL ERECTORS PREFER NOT TO HAVE TO FIELD WELDING TO METAL STUDS INCLUDED IN THEIR SCOPE.
8. CAPABILITY FOR ALLOWING VERTICAL SLIP IN THE METAL STUD WALL SYSTEM AT SOME LOCATION BETWEEN FLOORS IS REQUIRED TO ENSURE THAT RELATIVE DEFLECTIONS OF FLOORS/ ROOF DO NOT LOAD/CRUSH METAL STUD WALL SYSTEM.
9. DEPENDING ON THE GOVERNING JURISDICTION, FIRE-SAFING MAY BE REQUIRED FROM THE OUTSIDE FACE OF ANGLE/BENT PLATE TO THE INSIDE OR OUTSIDE FACE OF METAL STUD WALL SYSTEM.

SEAC

FIGURE 2.2-1 : METAL STUD CONSTRUCTION ISSUES - CASE A: BALLOON FRAMING

STRUCTURAL STEEL BUILDING – EXTERIOR WALL INTERFACE ISSUES

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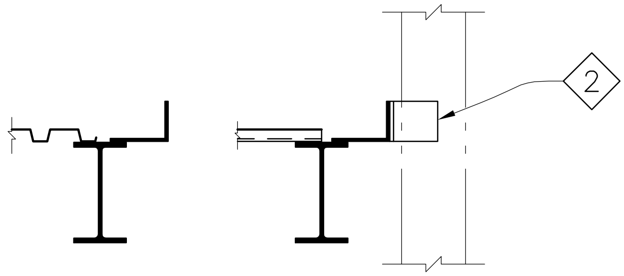
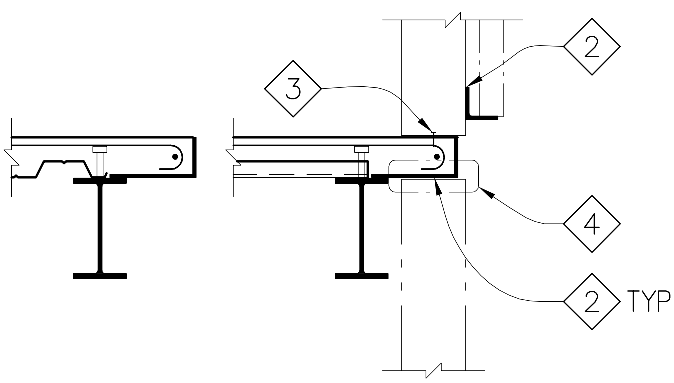


AT ROOF

NOTES:

1. SEE FIGURES 1.4 FOR STEEL FRAMING NOTES.
2. SEE FIGURE 2.2–1 FOR NOTES.
3. METAL STUD SCREW/ANCHOR FASTENED TO SLAB BY METAL STUD SUPPLIER.
4. CAPABILITY FOR ALLOWING VERTICAL SLIP IN THE METAL STUD WALL SYSTEM IS REQUIRED TO ENSURE THAT RELATIVE DEFLECTIONS OF FLOORS/ROOF DO NOT LOAD/CRUSH METAL STUD WALL SYSTEM.



AT FLOOR

SEAC

FIGURE 2.2-2 : METAL STUD CONSTRUCTION ISSUES - CASE B: INFILL FRAMING

STRUCTURAL STEEL BUILDING – EXTERIOR WALL INTERFACE ISSUES

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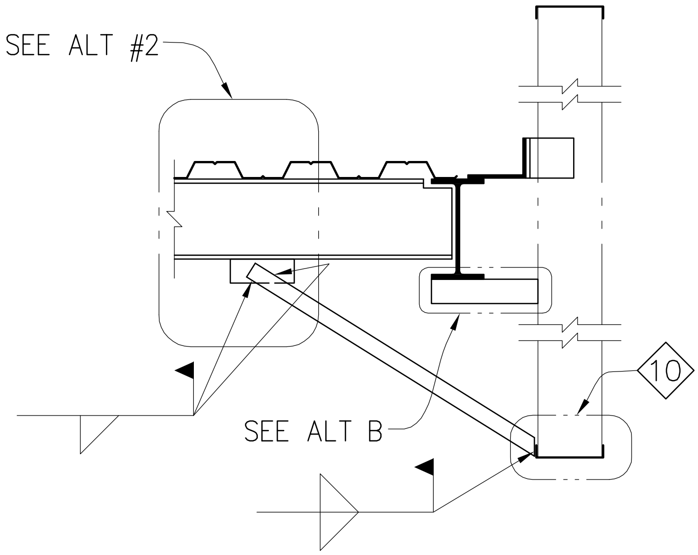
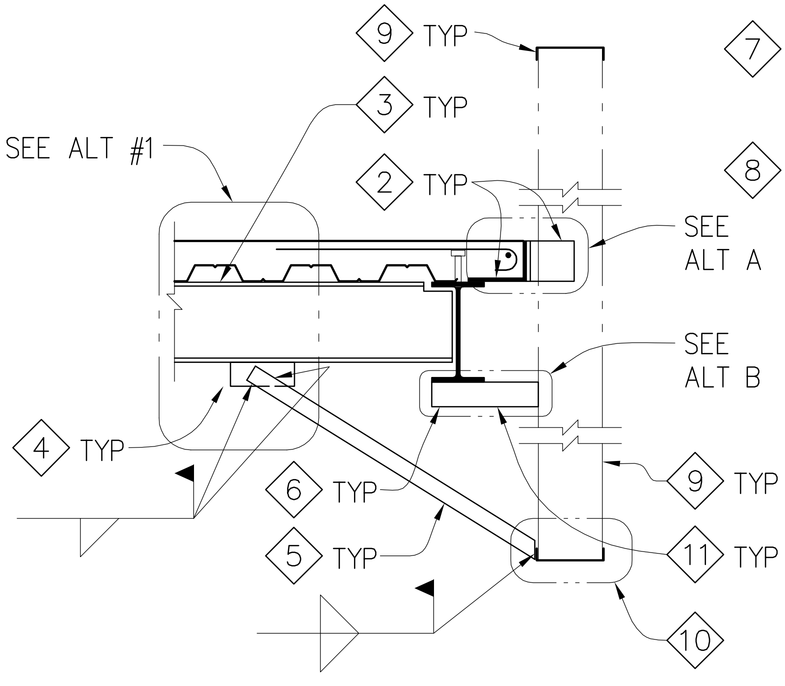


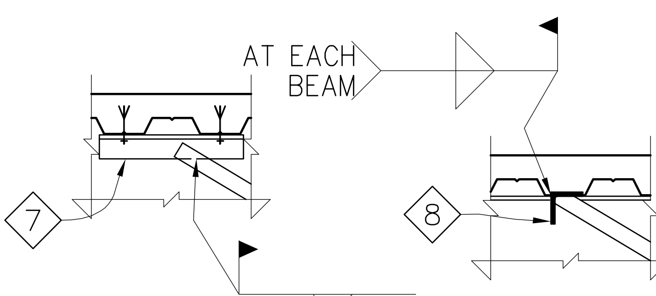
AT ROOF

NOTES:

1. SEE FIGURES 1.4 FOR STEEL FRAMING NOTES.
2. SEE FIGURE 2.2-1 FOR NOTES.
3. BEAM.
4. PLATE, ANGLE OR WT SHOP WELDED OR BOLTED TO BEAM, 1/4" MINIMUM.
5. KICKER - METAL STUDS (BY METAL STUD SUPPLIER) OR ANGLES (SUPPLIED BY STEEL FABRICATOR & INSTALLED BY METAL STUD SUPPLIER) AT BEAMS OR BEAMS & INTERMITTENT LOCATIONS (ALT #1 & ALT #2) BY METAL STUD SUPPLIER.
6. METAL STUD (BY METAL SUPPLIER) OR ANGLE (SUPPLIED BY STEEL FABRICTOR & INSTALLED BY METAL STUD SUPPLIER) SUPPORT BRACKET.
7. ANGLE, WT, OR BUILT-UP PLATE SECTION ANCHORED INTO SLAB BY STEEL FABRICATOR/ ERECTOR.
8. ANGLE OR WT SPANNING FROM BEAM TO BEAM BY STEEL FABRICATOR/ERECTOR.
9. METAL STUD FRAME (BY METAL STUD SUPPLIER) OR CHANNEL/TUBE FRAME BY (STEEL FABRICATOR/ ERECTOR) W/ METAL STUD INFILL.
10. CAPABILITY FOR ALLOWING VERTICAL SLIP IN THE METAL STUD WALL SYSTEM IS REQUIRED TO ENSURE THAT RELATIVE DEFLECTIONS OF FLOORS/ROOF DO NOT LOAD/CRUSH METAL STUD WALL SYSTEM.
11. BRACKETS/CONNECTIONS HERE COMPLICATE FIRE-PROOFING & FIRE SAFING SEQUENCING. SUPPLIED BY STEEL FABRICATOR & INSTALLED BY METAL STUD SUPPLIER.

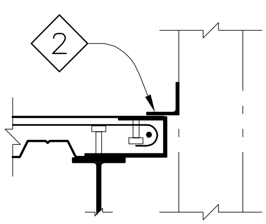


AT FLOOR

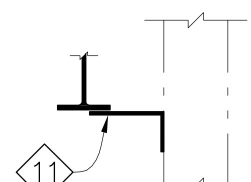


ALT #1

ALT #2



ALT A



ALT B

SEAC

FIGURE 2.2-3 : METAL STUD CONSTRUCTION ISSUES - CASE C: STRIP WINDOW PANELS

STRUCTURAL STEEL BUILDING - EXTERIOR WALL INTERFACE ISSUES

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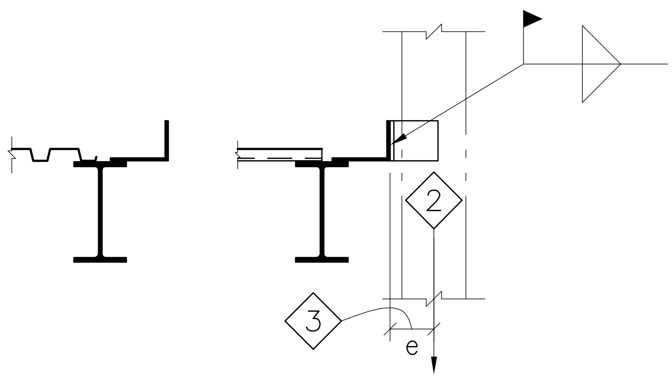
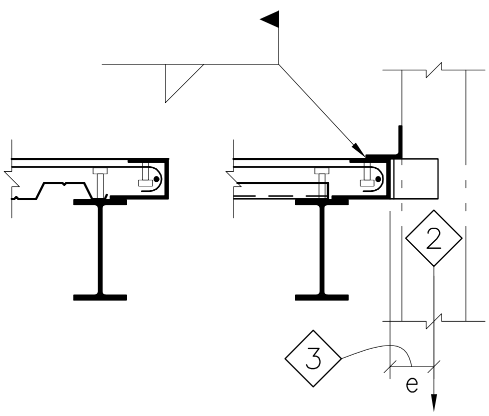
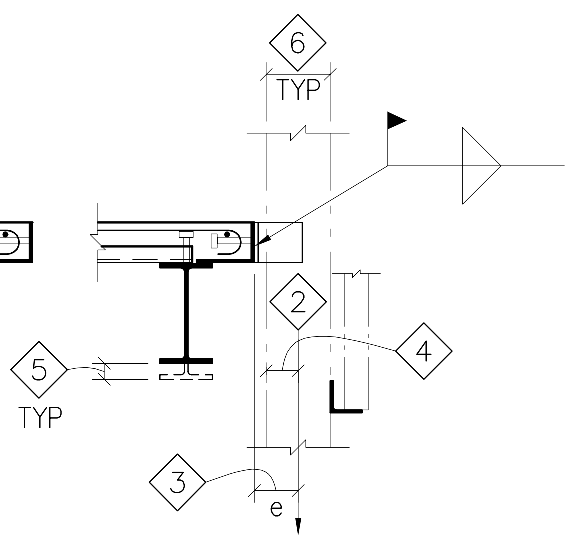


AT ROOF



AT FLOOR – OPTION B



AT FLOOR – OPTION A

NOTES:

1. SEE FIGURES 1.5 FOR STEEL FRAMING NOTES.

2. METAL STUD WALL WEIGHT (INCLUDING CONNECTIONS, LEDGER ANGLES, VENEER, ETC.) AT CENTER OF GRAVITY OF METAL STUD WALL SYSTEM.

3. TYPICAL ECCENTRICITY 'e' FOR WHICH METAL STUD WALL SYSTEM & CONNECTIONS TO STEEL ARE DESIGNED (NON–VERTICAL SLIP CLIP CONDITION).
   $e = ds + dgap + c$
   SEE CHART IN FIGURE 2.1b FOR VALUES.

4. DISTANCE FROM CENTER OF GRAVITY OF METAL STUD WALL SYSTEM TO INSIDE FACE OF METAL STUD WALL SYSTEM 'c'.

5. TYPICAL MAXIMUM LIVE LOAD DEFLECTIONS SHOULD BE LIMITED TO 3/8".

6. METAL STUD WALL SYSTEM THICKNESS 't'.

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FIGURE 2.3-1 : METAL STUD ENGINEERING ISSUES - CASE A: BALLOON FRAMING

STRUCTURAL STEEL BUILDING – EXTERIOR WALL INTERFACE ISSUES

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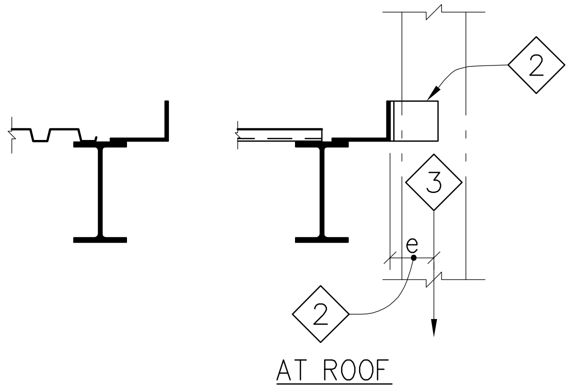
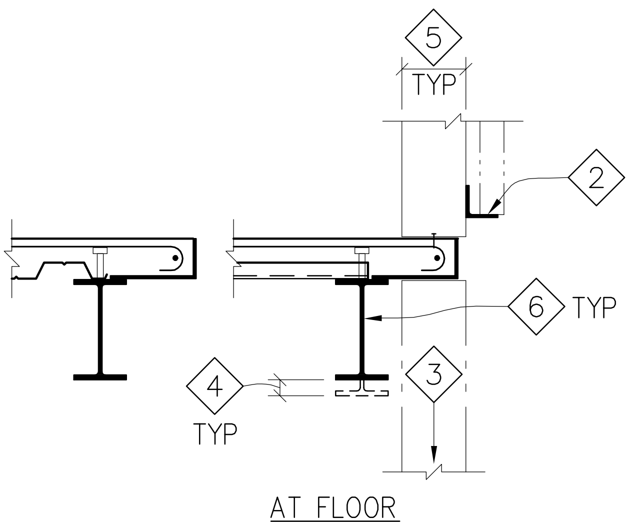
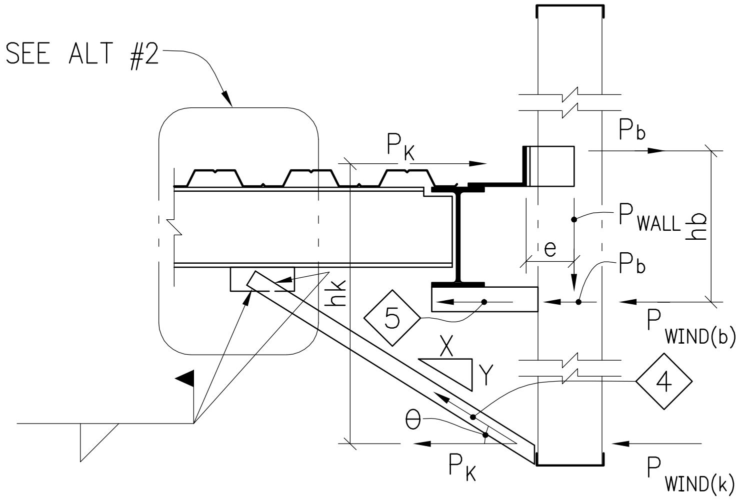




NOTES:

1. SEE FIGURES 1.5 FOR STEEL FRAMING NOTES.
2. SEE FIGURE 2.3–1 FOR NOTES.
3. METAL STUD WALL WEIGHT (INCLUDING CONNECTIONS, LEDGER ANGLES, VENEER, ETC.) AT CENTER OF GRAVITY OF METAL STUD WALL SYSTEM.
4. TYPICAL MAXIMUM LIVE LOAD DEFLECTIONS SHOULD BE LIMITED TO 3/8".
5. METAL STUD WALL SYSTEM THICKNESS 't'.
6. FIRE–PROOFING MUST GO ON STEEL PRIOR TO INSTALLING METAL STUD WALL SYSTEM.

SEAC	**FIGURE 2.3-2 : METAL STUD ENGINEERING ISSUES - CASE B: INFILL FRAMING** STRUCTURAL STEEL BUILDING – EXTERIOR WALL INTERFACE ISSUES	RMSCA ROCKY MOUNTAIN STEEL CONSTRUCTION ASSOCIATION



AT ROOF

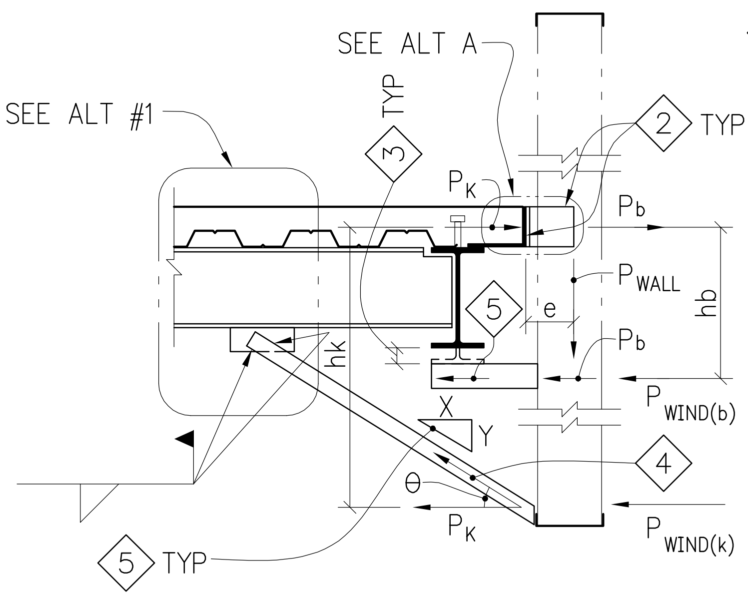
NOTES:

1. SEE FIGURES 1.5 FOR STEEL FRAMING NOTES.
2. SEE FIGURE 2.3-1 FOR NOTES. VERTICAL SLIP CLIP CANNOT BE SPECIFIED.
3. TYPICAL MAXIMUM LIVE LOAD DEFLECTIONS SHOULD BE LIMITED TO 3/8".
4. KICKER LOAD:

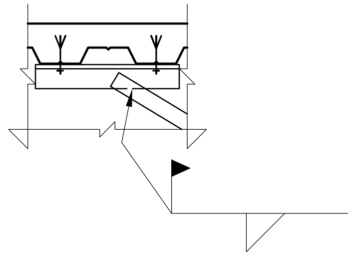
$$T/C = \frac{[P_k + P_{WIND(k)}]}{\cos\theta}$$

WHERE: $P_k = (P_{WALL})(e/hk)$

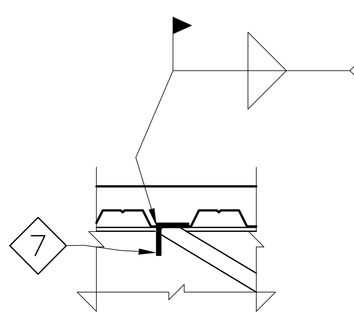
5. MINIMIZING Y/X REDUCES HORIZONTAL THRUST INDUCES IN METAL STUD WALL DUE TO BEAM VERTICAL DEFLECTIONS.



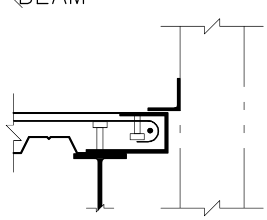
AT FLOOR



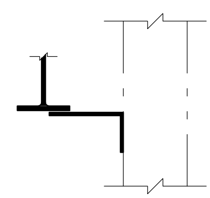
ALT #1



ALT #2



ALT A



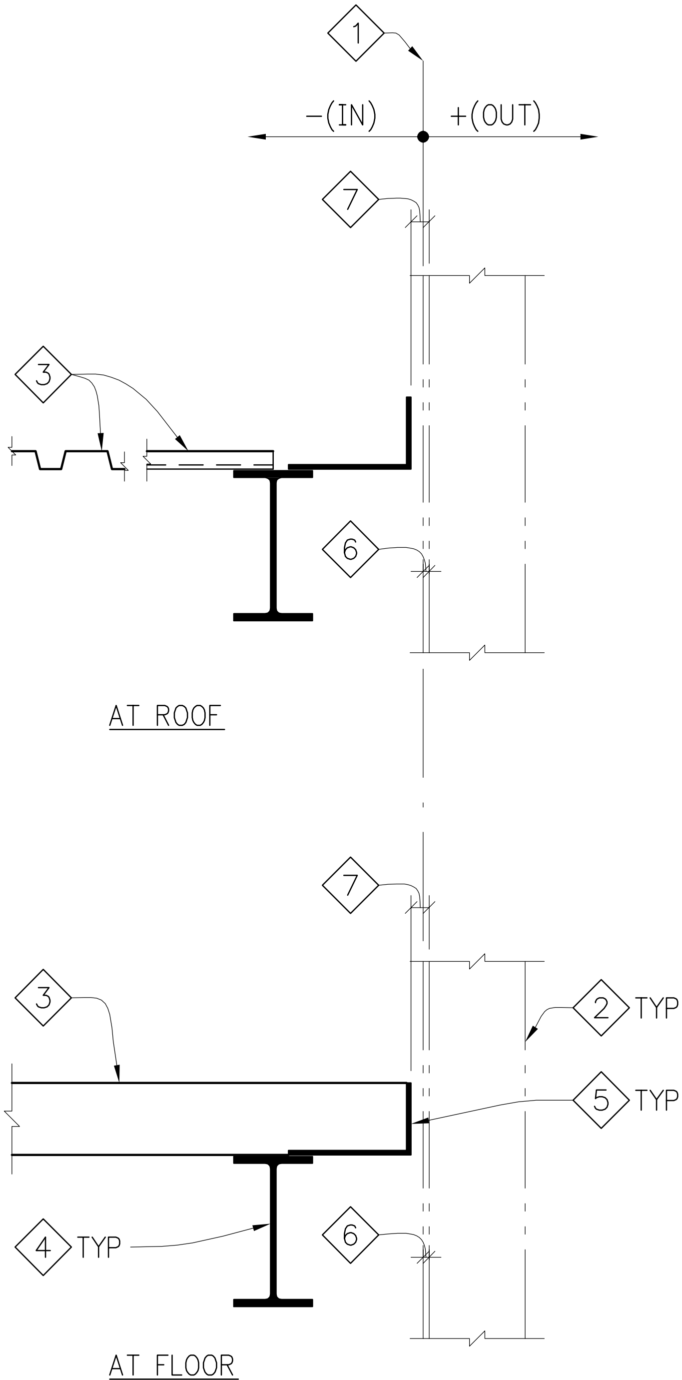
ALT B

SEAC

FIGURE 2.3-3 : METAL STUD ENGINEERING ISSUES - CASE C: STRIP WINDOW CENTER PANELS

STRUCTURAL STEEL BUILDING – EXTERIOR WALL INTERFACE ISSUES

RMSCA



NOTES:

1. THEORETICAL INSIDE FACE OF PRECAST CONCRETE SYSTEM.
2. PRECAST CONCRETE SYSTEM.
3. SLAB/DECK.
4. SPANDREL BEAM/GIRDER.
5. EDGE ANGLE/BENT PLATE.
6. PRECAST CONCRETE SYSTEM ± TOLERANCE. SEE FIGURE 3.1b FOR CHART.
7. EDGE OF SLAB/DECK TO INSIDE FACE OF PRECAST CONCRETE SYSTEM GAP 'dgap' REQUIRED:
   dgap = (ds+) + (dw−).
   SEE FIGURE 3.1b FOR CHART.

SEAC	**FIGURE 3.1a : PRECAST CONCRETE TOLERANCES** STRUCTURAL STEEL BUILDING – EXTERIOR WALL INTERFACE ISSUES	RMSCA ROCKY MOUNTAIN STEEL CONSTRUCTION ASSOCIATION

HEIGHT (ft)	ds (in)		dw (in)		dgap (in)	e (CASE C) (in)
	−(IN)	+(OUT)	−(IN)	+(OUT)		
10	0.5	0.5	0.25	0.25	0.75	1.25 + t/2
20	0.5	0.5	0.25	0.25	0.75	1.25 + t/2
30	0.5	0.5	0.25	0.25	0.75	1.25 + t/2
40	0.5	0.5	0.25	0.25	0.75	1.25 + t/2
50	0.5	0.5	0.25	0.25	0.75	1.25 + t/2
60	0.5	0.5	0.25	0.25	0.75	1.25 + t/2
70	0.5	0.5	0.25	0.25	0.75	1.25 + t/2
80	0.5	0.5	0.25	0.25	0.75	1.25 + t/2
90	0.5	0.5	0.25	0.25	0.75	1.25 + t/2
100	0.5	0.5	0.25	0.25	0.75	1.25 + t/2

NOTES: ds = de (VALUES TAKEN FROM CHART IN FIGURE 1.3b)
dw = EXTERIOR WALL SYSTEM TOLERANCE
dgap = (ds+) + (dw−)
dgap = 0.75" IS COMMON SPECIFIED 'GAP'
e = ds + dgap + t/2
SEE FIGURES 3.3 FOR GRAPHIC DEPICTION OF 'e' & 't'

SEAC

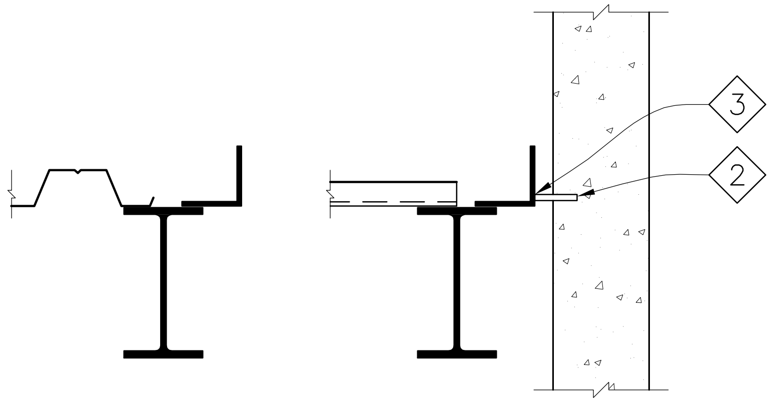
FIGURE 3.1b : PRECAST CONCRETE TOLERANCES

STRUCTURAL STEEL BUILDING – EXTERIOR WALL INTERFACE ISSUES

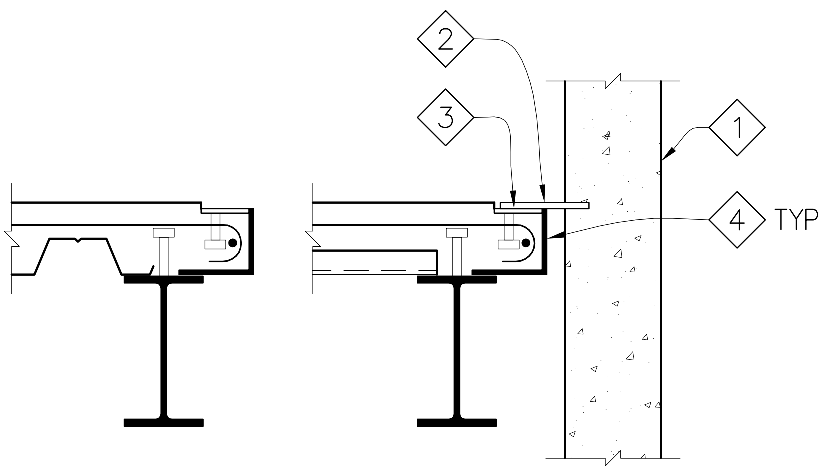
RMSCA
ROCKY MOUNTAIN STEEL CONSTRUCTION ASSOCIATION

NOTES:

1. SEE FIGURES 1.4 FOR STEEL FRAMING NOTES.
2. SLOTTED INSERT. INSERT ALLOWS FOR VERTICAL SLIP AND ROTATION OF PRECAST CONCRETE WITH RESPECT TO STEEL FRAMING BY PRECAST CONCRETE SUPPLIER.
3. CONNECTION TO STEEL BY PRECAST CONCRETE SUPPLIER.
4. EDGE ANGLE/BENT PLATE, 1/4" THICK MINIMUM.



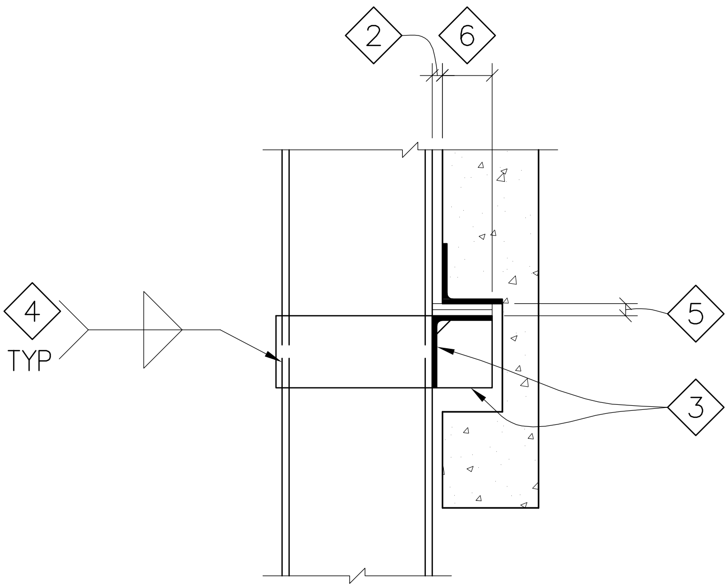
AT ROOF



AT FLOOR

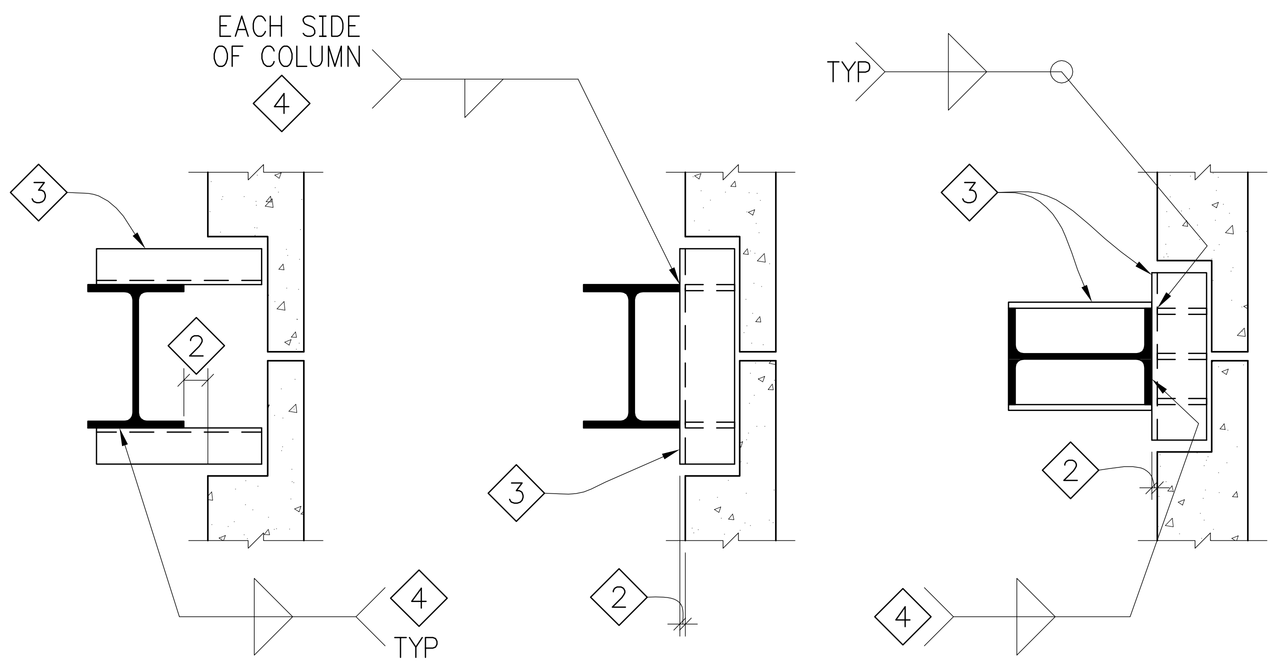
FIGURE 3.2-1 : PRECAST CONCRETE CONSTRUCTION ISSUES - CASE A

STRUCTURAL STEEL BUILDING — EXTERIOR WALL INTERFACE ISSUES



NOTES:

1. SEE FIGURES 1.4 FOR STEEL FRAMING NOTES.
2. 'dgap' REQUIRED = VALUE OBTAINED FROM FIG. 3.1b
3. STEEL BRACKET (ANGLES, WT'S, WIDE FLANGES, TUBES, CHANNELS, ETC.) IF INSTALLED IN SHOP, BY STEEL FABRICATOR. IF INSTALLED IN FIELD, BY PRECAST CONCRETE SUPPLIER. TYPICALLY IT IS MORE EFFICIENT & COST EFFECTIVE FOR THE PROJECT TO INSTALL BRACKETS IN THE SHOP.
4. CONNECTION IN SHOP (BY STEEL FABRICATOR) OR IN FIELD (BY PRECAST CONCRETE SUPPLIER).
5. SHIM STACK FOR FIELD ADJUSTMENT (TYPICALLY 1" THICK) BY PRECAST CONCRETE SUPPLIER. IT IS SIGNIFICANTLY MORE EFFICIENT & COST EFFECTIVE TO PROVIDE A SHIM STACK TO AVOID ELEVATION ERRORS & THUS, COSTLY REPAIRS IN THE FIELD.
6. 2" MIN BEARING TYPICALLY REQUIRED BY PRECAST CONCRETE SUPPLIER.



WEB ∥ WEB ∥ FLANGE ∥

SEAC

FIGURE 3.2-2a : PRECAST CONCRETE CONSTRUCTION ISSUES - CASE B

STRUCTURAL STEEL BUILDING – EXTERIOR WALL INTERFACE ISSUES

RMSCA

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NOTES:

1. SEE FIGURES 1.4 FOR STEEL FRAMING NOTES.
2. LATERAL SUPPORT FOR PRECAST CONCRETE TYPICALLY AT 4'-0" OC. MATERIAL AND CONNECTIONS BY PRECAST CONCRETE SUPPLIER. INSERT ALLOWS FOR VERTICAL SLIP AND ROTATION OF PRECAST CONCRETE WITH RESPECT TO STEEL FRAMING.
3. CONNECTION TO STEEL BY PRECAST CONCRETE SUPPLIER.

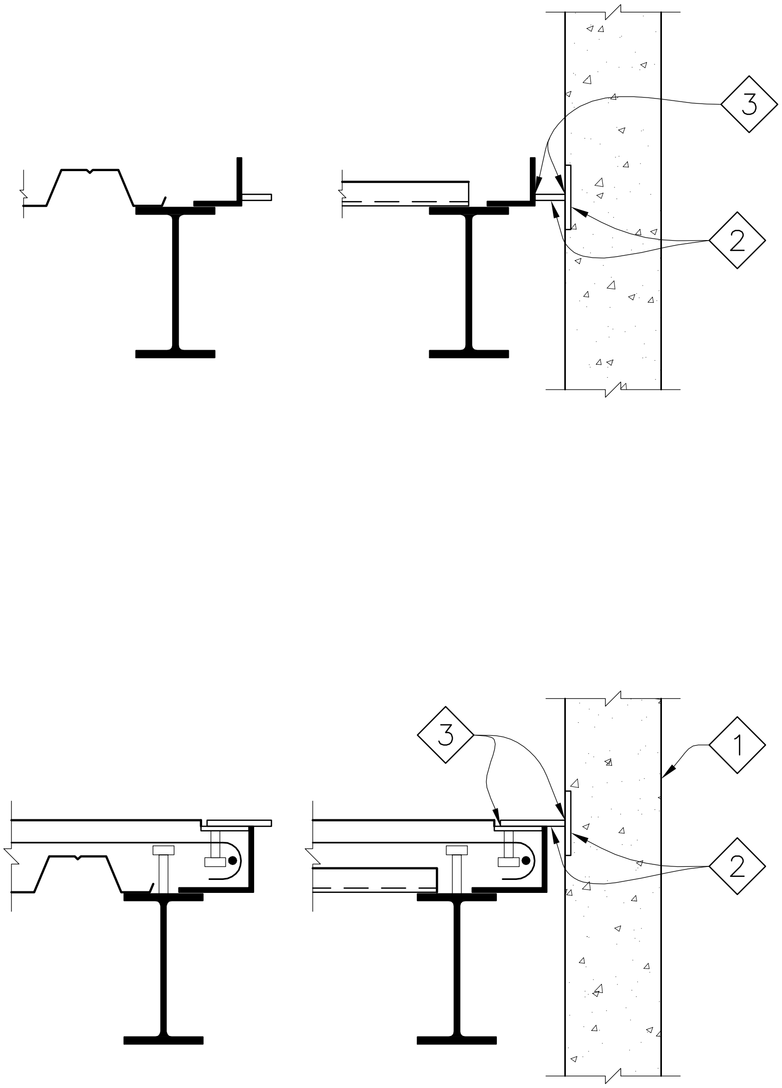

FIGURE 3.2-2b

SEAC

FIGURE 3.2-2b : PRECAST CONCRETE CONSTRUCTION ISSUES - CASE B

STRUCTURAL STEEL BUILDING - EXTERIOR WALL INTERFACE ISSUES

RMSCA

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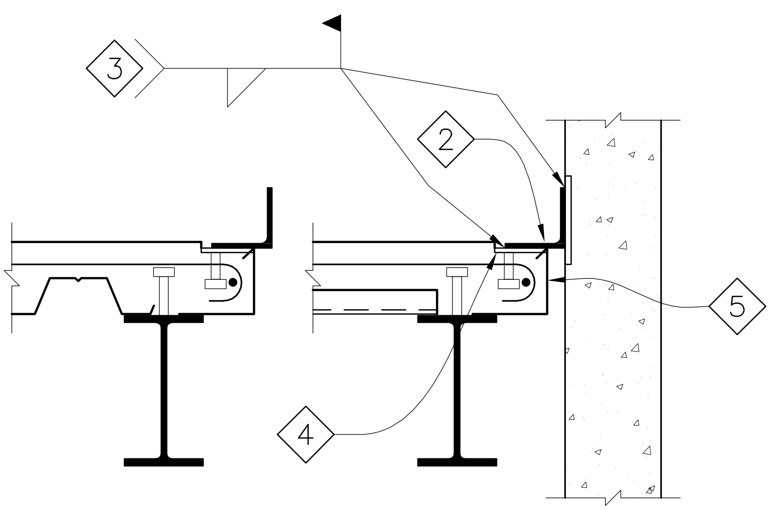
NOTES:

1. SEE FIGURES 1.4 FOR STEEL FRAMING NOTES.

2. CONTINUOUS STRONG-BACK MEMBER (ANGLE, TUBE, WIDE FLANGE, ETC.) PROVIDED BY PRECAST CONCRETE SUPPLIER.

3. WELD FROM PRECAST CONCRETE TO STRONG-BACK TO STEEL FRAMING BY PRECAST CONCRETE SUPPLIER.

4. EMBED PLATE BY PRECAST CONCRETE SUPPLIER. TYPICALLY SUPPORTS FOR WEIGHT OF PRECAST CONCRETE ARE PROVIDED AT 2 LOCATIONS NEAR THE ENDS OF THE STEEL SPANDREL BEAM/GIRDER.



SEAC

FIGURE 3.2-3 : PRECAST CONCRETE CONSTRUCTION ISSUES - CASE C

STRUCTURAL STEEL BUILDING – EXTERIOR WALL INTERFACE ISSUES

RMSCA
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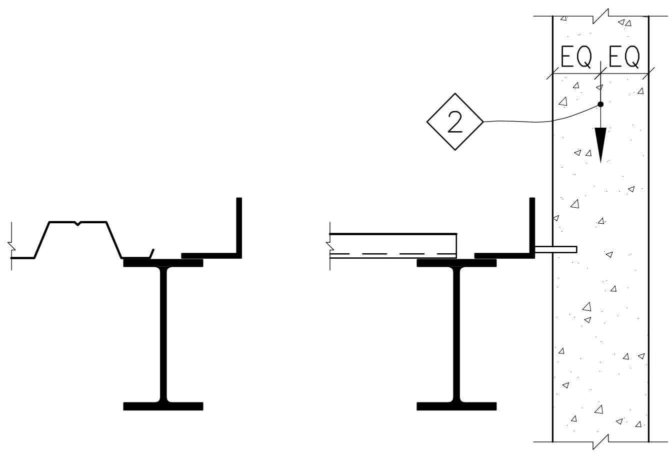
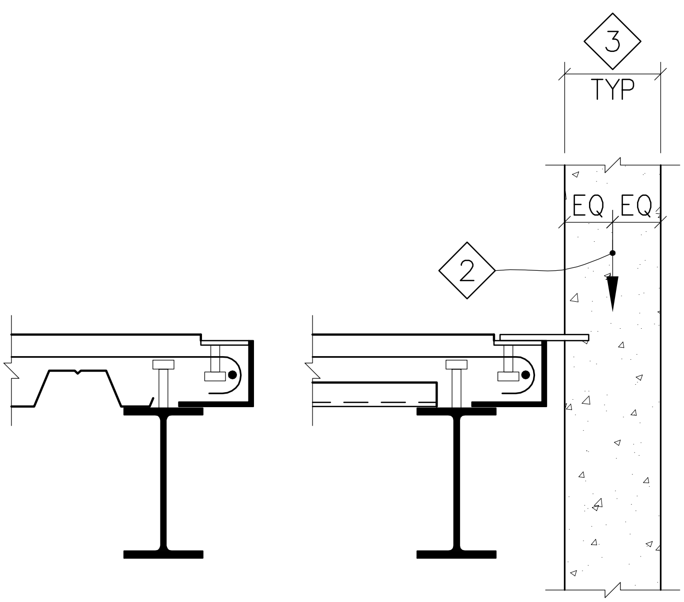
NOTES:

1. SEE FIGURES 1.5 FOR STEEL FRAMING NOTES.
2. PRECAST CONCRETE WALL WEIGHT CARRIED BY BUILDING FOUNDATION.
3. PRECAST CONCRETE THICKNESS 't'.





SEAC

FIGURE 3.3-1 : PRECAST CONCRETE ENGINEERING ISSUES - CASE A

STRUCTURAL STEEL BUILDING – EXTERIOR WALL INTERFACE ISSUES

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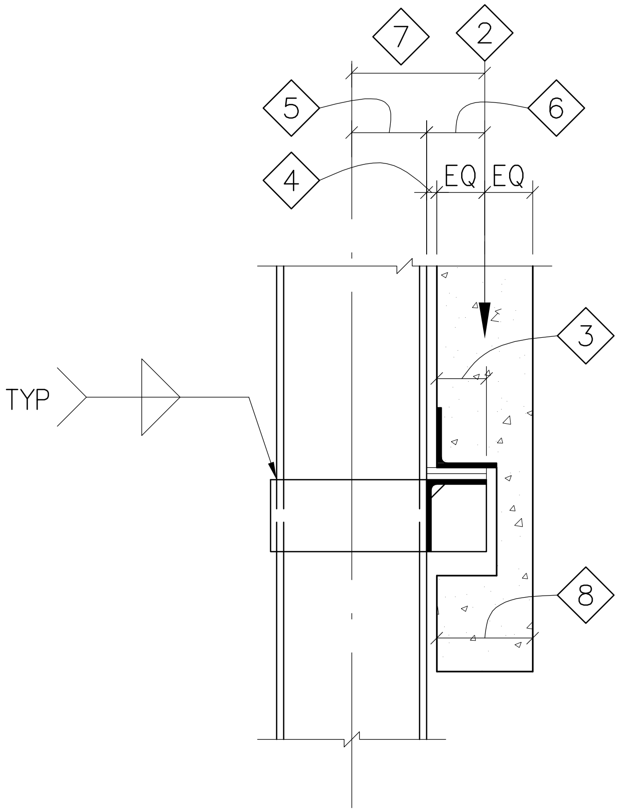

NOTES:

1. SEE FIGURES 1.5 FOR STEEL FRAMING NOTES.
2. PRECAST CONCRETE WALL WEIGHT.
3. 2" MINIMUM BEARING.
4. PRECAST CONCRETE WALL TO STEEL COLUMN FACE SPACE 'dp'.
5. STEEL COLUMN WIDTH/2 'dcol/2'.
6. TYPICAL ECCENTRICITY 'e' FOR WHICH BRACKET & CONNECTION STEEL COLUMN ARE DESIGNED FOR:
   $e = t/2 + dp$
7. TYPICAL ECCENTRICITY FOR WHICH THE COLUMN IS DESIGNED FOR:
   $e = t/2 + dp + dcol/2$
8. PRECAST CONCRETE THICKNESS 't'.

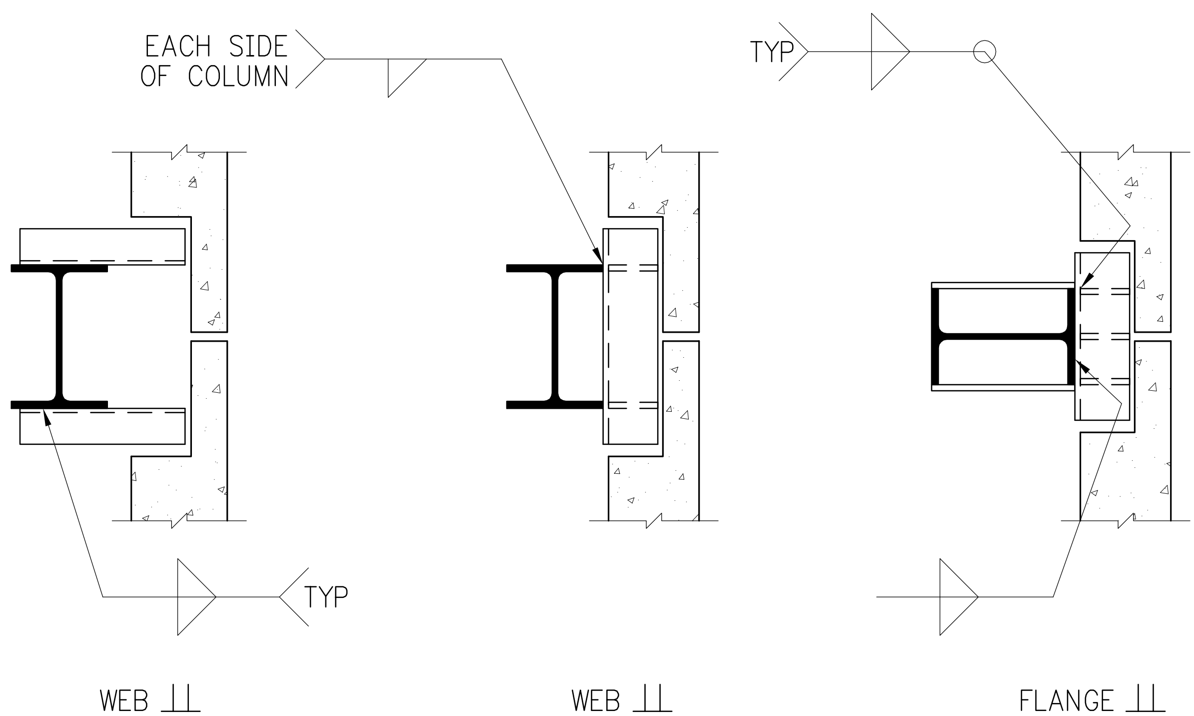

FIGURE 3.3-2a : PRECAST CONCRETE ENGINEERING ISSUES - CASE B

STRUCTURAL STEEL BUILDING - EXTERIOR WALL INTERFACE ISSUES

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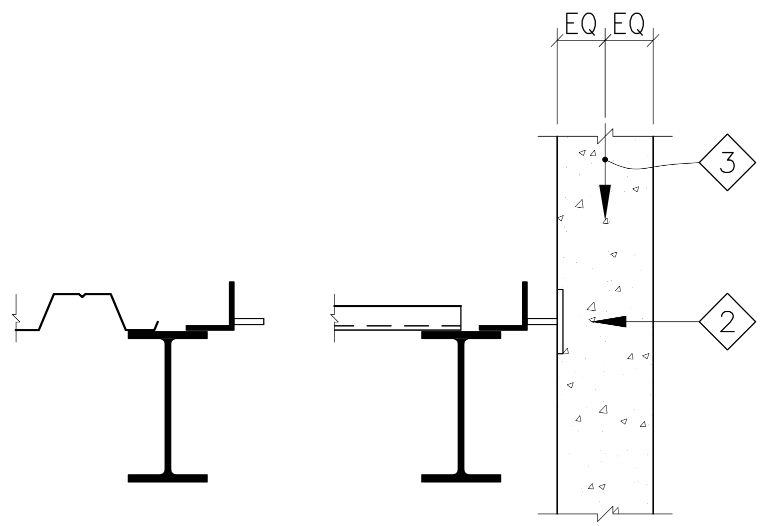
NOTES:

1. SEE FIGURES 1.5 FOR STEEL FRAMING NOTES.
2. LATERAL FORCE DUE TO WIND AND REQUIREMENTS FOR LATERALLY BRACING THE PRECAST CONCRETE FOR GRAVITY LOADS.
3. PRECAST CONCRETE WALL WEIGHT CARRIED BY STEEL COLUMNS.



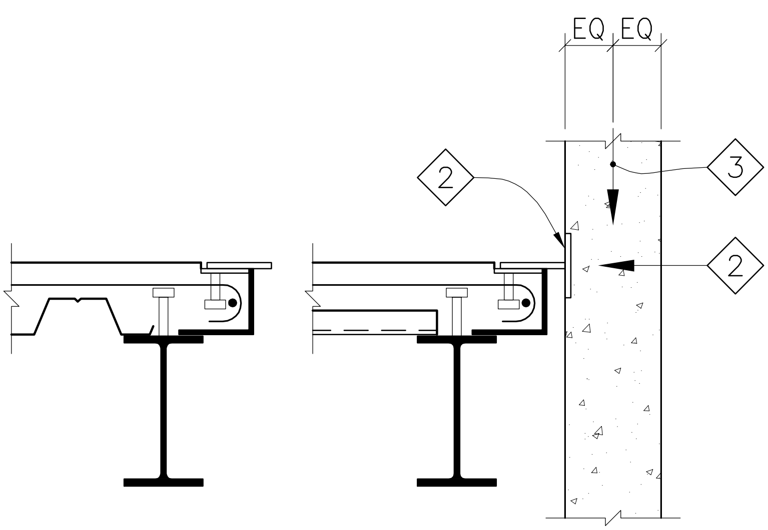
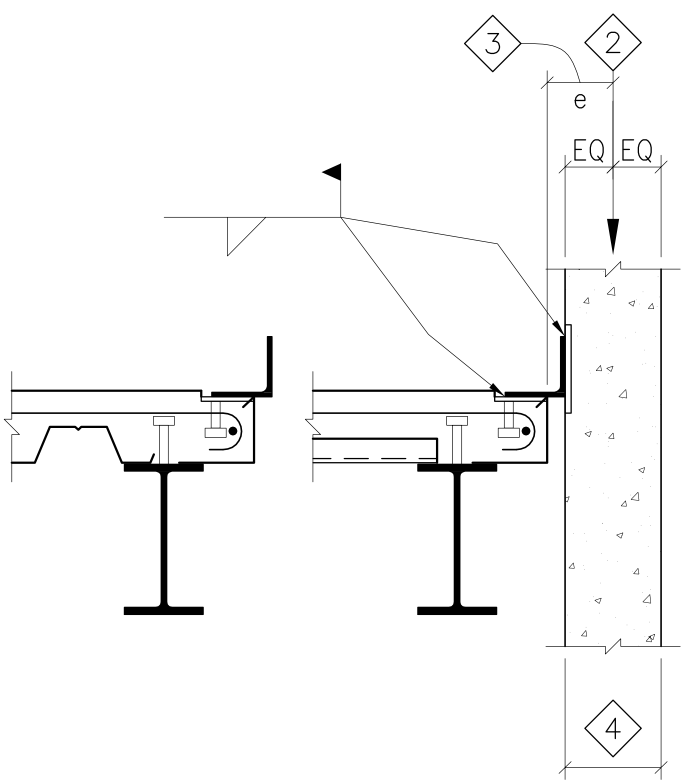


FIGURE 3.3-2b : PRECAST CONCRETE ENGINEERING ISSUES - CASE B

STRUCTURAL STEEL BUILDING – EXTERIOR WALL INTERFACE ISSUES

NOTES:

1. SEE FIGURES 1.5 FOR STEEL FRAMING NOTES.
2. PRECAST CONCRETE WALL WEIGHT.
3. TYPICAL ECCENTRICITY 'e' FOR WHICH CONTINUOUS STRONG-BACK MEMBER TO STEEL & CONNECTIONS ARE DESIGNED FOR:
   e = ds + dgap + t/2
   SEE CHART IN FIGURE 3.1b FOR VALUES.
4. PRECAST CONCRETE THICKNESS 't'.



SEAC

FIGURE 3.3-3 : PRECAST CONCRETE ENGINEERING ISSUES - CASE C

STRUCTURAL STEEL BUILDING - EXTERIOR WALL INTERFACE ISSUES

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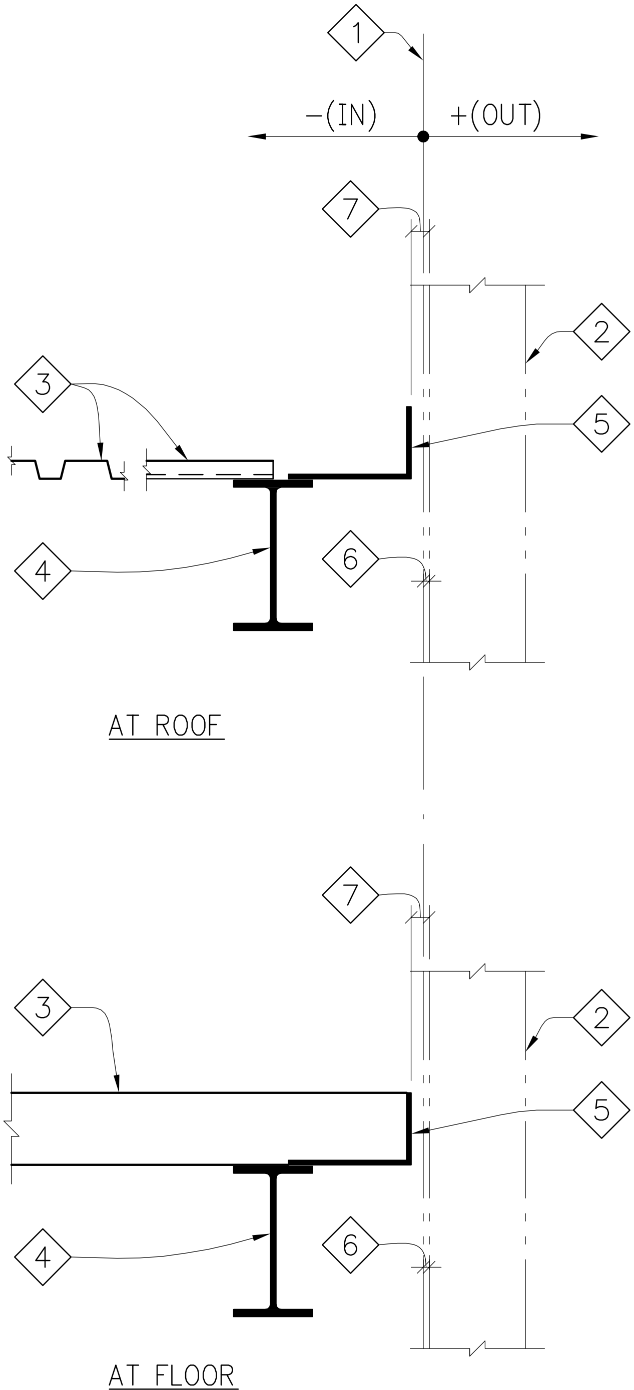

NOTES:

1. THEORETICAL INSIDE FACE OF CURTAIN WALL SYSTEM.
2. CURTAIN WALL SYSTEM.
3. SLAB/DECK.
4. SPANDREL BEAM/GIRDER.
5. EDGE ANGLE/BENT PLATE.
6. CURTAIN WALL SYSTEM ± TOLERANCE. SEE FIGURE 4.1b FOR CHART.
7. EDGE OF SLAB/DECK TO INSIDE FACE OF CURTAIN WALL SYSTEM GAP 'dgap' REQUIRED:
   dgap = (ds+) + (dw−)
   SEE FIGURE 4.1−1b FOR CHART.

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FIGURE 4.1-1a : CURTAIN WALL TOLERANCES

STRUCTURAL STEEL BUILDING − EXTERIOR WALL INTERFACE ISSUES

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HEIGHT (in)	ds (in)		dw (in)		dgap (in)	e (in)
	−(IN)	+(OUT)	−(IN)	+(OUT)		
10	0.5	0.5	0.06	0.06	0.56	1.25 + t/2
20	0.5	0.5	0.06	0.06	0.56	1.25 + t/2
30	0.5	0.5	0.06	0.06	0.56	1.25 + t/2
40	0.5	0.5	0.06	0.06	0.56	1.25 + t/2
50	0.5	0.5	0.06	0.06	0.56	1.25 + t/2
60	0.5	0.5	0.06	0.06	0.56	1.25 + t/2
70	0.5	0.5	0.06	0.06	0.56	1.25 + t/2
80	0.5	0.5	0.06	0.06	0.56	1.25 + t/2
90	0.5	0.5	0.06	0.06	0.56	1.25 + t/2
100	0.5	0.5	0.06	0.06	0.56	1.25 + t/2

NOTES:
- ds = de (VALUES TAKEN FROM CHART IN FIGURE 1.3b)
- dw = EXTERIOR WALL SYSTEM TOLERANCE
- dgap = (ds+) + (dw−)
- dgap = 0.75" IS A COMMON SPECIFIED 'GAP'
- e = ds + dgap + t/2
- SEE FIGURE 4.3−1 FOR GRAPHIC DEPICTION OF 'e' & 't'

SEAC

FIGURE 4.1-1b : CURTAIN WALL TOLERANCES

STRUCTURAL STEEL BUILDING − EXTERIOR WALL INTERFACE ISSUES

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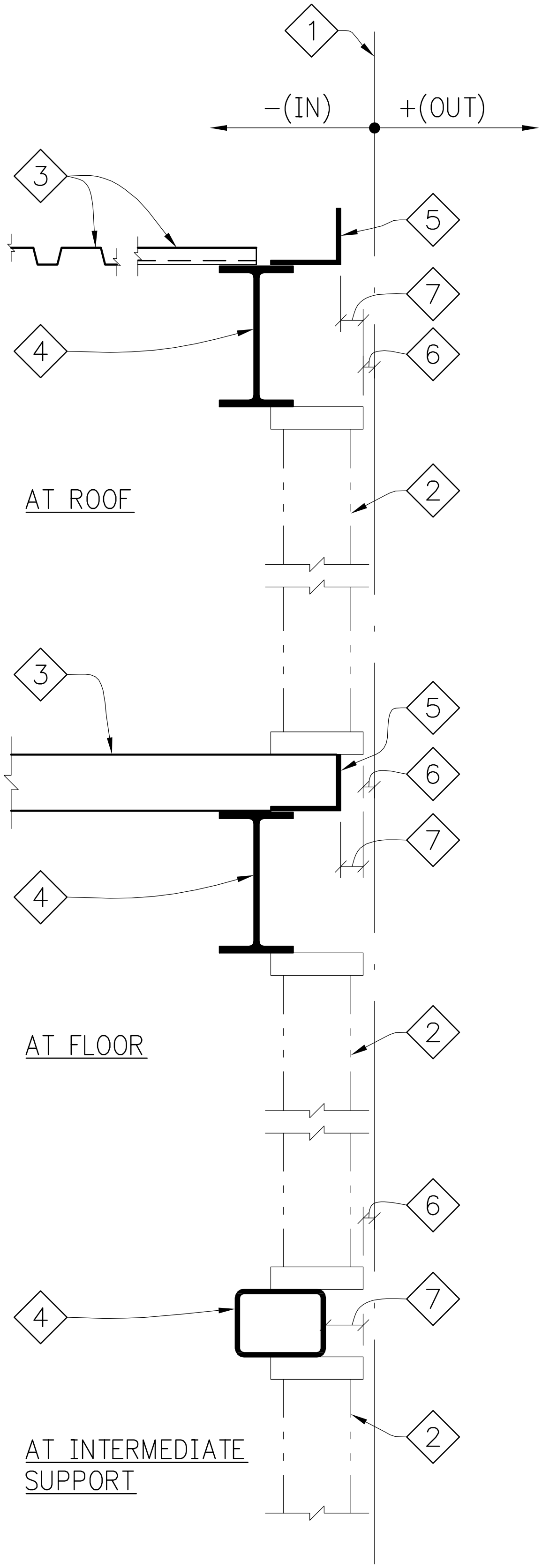

NOTES:

1. THEORETICAL INSIDE FACE OF STOREFRONT SYSTEM.
2. STOREFRONT SYSTEM.
3. SLAB/DECK.
4. SPANDREL BEAM/GIRDER/GIRT.
5. EDGE ANGLE/BENT PLATE.
6. STOREFRONT SYSTEM ± TOLERANCE. SEE FIGURE 4.1–2b FOR CHART.
7. EDGE OF SLAB/DECK/GIRT TO OUTSIDE FACE OF STOREFRONT SYSTEM GAP 'dgap' REQUIRED. SEE FIGURE 4.1–2b FOR CHART.
   dgap = ds(OUT) + dw(IN).

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FIGURE 4.1-2a : STOREFRONT TOLERANCES

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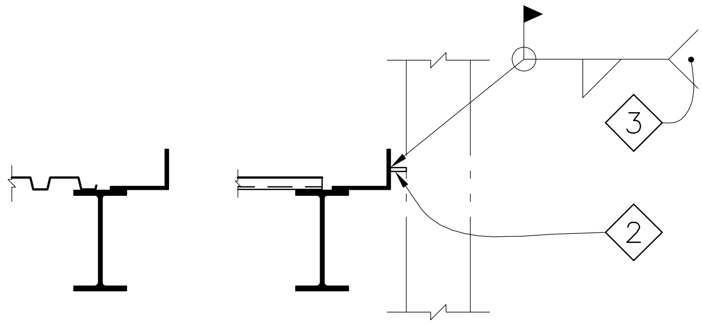
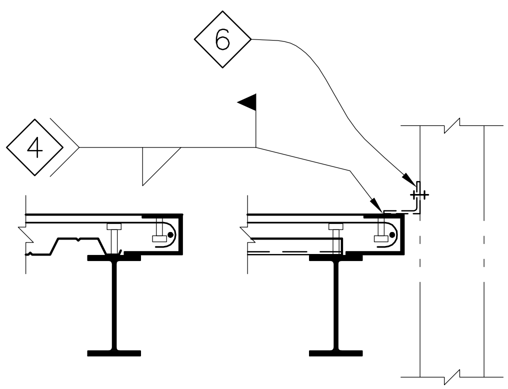
HEIGHT (in)	ds (in)		dw (in)		dgap (in)	e (in)
	−(IN)	+(OUT)	−(IN)	+(OUT)		
10	0.5	0.5	0.06	0.06	0.56	N/A
20	0.5	0.5	0.06	0.06	0.56	N/A
30	0.5	0.5	0.06	0.06	0.56	N/A
40	0.5	0.5	0.06	0.06	0.56	N/A
50	0.5	0.5	0.06	0.06	0.56	N/A
60	0.5	0.5	0.06	0.06	0.56	N/A
70	0.5	0.5	0.06	0.06	0.56	N/A
80	0.5	0.5	0.06	0.06	0.56	N/A
90	0.5	0.5	0.06	0.06	0.56	N/A
100	0.5	0.5	0.06	0.06	0.56	N/A

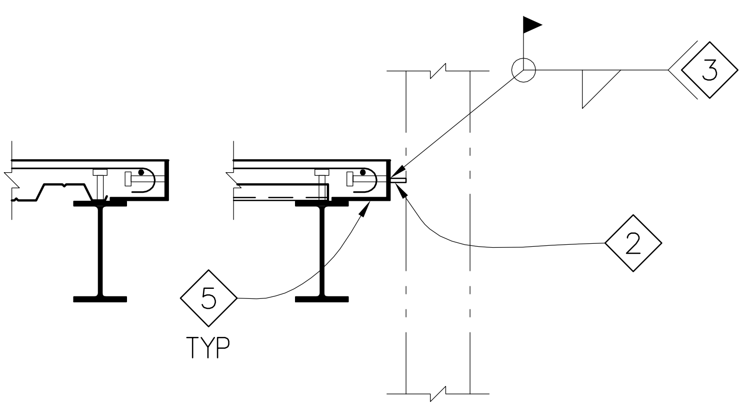
NOTES: ds = de (VALUES TAKEN FROM CHART IN FIGURE 1.3b)
dw = EXTERIOR WALL SYSTEM TOLERANCE
dgap = (ds+) + (dw−)
dgap = 0.75” IS A COMMON SPECIFIED 'GAP'
SEE FIGURE 4.3−1 FOR GRAPHIC DEPICTION OF 'e'



AT ROOF



AT FLOOR – OPTION B



AT FLOOR – OPTION A

NOTES:

1. SEE FIGURE 1.4 FOR STEEL FRAMING NOTES.
2. TYPICALLY 1/4" OR 3/8" DIAMETER (1/2" DIAMETER ANCHORS ARE USED FOR UNCONVENTIONAL/HEAVY SYSTEMS) CURTAIN WALL ANCHORS (BY CURTAIN WALL SUPPLIER), ANCHORED TO MID-HEIGHT OF EDGE ANGLE/ BENT PLATE.
3. ANCHORS ARE FIELD WELDED BY CURTAIN WALL SUPPLIER TO THE VERTICAL FACE OF THE EDGE ANGLE/ BENT PLATE AT EACH MULLION (WELD IS BY CURTAIN WALL SUPPLIER).
4. FIELD WELD/ANCHOR/SCREW BY CURTAIN WALL SUPPLIER.
5. EDGE ANGLE/BENT PLATE, 1/4" THICK MINIMUM.
6. ANGLE OR PLATE & ATTACHMENT TO CURTAIN WALL BY CURTAIN WALL SUPPLIER.

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FIGURE 4.2-1 : CURTAIN WALL CONSTRUCTION ISSUES

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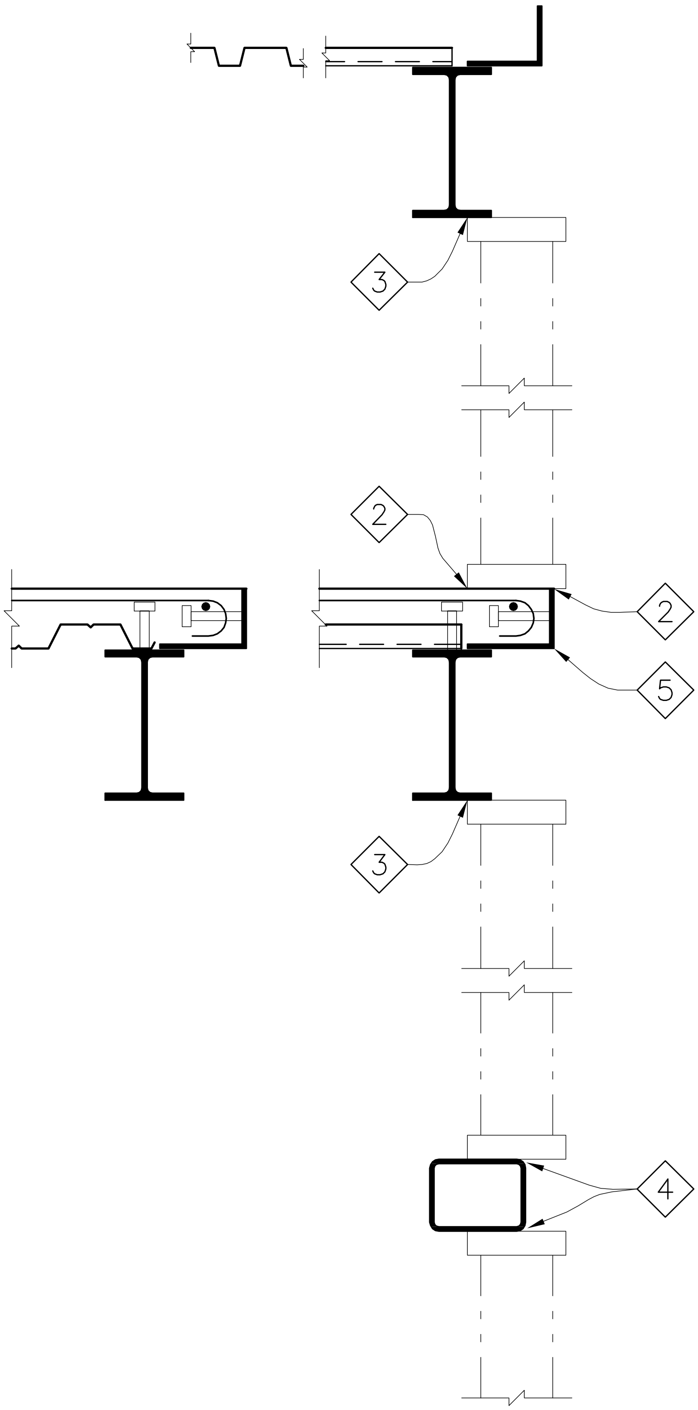

NOTES:

1. SEE FIGURE 1.4 FOR STEEL FRAMING NOTES.

2. CONNECTION TO EDGE ANGLE/BENT PLATE VIA WELDS, CLIPS, ETC. CONNECTION TO SLAB VIA EXPANSION ANCHORS, WELD TO EMBED PLATES, ETC. BY STOREFRONT SUPPLIER.

3. CONNECTION TO BEAMS/GIRDERS VIA CLIPS THAT ALLOW VERTICAL SLIP TO ACCOUNT FOR ROOF/FLOOR LIVE LOAD DEFLECTIONS BY STOREFRONT SUPPLIER.

4. CONNECTION TO GIRTS VIA CLIPS, WELDS, ETC. BY STOREFRONT SUPPLIER.

5. EDGE ANGLE/BENT PLATE, 1/4" MINIMUM.

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FIGURE 4.2-2 : STOREFRONT CONSTRUCTION ISSUES

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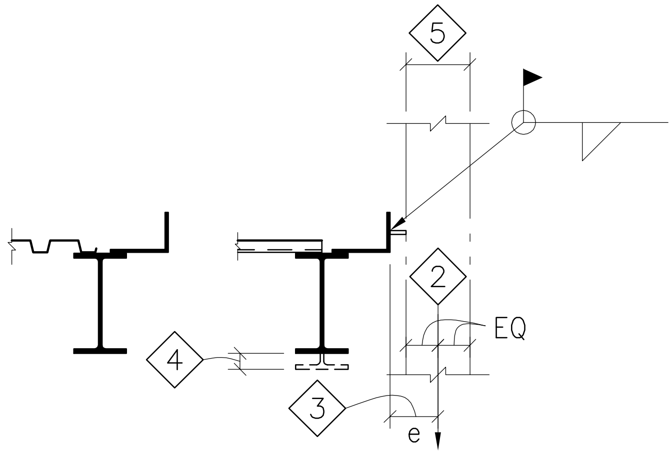
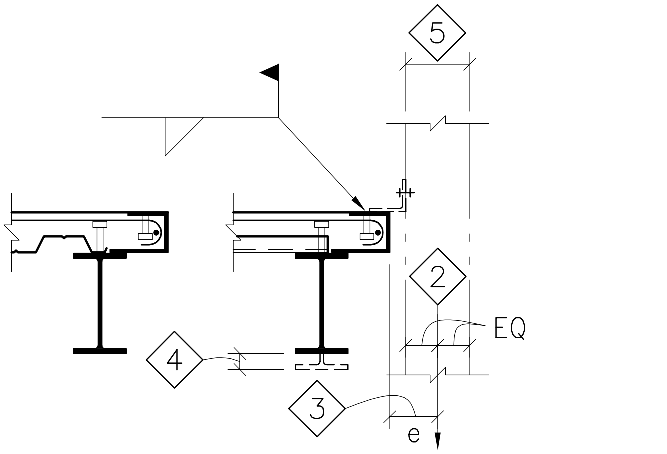
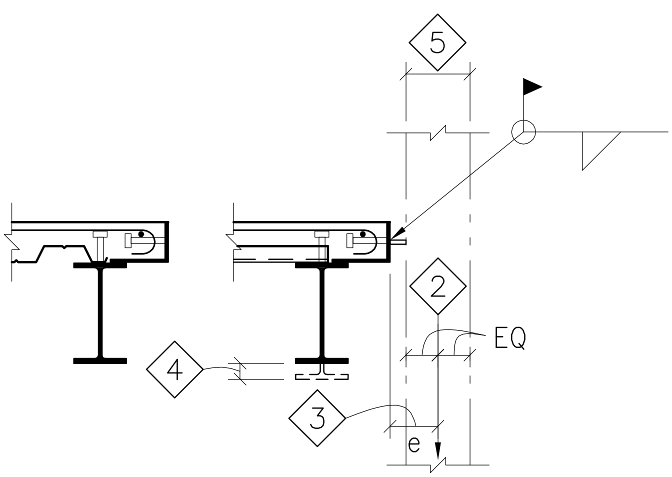


AT ROOF



AT FLOOR – OPTION B



AT FLOOR – OPTION A

NOTES:

1. SEE FIGURE 1.5 FOR STEEL FRAMING NOTES.
2. CURTAIN WALL SYSTEM WEIGHT (INCLUDING CONNECTIONS).
3. TYPICALLY ECCENTRICITY 'e' FOR WHICH CURTAIN WALL FRAMING & CONNECTIONS TO STEEL ARE DESIGNED FOR:
   $e = ds + dgap + t/2$.
   SEE CHART IN FIGURE 4.1–1b FOR VALUES.
4. TYPICAL MAXIMUM LIVE LOAD DEFLECTIONS SHOULD BE LIMITED TO 1/4".
5. CURTAIN WALL THICKNESS 't'.

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FIGURE 4.3-1 : CURTAIN WALL ENGINEERING ISSUES

STRUCTURAL STEEL BUILDING – EXTERIOR WALL INTERFACE ISSUES

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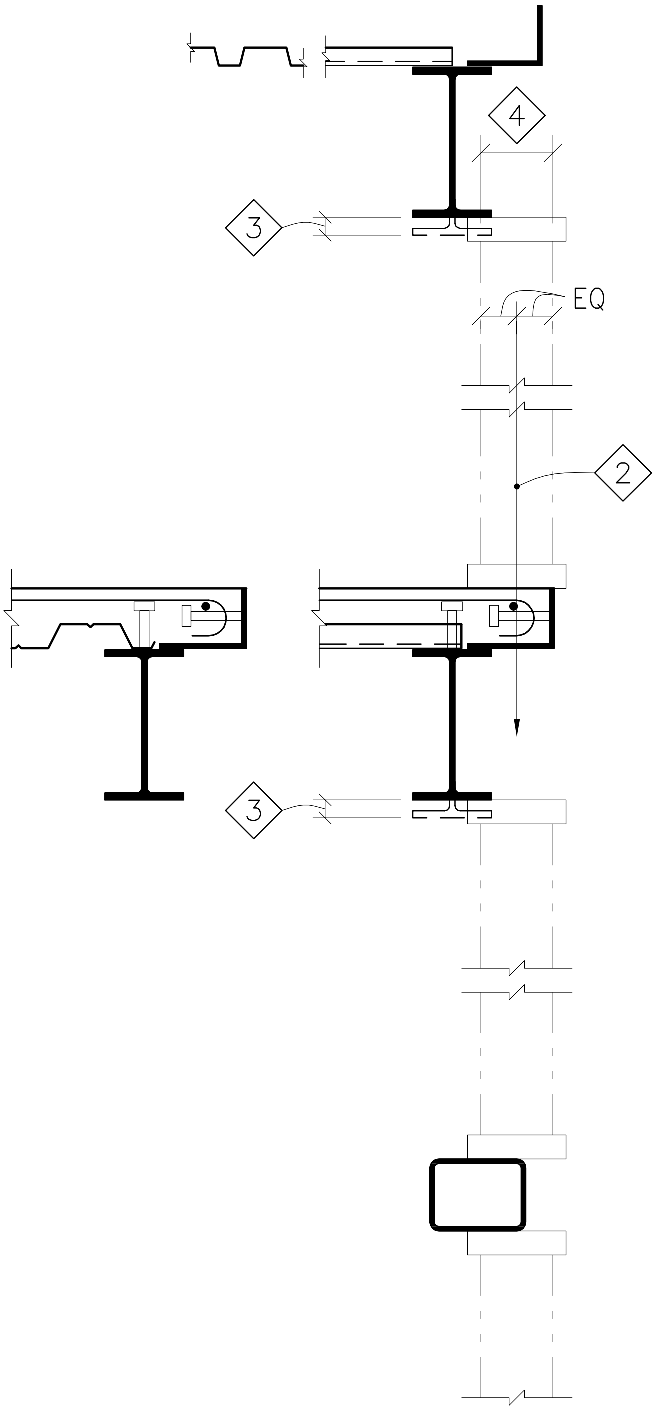

NOTES:

1. SEE FIGURES 1.5 FOR STEEL FRAMING NOTES.
2. STOREFRONT SYSTEM WEIGHT (INCLUDING CONNECTIONS).
3. TYPICAL MAXIMUM LIVE LOAD DEFLECTIONS SHOULD BE LIMITED TO 1/4".
4. STOREFRONT THICKNESS 't'.

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FIGURE 4.3-2 : STOREFRONT ENGINEERING ISSUES

STRUCTURAL STEEL BUILDING – EXTERIOR WALL INTERFACE ISSUES

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