
PART 1 GENERAL**1.1 RELATED DOCUMENTS**

- A. The drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes tolerances for the structural frame and construction surveying:
1. General contractor's monitoring plan for the structural frame.
 2. Vertical alignment tolerance.
 3. Horizontal alignment tolerance.
 4. Tolerance for embedded items.
 5. Tolerance for cross-sectional dimensions of concrete elements.
- B. Related Sections
1. 01 45 00 – Structural Testing, Inspection, and Quality Assurance
 2. 03 10 00 – Concrete Forming and Accessories
 3. 03 30 00 – Cast-in-Place Concrete
 4. 05 12 00 – Structural Steel Framing
 5. 05 31 00 – Steel Decking

1.3 REFERENCE STANDARDS

- A. The latest versions of the publications listed below form a part of this Specification; comply with the provisions of these publications except as otherwise shown or specified.
- B. American Concrete Institute: ACI 117 – Standard Specification for Tolerances for Concrete.
- C. American Institute of Steel Construction: AISC 303 – Code of Standard Practice for Steel Buildings and Bridges.

1.4 SUBMITTALS

- A. Submit the following according to Conditions of the Construction Contract and Division 1 Specification Sections.
- B. General Contractor's Methods Description Narrative detailing the plan for surveying and monitoring of the structure during construction.
1. Narrative shall address all of the items described below in Paragraph 1.05 of this Specification Section.

1.5 CONSTRUCTION TOLERANCE REQUIREMENTS

- A. The General Contractor is responsible for constructing the building within tolerance. The tolerance of the structural frame shall be in accordance with the following industry standards, except where more stringent requirements are specifically noted in this Specification Section.
1. American Concrete Institute: ACI 117 – Standard Specification for Tolerances for Concrete.
 2. American Institute of Steel Construction: AISC 303 – Code of Standard Practice for Steel Buildings and Bridges.
- B. Methods Description Narrative: The General Contractor shall prepare a Methods Description Narrative that shall address the following topics.
1. Survey procedures to monitor column and shear wall shortening.
 - a. The splice elevations of the steel columns shall be surveyed at every tier. The steel columns shall be fabricated over length to account for expected shortening as follows, unless directed otherwise by the Structural Engineer: 1/8 inch per story below Level 36; 3/32 inch per story above Level 36. This amount is based on experience with similar sized projects and has been further refined using the General Contractor's construction schedule.

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 - b. The shear wall elevations shall be surveyed at each of four outside wall corners at the following levels: P3, 1, 5, 9, 13, 17, 21, 25, 28, 32, 36, 40, 44, 48, 50, 52, 56, 60 and 62. The shear walls shall be placed to the reference floor elevation at each level unless directed otherwise by the Structural Engineer.
 - c. As construction progresses to higher floors, shear wall corner elevations and steel column splice elevations shall be re-surveyed at the following lower floors: P3, 1, 5, 13, 28, 44, and 62.
 - d. Survey data shall be submitted within 24 hours.
 - 2. Survey procedures to monitor the drift and alignment of the structural frame.
 - 3. Survey procedures to monitor deflection of slab. The General Contractor shall survey the deflection of at least the following levels: 6, 13, 21, 28, 36, 44, 51, 56, and 62 to monitor the deflection of the floor. Survey elevations shall be taken of the bottom flange of every perimeter girder at quarter points (and cantilever tips) along the span and of every other beam at quarter points along the span. Survey shall be performed after steel is erected and again within 24 hours after the concrete slab is placed.
 - 4. Shop fabrication adjustment of columns length to account for column shortening, if employed.
 - 5. Shear wall elevation adjustment procedures when monitored elevations fall outside expected range.
 - 6. Executive summary of quality control plans as related to construction tolerance.
 - 7. Executive summary of shear wall quality control plan as related to construction tolerance and expected/historical concrete mix shrinkage properties.
 - 8. Description of fabrication and installation procedures for steel deck edge forms.
- C. Vertical Alignment:
- 1. The following tolerance limits shall apply to all vertical members such as concrete walls and steel columns.
 - 2. For heights 100 feet or less: Vertical members of the structural frame shall have a tolerance of 1 inch in any direction with a maximum out of plumb slope not to exceed 1/500. See Figure 1.
 - 3. For heights greater than 100 feet: Vertical members of the structural frame shall have a tolerance of 2 inches in any direction with a maximum out of plumb slope not to exceed 1/500. See Figure 2.
 - 4. For vertical elements next to elevator openings: In addition to the tolerance limits shown in Figures 1 and 2, the reduction in the clear elevator hoistway dimension shall be limited to 2 inches total. See Figure 3.
- D. Horizontal Alignment:
- 1. The following tolerance limits shall apply to horizontal alignment (i.e., plan location) of horizontal elements of the structural frame such as beams, girders, and concrete slab edges.
 - 2. The variation in the horizontal alignment of the work points of a steel beam shall be acceptable if caused solely by variations in steel column or concrete shear wall alignment that are within the limits of Paragraph 1.05C. See Figure 4.
 - 3. Edge forms for composite slabs shall be field installed to a tolerance of +/- 1 inch from the established building work lines. See Figure 4.
 - 4. The maximum offset in slab edge location between adjacent floors shall be +/- 3/8 inch. See Figure 4.
- E. Steel Elements Embedded in Concrete
- 1. The following tolerance limits shall apply to the placement of steel elements of the structure embedded into concrete.
 - 2. The placement tolerance for embedded steel elements is +/- 1 inch for both vertical and horizontal alignment. Compression and tension ties embedded in the core shall be with 1/8 inch of the specified location for both vertical and horizontal alignment, and shall not be rotated.
- F. Cross-Sectional Dimensions of Concrete Elements
- 1. The following tolerance limits shall apply to the thickness of concrete elements such as walls, beams, and slabs.
 - 2. The tolerance for slab thickness shall be +3/8 inch and -1/4 inch.
 - 3. The tolerance for cross-sectional dimension of concrete walls and beams shall be +1/2 inch and -3/8 inch.

PART 2 PRODUCTS – NOT APPLICABLE

PART 3 EXECUTION – NOT APPLICABLE

END OF SECTION

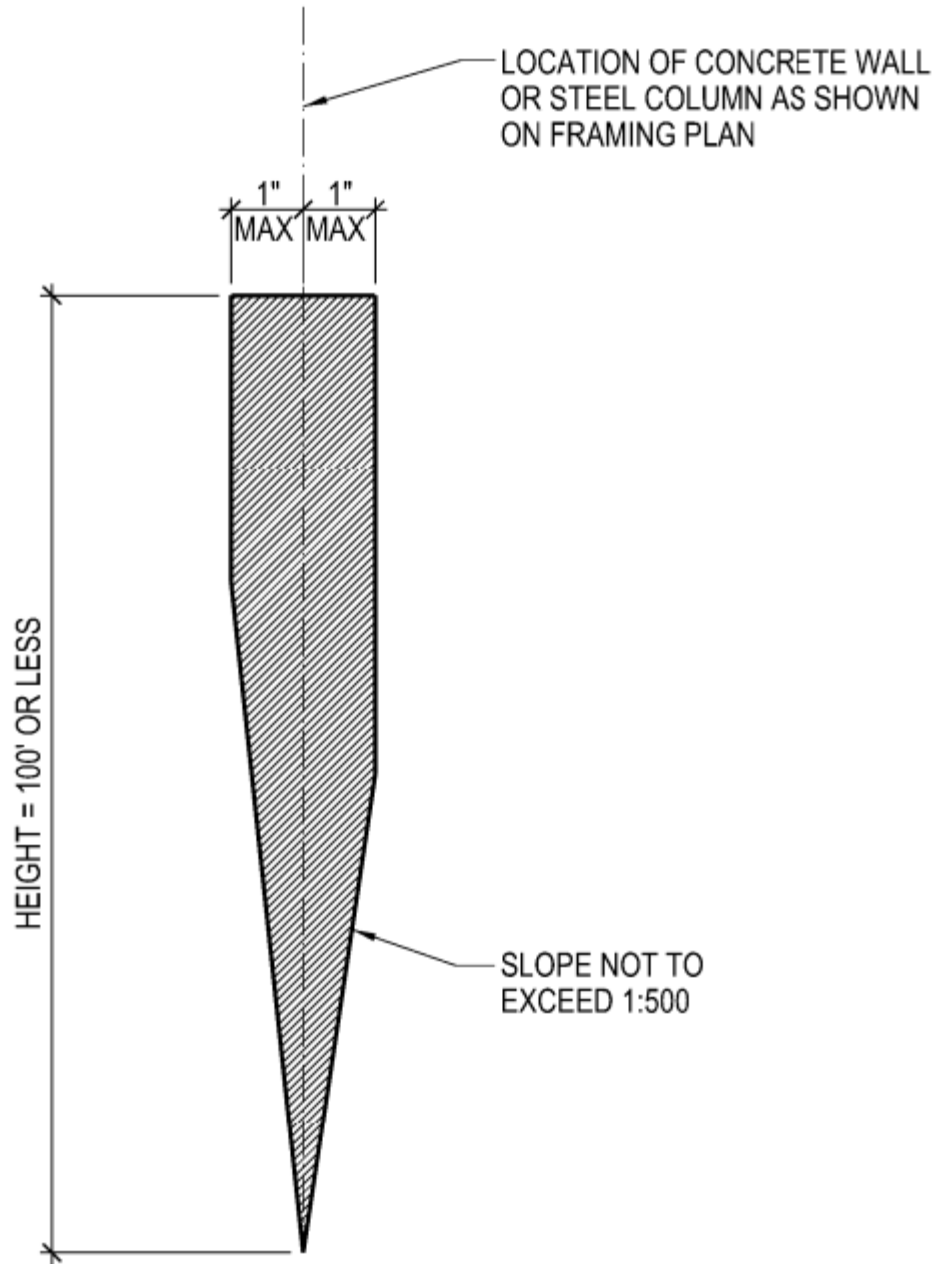


Figure 1. Vertical alignment, low

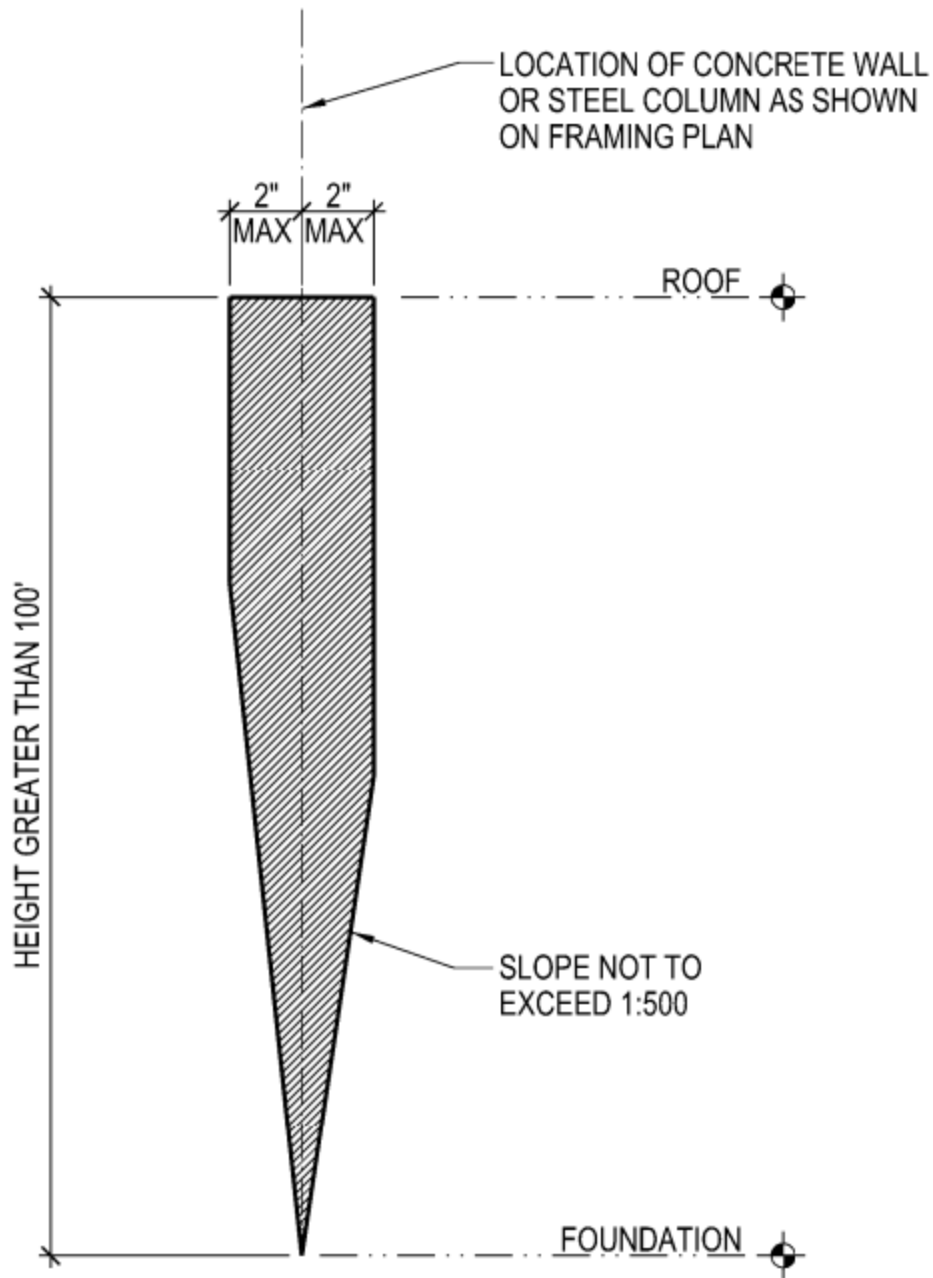


Figure 2. Vertical alignment, high

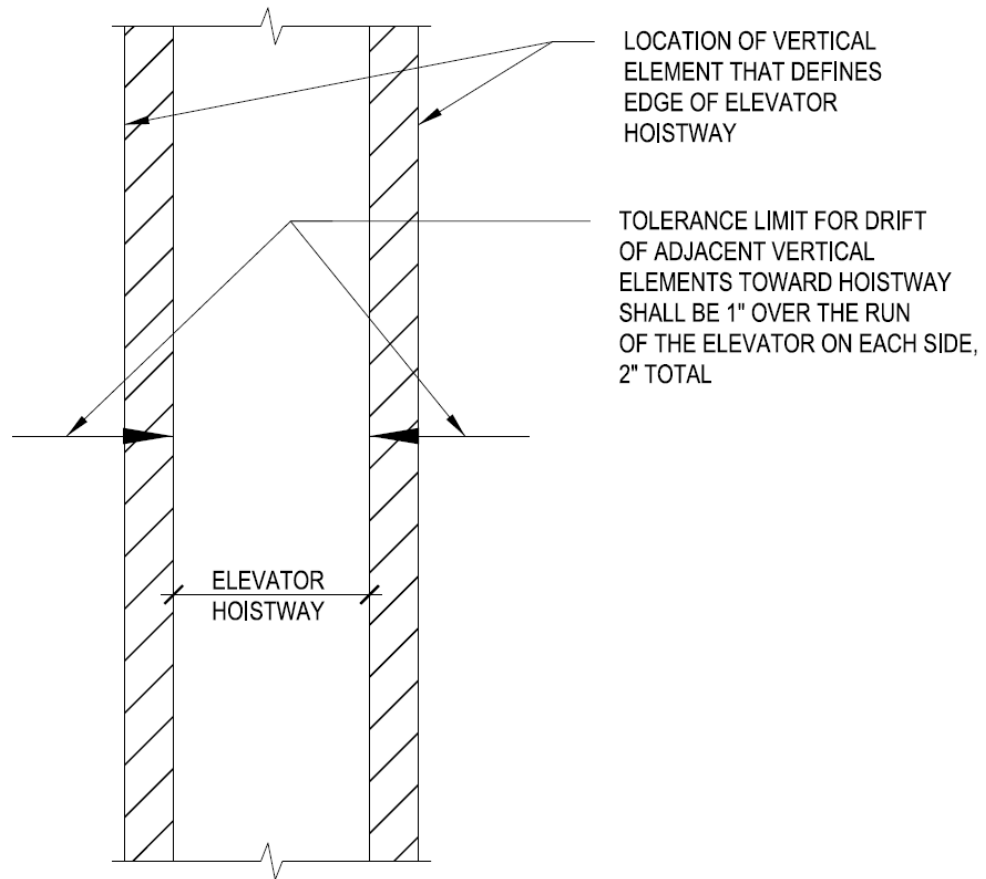


Figure 3. Vertical alignment, elevator hoistway

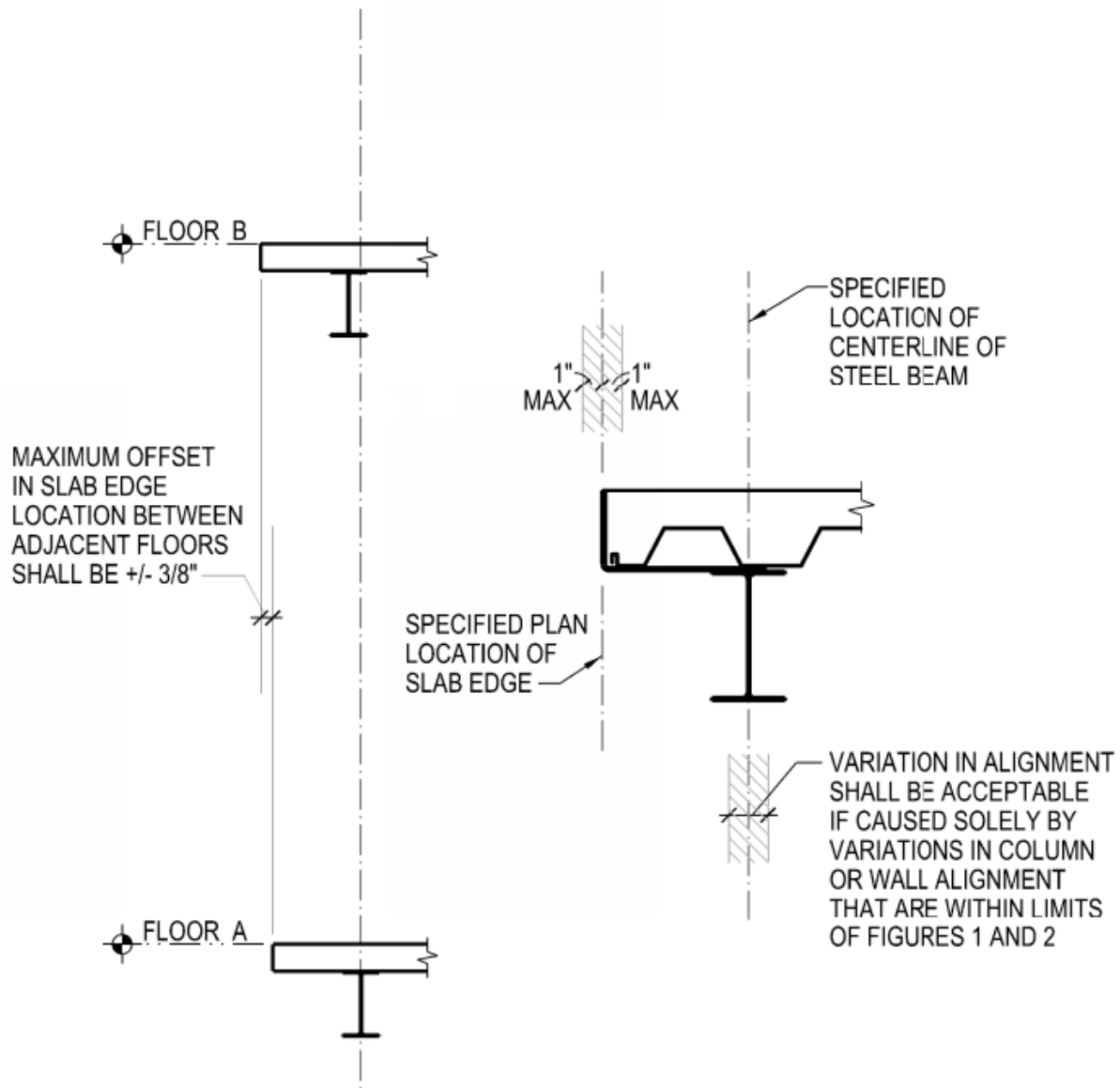


Figure 4. Horizontal alignment