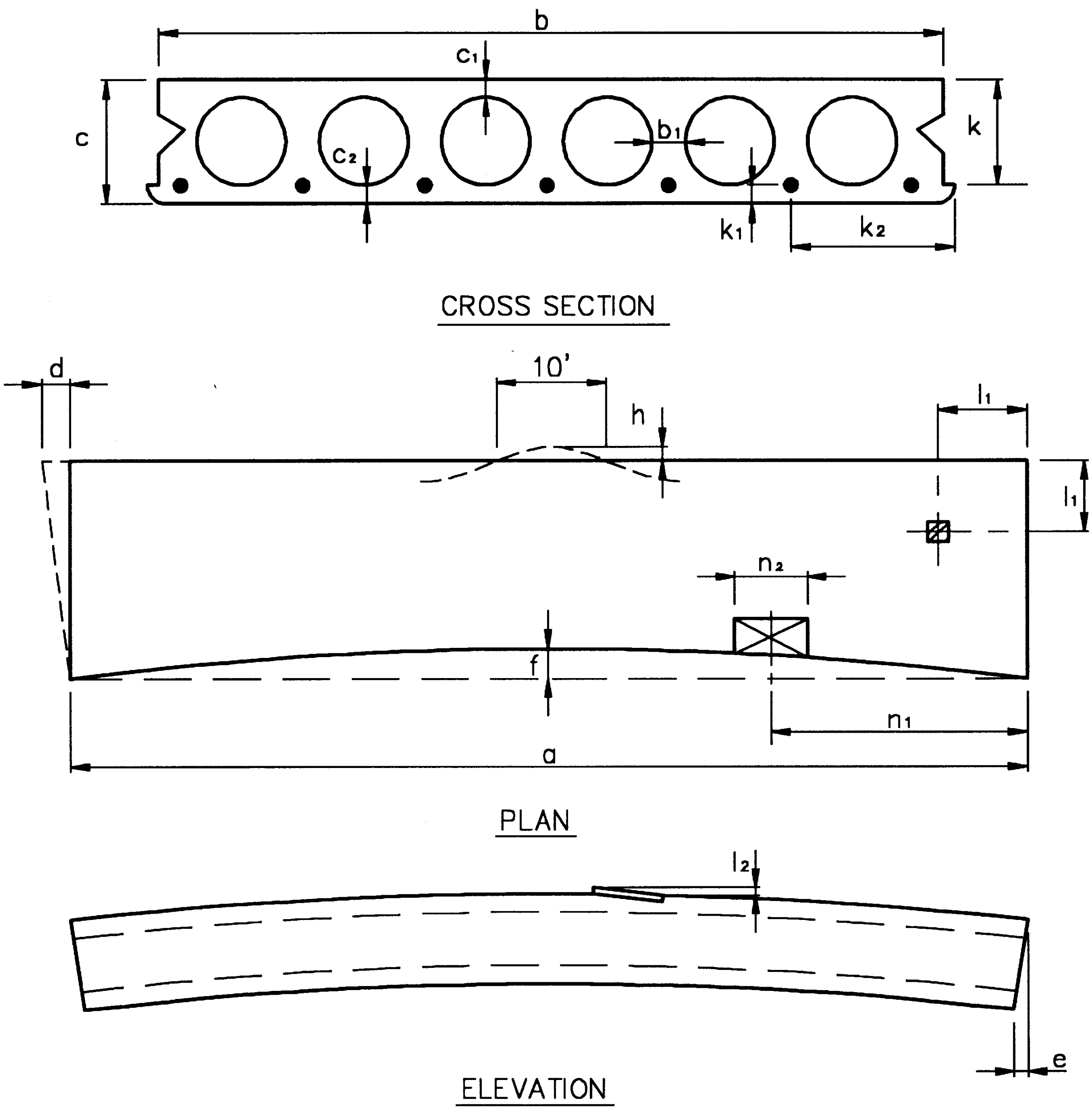


Figure B-7 Hollow-Core Slab

B-7 Hollow-Core Slab

a = Length .... ± 1/2 in. [± 13 mm]

b = Width (overall) .... ± 1/4 in. [± 6 mm]

b_l = Web Width

The total web width defined by the sum of the actual measured values of " b_l " shall not be less than 85 percent of the sum of the nominal web widths " $b_{l,\ nominal}$"

c = Depth (overall) .... ± 1/4 in. [± 6 mm]

c_1 = Top Flange Depth

Top flange area defined by the actual measured values of average " c_1" x "b" shall not be less than 85 percent of the nominal area calculated by " $c_{1,\ nominal}$" x "$b_{nominal}$"

c_2 = Bottom Flange Depth

Bottom flange area defined by the actual measured values of average " c_2" x "b" shall not be less than 85 percent of the nominal area calculated by " $c_{2,\ nominal}$" x "$b_{nominal}$"

d = Variation From Specified Plan End Squareness or Skew .... ± 1/2 in. [± 13 mm]

e = Variation From Specified Elevation End Squareness or Skew ...... ± 1/8 in. per 12 in., ± 1/2 in. maximum .... [± 3 mm per 300 mm, ± 13 mm maximum]

f = Sweep .... ± 3/8 in. [± 10 mm]

g – Applications requiring close control of differential camber between adjacent members should be discussed with the producer to determine applicable tolerances.

h = Local Smoothness of any surface.............................. .... 1/4 in. in 10 ft. [6 mm in 3 m]

k = Center of Gravity (CG) of Strand Group .... ± 1/4 in. [± 6 mm]

k_1 = Location of Strand Perpendicular to Plane of Panel .... ± 1/2 in. [± 13 mm]
minimum cover = 3/4 in. [19 mm]

k_2 = Location of Strand Parallel to Plane of Panel .... ± 3/4 in. [± 19 mm]
minimum cover = 3/4 in. [19 mm]

l_1 = Location of Embedment † .... ± 2 in. [± 50 mm]

l_2 = Tipping and Flushness of Embedment .... ± 1/4 in. [± 6 mm]

n_1 = Location of Blockout .... ± 2 in. [± 50 mm]

n_2 = Size of Blockouts .... ± 1/2 in. [± 13 mm]

x = Weight

Actual measured value shall not exceed 110 percent of the nominal published unit weight used in the design.

See pages B.1 through B.4 for additional information and explanation of tolerance requirements for camber, sweep and local smoothness.

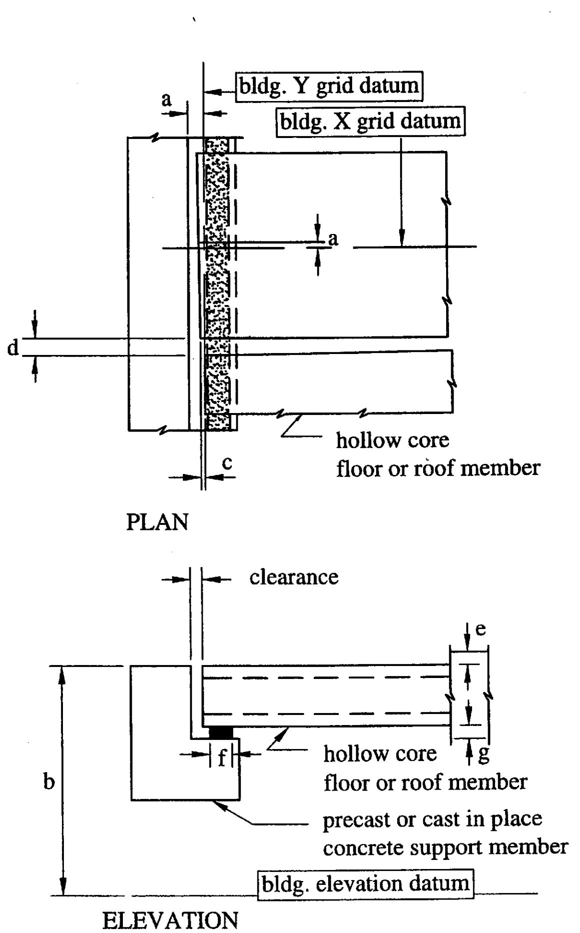
† Some hollow-core production systems do not permit the incorporation of embedments. Contact local producers for suitable alternate details if embedments are not practical.

For most flexural members, maximum camber variation from design camber is ±¾ in., and maximum differential camber between adjacent units of the same design is ¾ in. This may be increased for joists used in composite construction. Recommendations for camber and differential camber of hollow-core slabs are not listed, because production variations between hollow-core systems result in different tolerances for each type.

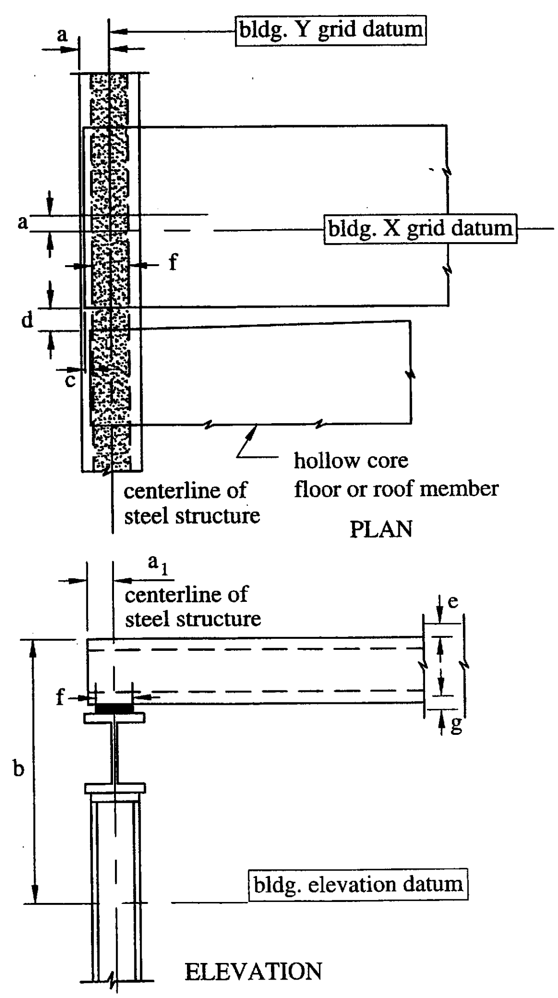
Fig. 1.8.2 Erection tolerances - hollow core floor and roof members

a = Plan location from building grid datum .... ± 1 in
a_1 = Plan location from centerline of steel* .... ± 1 in
b = Top elevation from nominal top elevation at member ends
  Covered with topping .... ± 3/4 in
  Untopped floor .... ± 1/4 in
  Untopped roof .... ± 3/4 in
c = Maximum jog in alignment of matching edges
  (both topped and untopped construction) .... 1 in
d = Joint width
  0 to 40 ft member length .... ± 1/2 in
  41 to 60 ft member length .... ± 3/4 in
  61 ft plus .... ± 1 in
e = Differential top elevation as erected
  Covered with topping .... 3/4 in
  Untopped floor .... 1/4 in
  Untopped roof** .... 3/4 in
f = Bearing length*** (span direction) .... ± 3/4 in
g = Differential bottom elevation of exposed hollow-core slabs**** .... 1/4 in

* For precast concrete erected on a steel frame building, this tolerance takes precedence over tolerance on dimension "a".
** It may be necessary to feather the edges to ± 1/4 in to properly apply some roof membranes.
*** This is a setting tolerance and should not be confused with structural performance requirements set by the architect/engineer.
**** Untopped installation will require a larger tolerance here.



Precast element to precast or cast-in-place concrete or masonry



Precast element to structural steel

APPENDIX B

Product Dimension Tolerances

Product tolerances are necessary in any manufacturing process. They are normally determined by function and appearance requirements, and by economic and practical production considerations. Tolerances for manufacturing precast products are standardized throughout the industry and should not be reduced, and therefore made more costly, unless absolutely necessary.

The tolerances listed herein are the minimum acceptable criteria in the absence of other specifications. Projects under the control of special authorities, such as state departments of transportation, will often have a full set of tolerances specified. In these situations, the tolerances specified by the controlling authority may govern.

For products not specifically listed, select the appropriate tolerances from the listed type (or types) that most closely matches the function of the product.

A dimensional layout and measurement plan is needed to control the production of precast elements so that the measurement process does not result in unintended accumulation of tolerances. For example, the location of multiple embedments should always be measured from the appropriate control surface, rather than measuring some from a member edge and others from intermediate embedments. The member diagrams in this Appendix show the location of features to which the tolerances apply. They are not intended to show the most appropriate reference feature for measurement. The appropriate dimensioning system to achieve the desired tolerances should be established by the engineer and shown on the production drawings.

Definitions and Notes on Tolerances

Bowing and Warping - Bowing is an overall out-of-plane curvature of a surface whose edges remain parallel (See Figure b.1). ← Bowing is NOT Camber

Differential bowing is a consideration for panels that are viewed together on the completed structure. If we use the convention that convex bowing is positive (+) and concave bowing is negative (-), then the magnitude of differential bowing can be determined by subtracting the bow in adjacent panels. For example, refer to Figure b.2. If the maximum bow in Panel 3 is + 1/4 inch [+ 6 mm] and the maximum bow in Panel 4 is - 1/4 inch [- 6 mm] then the differential bowing between the two adjacent panels is 1/2 inch [13 mm].

Warping is the twisting of a member, resulting in an overall out-of-plane curvature of surfaces, characterized by non-parallel edges (See Figure b.3).

Bowing and warping tolerances are often important aspects of panel visual features. They have an important influence on the visual effects relating to edge match-up during erection, and on the visual appearance of the erected panels, both individually and when viewed together. These tolerances also influence the ease of erection and functional performance of panel connections and panel interface elements.

Differential temperature effects and differential moisture absorption between the inside and outside faces of a panel, the effects of prestress eccentricity, and differential shrinkage between wythes in an insulated panel can all contribute to panel bowing and warping. The design of a panel and its relative stiffness or ability to resist deflection as a plate member must be consistent with the specified tolerances. Panels that are relatively thin in cross section when compared to their overall plan dimensions are more likely to bow or warp as a result of member design, manufacturing and environmental conditions.

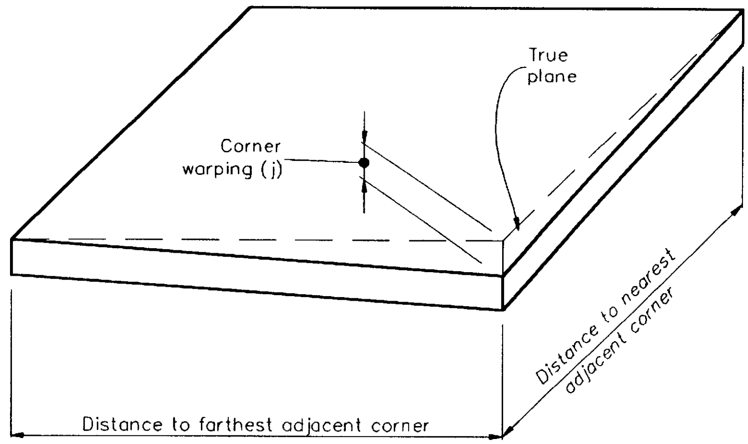


Figure b.3 Warping Definitions for Panels

Camber - The deflection that occurs in prestressed concrete members due to the net bending resulting from the eccentricity of the prestress force. For members with span-to-depth ratio at or exceeding 25, the camber tolerance given herein may not apply. If the application requires control of camber to the listed tolerance in beams with high span-to-depth ratio, special production measures may be required. The precaster should be consulted regarding this requirement.

Prediction of camber in a prestressed member is based on empirical formulas. The accuracy of these estimated values decreases with time. Measurement of camber for comparison to predicted design values should be completed within 72 hours of transfer of prestressing force.

Temperature variation across a member section can have a significant impact on the measured camber. Camber should be evaluated under conditions that minimize the effect of temperature variation due to solar radiation, such as early in the morning.

When the finished floor or deck surface is created by the precast elements as erected (pretopped), the overall depth of the member becomes a primary control feature and the deck surface becomes a primary control surface for both fabrication and erection. In order to achieve the desired tolerances on the overall floor or deck it may be necessary to use special production measures to control camber and differential camber among the adjacent elements.

Clearance - Interface space (distance) between two elements. Clearance is normally specified to allow for the effects of product and erection tolerances and for anticipated movement (e.g., deflection, thermal movement).

Cover - The least distance between the surface of the reinforcement and the surface of the concrete element.

Flatness - The degree to which a surface approximates a plane.

Harped (Deflected) Strand - The path of a prestressing strand in a member may be altered from the horizontal to increase load carrying capacity or to control member stresses, or both. This practice is referred to as harping, deflecting, or depressing the strand.

The economical location of strand harping points depends on individual form set-up characteristics. A large tolerance for this item generally has little design or structural consequence.

Smoothness - The degree to which a surface is locally flat (See Figure b.4).

The local smoothness criterion does not apply to visually concealed surfaces, or to surfaces intentionally roughened to receive a field-placed concrete topping. Smoothness is primarily a function of the form surface used to manufacture the product. Requiring a smoothness tolerance on visually non-critical surfaces will unnecessarily increase project costs due to increased forming and surface finishing costs.

Local smoothness is usually expressed in inches deviation from a 10 ft. [mm/3m] straight edge. The tolerance should be checked with a 10 ft. [3 m] straightedge, or the equivalent, as shown in Figure b.4 unless other methods are specified or agreed to. Figure b.4 shows how to determine if a surface meets a tolerance of 1/4 inch [6 mm] as measured beneath a 10 ft. [3 m] straightedge. A 1/4 inch [6 mm] diameter roller should fit anywhere between the straight edge and the member surface being measured when the straightedge is supported at its ends on 3/8 inch [10 mm] shims as shown. A 1/2 inch [13 mm] diameter roller should not fit between the surface and the straightedge.

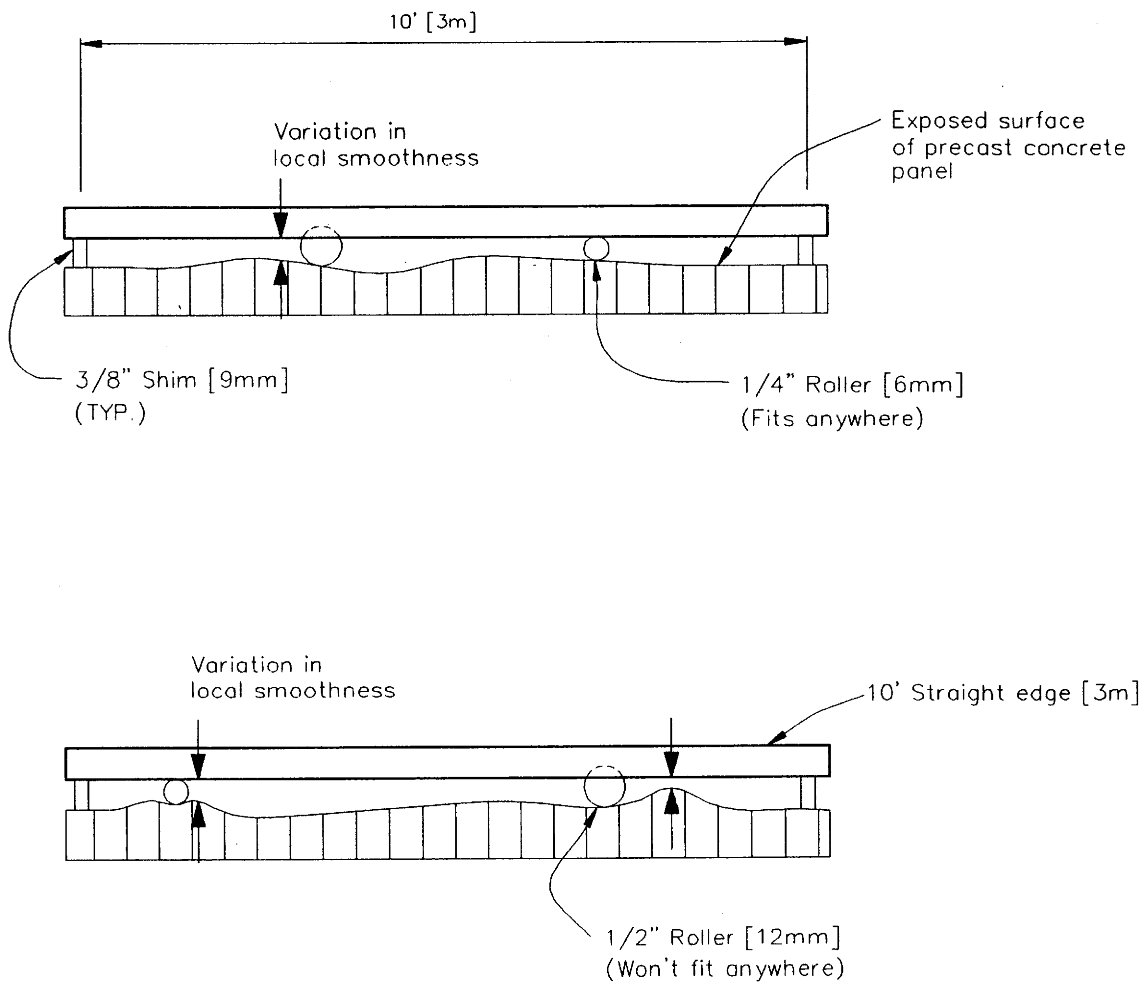


Figure b.4 Measuring Local Smoothness Variations For a Tolerance of 1/4 Inch

Sweep - A variation in horizontal alignment from a straight line parallel to centerline of member (horizontal bowing).

Tolerance - Permissible variation from specified requirements.