Manufacturing and Installation Guidelines & Guide Specifications

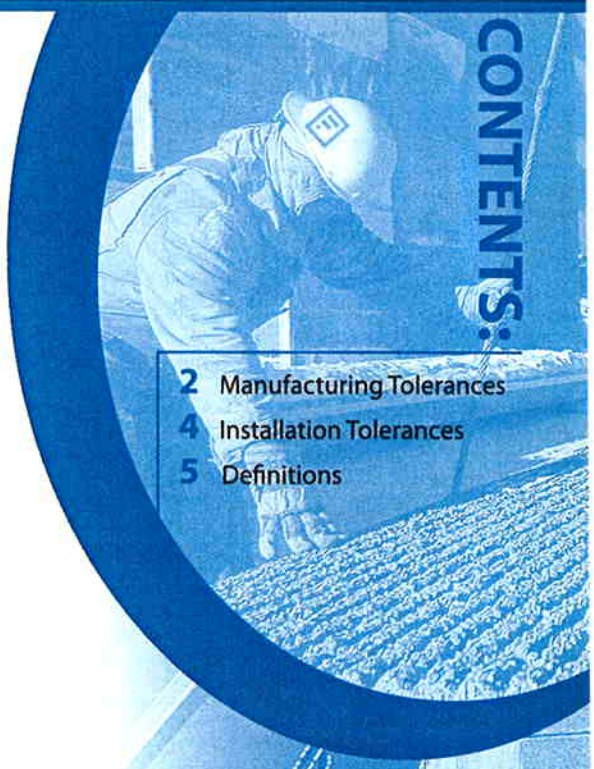
Fabcon Design Guidelines for Precast Concrete Wall Panels

Fabcon is committed to construction innovation and safety. Through continuous improvement in quality and efficiency, Fabcon delivers high quality products and services of exceptional value.

This document provides guidelines for designing precast concrete wall panels to Fabcon's manufacturing and installation tolerances. Based heavily on the quality control manual for precast and prestressed concrete plants published by the National Precast Concrete Association (NPCA) and PCI MNL 116, PCI MNL 127. These tolerances reflect Fabcon's unique manufacturing processes and patented products.

As a designer, manufacturer and installer of precast products, Fabcon delivers a complete wall panel system. These tolerances represent our acceptable manufacturing and installation guidelines. They do not represent an exhaustive criteria for rejection.

These Guidelines are intended as a reference for licensed designers and construction professionals. Nothing in these Guidelines shall relieve the designer of record from responsibility for the structure's design and proper interface of the precast panel system with the building structure. Fabcon is not responsible for deficiencies in building design.



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Remedies

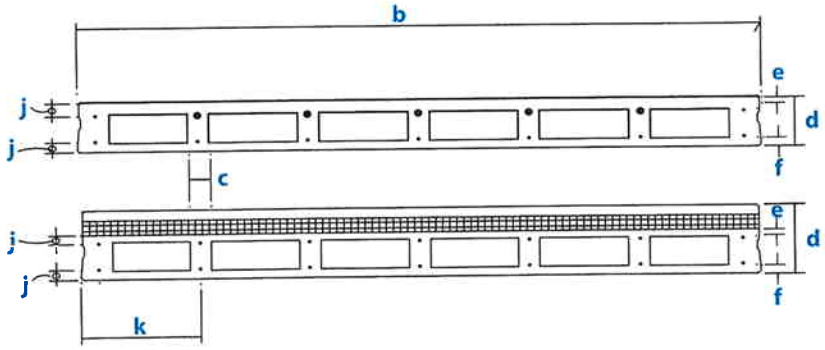
Fabcon may elect one or more of the following solutions:

- Bring the product into tolerance by industry-standard repair methods
- Provide calculations that demonstrate that the product/installation meets acceptable structural and architectural performance criteria
- Demonstrate that the completed system meets acceptable structural and architectural requirements or offer modifications to meet design requirements
- Replace the products that are out of tolerance.

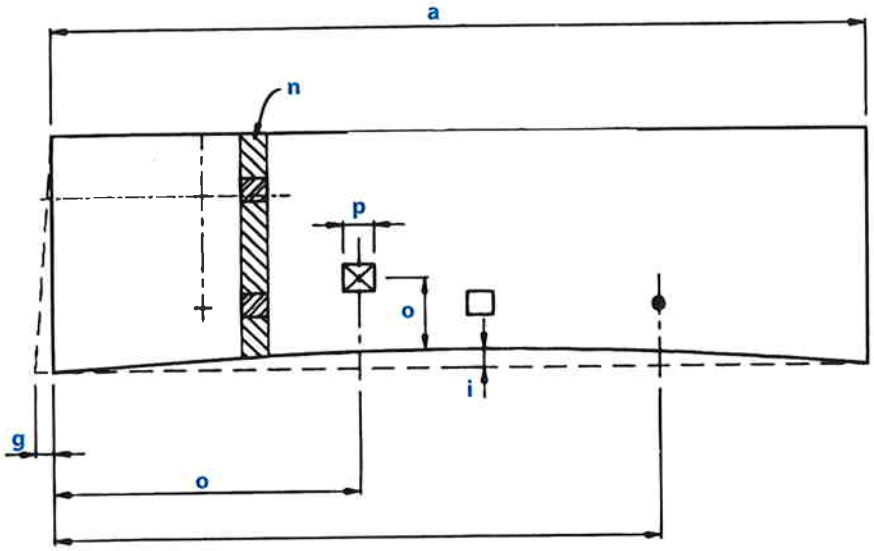
Due to the inherent nature of concrete, hydration, handling and shipping of precast, some chipping or cracking may occur. Product may require routine finishing such as blending for texture and color after installation. Fabcon bases our scope of work on a completed wall panel system and specifically excludes project specifications granting the unilateral right to reject product that is correctable utilizing standard industry repair methods or can be demonstrated to meet structural and/or architectural performance criteria.

VersaCore+*Green* Wall Panel Manufacturing Tolerances

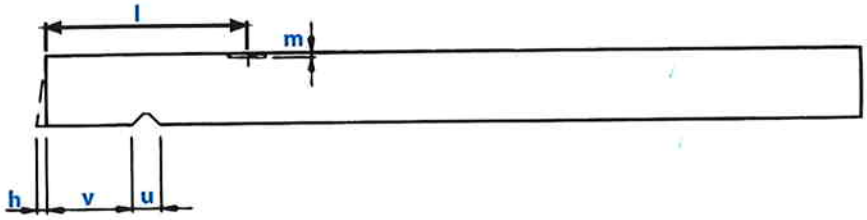
CROSS SECTION



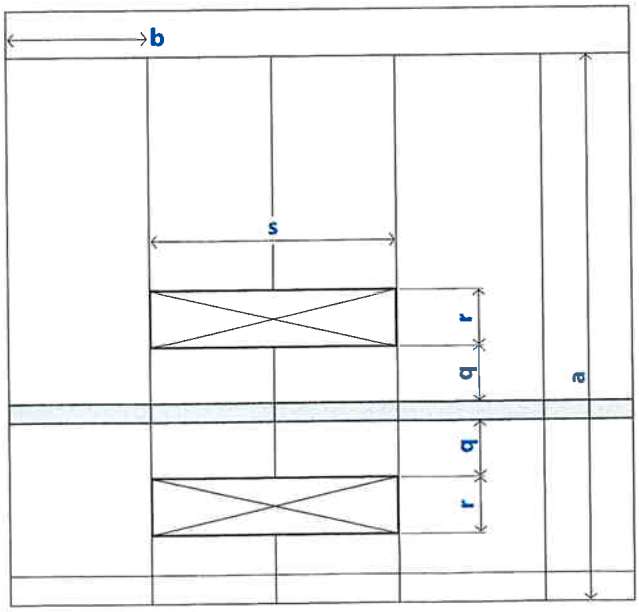
PLAN

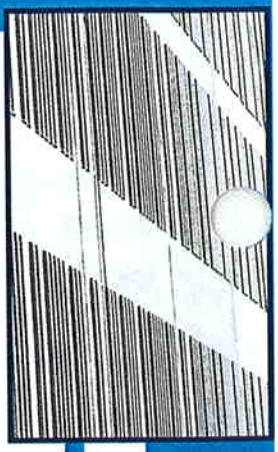


ELEVATION



PROFILE





VersaCore+*Green* Wall Panel Manufacturing Tolerances

	Fabcon	MNL 116	NPCA
a = Length ..... ± 1/2 in. [± 13 mm]	✓		1/8" per 10' ≤ 3/4"
b = Width (overall) ..... ± 1/4 in. [±6mm]	✓		+1/8" < 10' +1/8" -3/16" > 10' but < 20'
c = Web Width The total web width defined by the sum of the actual measured values of " b_1 " shall not be less than 85 percent of the sum of the nominal web widths " $b_{1,\ nominal}$ " with localized areas		N/A	✓
d = Depth (overall) ..... ± 1/4 in. [± 6 mm]	✓		+1/4" -1/8"
e = Top Flange Depth Top flange area defined by the actual measured values of average " e" x "b" shall not average less than 85 percent of the nominal area calculated by "e , nominal " x "$b_{nominal}$" ..... ≥ 3/4 in. [≥ 18mm]		N/A	✓
f = Bottom Flange Depth Bottom flange area defined by the actual measured values of average " f" x "b" shall not be less than 85 pZercent of the nominal area calculated by "$f_{,nominal}$ " x "$b_{nominal}$"..... ≥ 3/4 in. [≥ 18mm]		N/A	✓
g = Variation from Specified Plan End Squareness or Skew..... ± 1/8 in. per 12 in. width, ± 1/2 in. maximum [± 3 mm per 300 mm width, ± 13 mm maximum]	✓		✓
h = Variation from Specified Elevation End Squareness or Skew..... ± 1/8 in. per 12 in. [± 3 mm per 300 mm]	✓		1/16" per 12" no greater than 1"
i = Sweep..... ± 1/8 in. per 20 ft., + 3/8 in. maximum [± 3 mm per 6 m, ± 10 mm maximum]	✓		✓
j = Location of Strand Perpendicular to Plane of Panel ..... ± 1/4 in. [±6 mm]	✓		✓
k = Location of Strand Parallel to Plane of Panel..... ± 1/2 in [±13 mm]		± 1"	✓

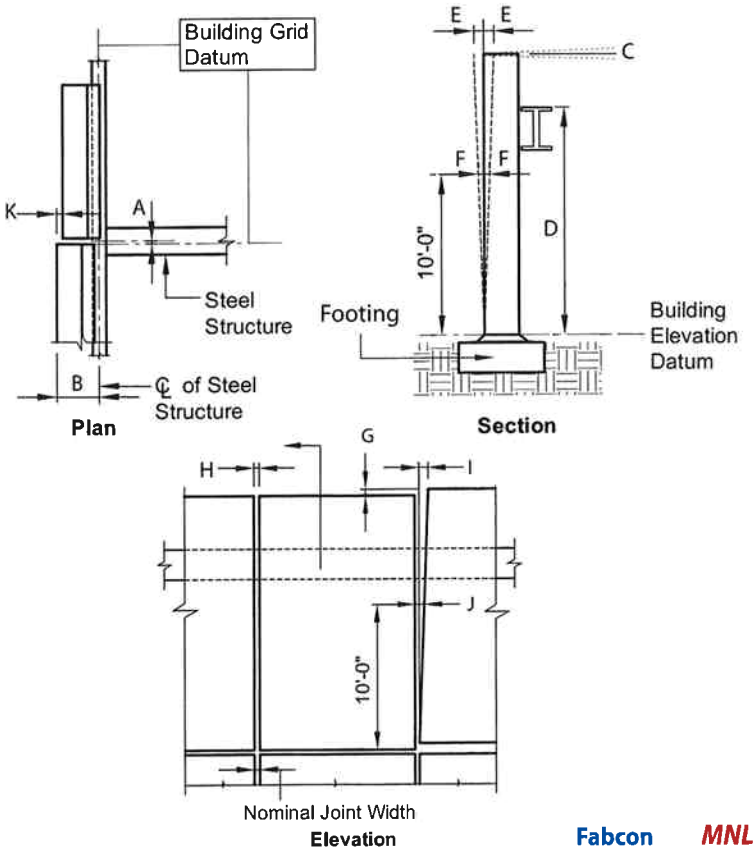
	Fabcon	MNL 116	NPCA
l = Location of Embedment ..... ± 1 in. [± 13 mm]	✓		± 1/2" inserts ± 1" weld plates
m = Tipping and Flushness of Embedment..... ± 1/4 in. [±6 mm]	✓		✓
n = Concrete Surface Between Embedments to Receive Continuous Ledger, Relative to Plane of Embed`ments ..... - 1/4 in., + 0 in. [- 6 mm, + 0 mm]	✓		✓
o = Location of Blockout ..... ± 1 in. [± 25 mm]	✓		✓
p = Size of Blockouts..... ± 1/2 in. [±13 mm]	✓		✓
q = Location of Opening..... ± 1/4 in. [± 6 mm]		± 1"	✓
r = Height of Opening..... + 3/4 in. -1/4 in.		± 1/2"	✓
s = Width of Opening..... + 1 in. - 1/2 in.		± 1/2"	✓
t = Location of Inserts for Structural Connections.... ± 1 in. [± 25 mm]*		± 1/8"	1/2"
u = Size of Architectural Feature... ± 1/4 in. [± 6 mm]		± 1/8"	✓
v = Location of Architectural Feature..... ± 1/4 in. [± 6 mm] ..... ≥ 3 in. [≥ 75 mm]		NA	✓
Weight Actual measured value shall not exceed 110% of the nominal published unit weight used in the design.		NA	✓
Bow ..... $\leq {}^{a}/_{360}$	✓		1/360 x diagonal but greater than 1"
Differential Bowing Between Adjacent Panels of the same design ..... ± 1/2 in. [± 13 mm]	✓		✓
Warp ..... ± 1/16 in. per foot [± 1.5 mm per 300 mm] of distance from adjacent corner	✓		✓
***For Further Details Contact Your Fabcon Representative**			

Concrete is a variable material. Even after final finishing, there will be a range of color and texture in the surface. Some variations are to be expected.

In general Fabcon steel form finish compiles with 4th Edition PCI MNL 116 appendix "C" for a grade "B" which states in part

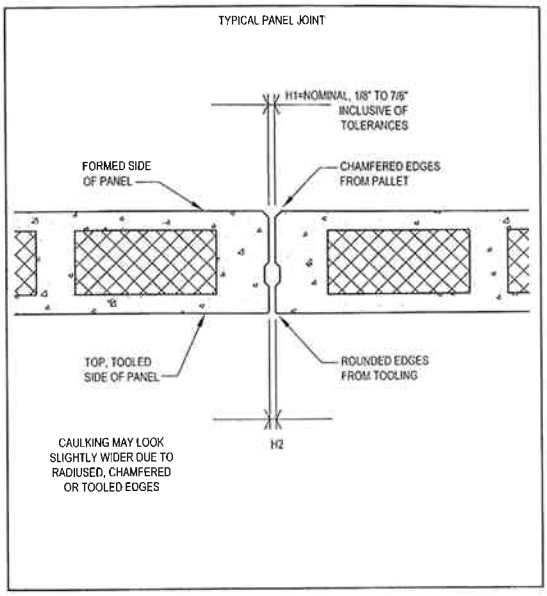
"All air holes over 1/4 in. (6 mm) in size should be filled. Air holes between 1/8 and 1/4 in. (3 and 6 mm) in width that occur in high concentration (more than one per 2" by 2" [1300 mm2]) should be filled. Surface blemishes due to holes or dents in forms should be repaired. Discoloration should be permitted at form joints. This finish may be used on visually exposed structural members such as columns or walls...."

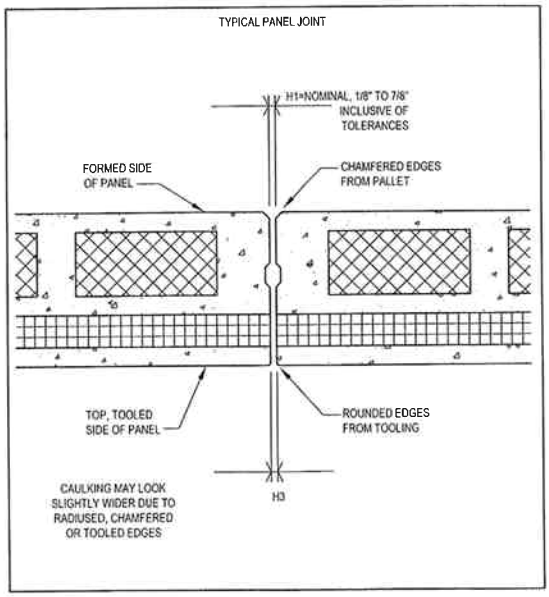
VersaCore+*Green* Wall Panel Field Installation Tolerances*



Fabcon *MNL 116*

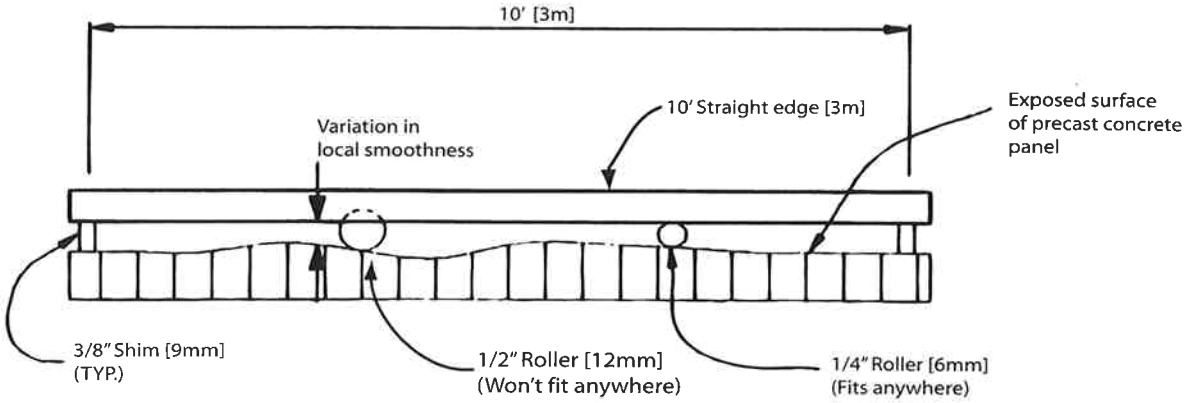
A	=	Plan location from building grid datum	±1/2 in.	✓
B	=	Plan location from centerline of steel support	±1/2 in.	✓
C	=	Top elevation from nominal top elevation:		
		Exposed individual panel	±1/2 in.	✓
		Non-exposed individual panel	±3/4 in.	✓
		Exposed relative to adjacent panel	±1/2 in.	✓
		Non-exposed relative to adjacent panel	±3/4 in.	✓
D	=	Support elevation from nominal elevation:		
		Maximum low	1/2 in.	✓
		Maximum high	1/4 in.	✓
E	=	Maximum plumb variation over height of structure or over 100 ft which ever is less*	±1 in.	✓
F	=	Plumb in any 10 ft of element height	±1/4 in.	✓
G	=	Maximum jog in alignment of matching edges	±1/2 in.	✓
H	=	Joint width (governs over joint taper)	±3/8 in.	✓
	H 1	Form Side 1/2 in.	±3/8 in.	*NA*
	H 2	Top Face Side 3/4 in.	±3/8 in.	*NA*
	H 3	Top Face Side 7/8 in.	±3/8 in.	*NA*
I	=	Joint taper over height	±3/4 in.	*1/2"*
J	=	Joint taper over 10 ft height	±3/8 in.	✓
K	=	Maximum jog in alignment of matching faces:		
		Exposed to view	±3/8 in.	✓
		Not exposed to view	±3/4 in.	✓
L	=	Differential bowing or camber as erected between adjacent members of the same design	±1/2 in.	✓





* NPCA Quality Manual does not address field installation tolerances.

Definitions



Camber - The deflection that occurs in prestressed concrete members due to the net bending resulting from the eccentricity of the prestress force.

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.

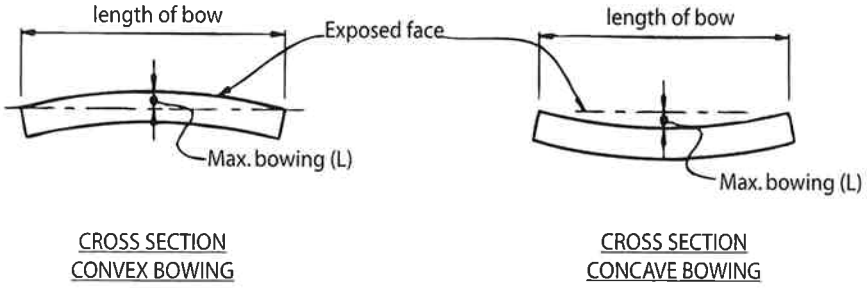
Flatness - The degree to which a surface approximates a plane.

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.

Smoothness - The degree to which a surface is locally flat.

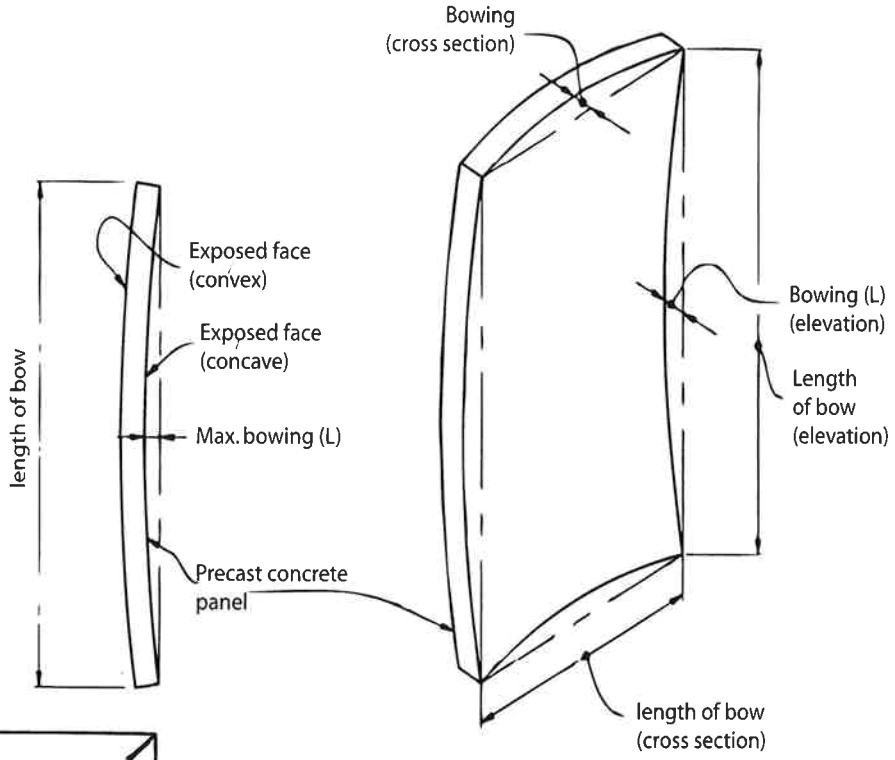
Sweep - A variation in horizontal alignment from a straight line parallel to centerline of member (horizontal bowing).

Tolerance - Permissible variation from specified requirements.

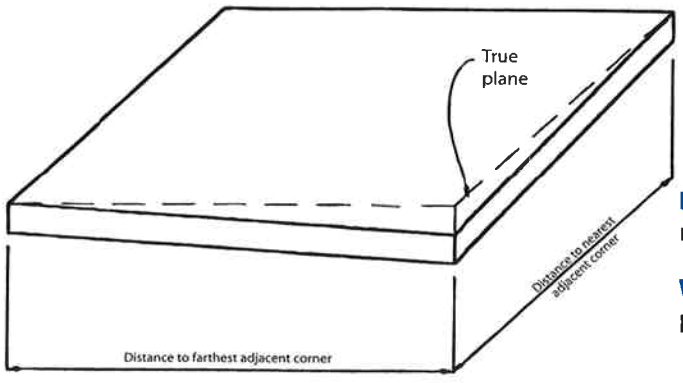


CROSS SECTION CONVEX BOWING

CROSS SECTION CONCAVE BOWING



PANEL BOWED IN BOTH ELEVATION AND CROSS SECTION



Bowing - An overall out-of-plane curvature of a surface whose edges remain parallel.

Warping - The twisting of a member, resulting in an overall out-of-plane curvature of surfaces, characterized by non-parallel edges.

GUIDE SPECIFICATIONS

FOR

PRESTRESSED/PRECAST CONCRETE WALLS AND PLANK

GENERAL

1.01 DESCRIPTION

A. Work Included:

These specifications cover precast, prestressed structural concrete construction, including product design not shown on contract drawings, manufacture, transportation, erection and other related items such as anchorage, bearing pads, storage and protection of precast concrete.

B. Related Work Specified Elsewhere:

1. Cast-in Place concrete: Section _____.
2. Precast Architectural Concrete: Section _____.
3. Post-tensioning: Section _____.
4. Masonry Bearing Walls: Section _____.
5. Miscellaneous Steel: Section _____.
6. Waterproofing: Section _____.
7. Flashing and Sheet Metal: Section _____.
8. Sealants and Caulking Section _____.
9. Painting: Section _____.
10. Holes for Other Trades: Section _____.

C. Work Furnished and Installed By Others:

1. Receivers or Reglets for Flashing: Section _____.
2. Elevator Guides: Section _____.

1.02 QUALITY ASSURANCE

A. Manufacturer Qualification:

The precast concrete manufacturing plant shall be certified by the National Precast Concrete Association (NPCA) or other qualified third party certification for a minimum of 12 months prior to the start of fabrication of this project. Precast concrete manufacturer must have produced product similar to what is being specified for a minimum of five years.

B. Erector Qualification:

Regularly engaged for at least five years in the erection of precast structural concrete similar to the requirements of this project.

C. Welder Qualifications:

In accordance with AWS D1.1

D. Testing:

In general compliance with testing provisions in The NPCA manual for *QualityControl* for Plants and Production of Precast and Prestressed ConcreteProducts and specifically *"Fabcon Design Guidelines for Precast Concrete Wall Panels"* current version.

E. Requirements of Regulatory Agencies:

All local codes plus the following specifications, standards and codes are a part of these specifications:

1. ACI 318 – Building Code Requirements for Reinforced Concrete
2. AWS D1.1 – Structural Welding Code – Steel
3. ASTM Specifications – As referred to in Part 2, Products.

1.03 SUBMITTALS

A. Shop Drawings:

1. Plans and/or elevations locating and defining all material furnished by manufacturer (includes top of panel, type of bearing, openings, finishes, type of insulation).

2. Sections and details showing connections, blockouts, cast-in items and their relation to the structure.

3. Description of all loose, cast-in and field hardware

4. Field installed anchor location drawings.

B. Product Design Criteria:

1. Loading for Design:
   a. Initial handling and erection stresses.
   b. All dead and live loads as specified on the contract drawings.
   c. All other loads specified for member, where applicable.

2. Design calculations of products not completed on the contract drawings shall be performed by a engineer trained in precast, prestressed concrete design, registered in the state where the project is located and submitted for approval upon request.

3. Design shall be in accordance with all applicable codes and latest edition of ACI318.

C. Test Reports:

Reports of tests on concrete and other materials upon request.

PRODUCTS

2.01 PRODUCT TYPE

A. Precast, prestressed insulated wall panels. (Thickness as specified by structural performance and R-Value.)
B. Precast, prestressed insulated sandwich wall panels
C. Precast, prestressed plank

2.02 MATERIALS

A. Portland Cement:

ASTM C150 – Type I or III or blend

B. Admixtures:

1. Air-entraining admixtures: ASTM C260
2. Water reducing, retarding, accelerating, high-range water reducing admixtures: ASTM C494
3. Fly ash as required by manufacturer

C. Aggregates:

ASTM C33 or C330

D. Water:

Potable and free from foreign materials in amounts harmful to concrete and embedded steel.

E. Reinforcing Steel:

1. Bars:

    a. Deformed Billet Steel: ASTM A615
    b. Deformed Rail Steel: ASTM A616
    c. Deformed Axle Steel: ASTM A617
    d. Deformed Low-Alloy Steel: ASTM A706

2. Wire:

    Cold-Drawn Steel: ASTM A82

3. Wire Fabric:

    a. Welded Steel: ASTM A185
    b. Welded Deformed Steel: ASTM A497

F. Strand:

Uncoated, 7-wire, stress-relieved or low relaxation strand: ASTM A416 (including supplement) – Grade 250K or 270K.

G. Anchors and Inserts:

1. Materials—Structural Steel: ASTM A36 minimum
2. Finish—Manufacturer's Standards

H. Grout:

Cement Grout: Portland cement, sand and water sufficient for placement and hydration.

I. Welded Studs:

AWS D1.1

J. Rigid Insulation:

1. Expanded Polystryrene R(min) =4.17/in @ 40°
   =3.85/in.@ 75°

K. Concrete Mixes:

1. 28-Day Compressive Strength: Minimum of 7000 psi
2. Release Strength: Minimum of 3500 psi
3. Exposed surfaces to have up to 11 percent entrained air.
4. Mix may include flyash as required by producer.
5. Use of calcium chloride: chloride ions or other salts are not permitted.

2.03 MANUFACTURE

A. Manufacturing procedure shall be in general compliance with NPCA guidelines and specifically comply with "*Fabcon Design Guidelines For Precast Concrete Wall Panels – Manufacturing and Installation Guidelines*" version 01-08.

B. Finishes:

1. In general finishes will comply with "Grade B" per PCI NML 116, 4th Edition, Appendix "C".
2. Standard Underside: Resulting from casting against approved forms using good industry practice in cleaning of forms, design of concrete mix, placing and curing. Small surface holes caused by air bubbles, normal color variation, normal form joint marks, minor chips and spalls shall be tolerated, but no major or unsightly imperfections, honeycomb or other defects shall be permitted, unless they are nonstructural in nature and are patched.
3. Standard Top: Result of vibrating screed and additional hand finishing at projections. Normal color variation, minor indentations, minor chips and spalls shall be permitted. No major imperfections, honeycomb or defects shall be permitted.
4. Exposed aggregate finishes to be accomplished with concrete retarding chemicals used in compliance with manufacturer's recommendation. Exposed aggregate process may be applied to the "top" surface or form side in conjunction with standard and special finish profiles. Per manufacturer's finish selection or custom finish as developed in conjunction with manufacturer. Exposed aggregate finishes are to be washed in the plant or field to remove slurry from the face of the panels. Sealers, if specified to be field applied by others.

A.) Tints (Pigment)

Color and type of aggregate and tints subject to availability. Variation in color and texture of natural materials is inherent in the final product. Maximum concentration of tint not greater than 3%. Contact Fabcon sales representative for availability and color of aggregates and tints.

B.) White Cement

5. Bands and Reveals
   a. Formed Reveals (Form Side)
   b. Troweled Band (Top Finish)
   c. Ground Reveals (Top Finish)
   d. Medallions
   e. Brick (Form Side)

6. Brick Applications
   a. Cast-in thin brick with formliner
   b. Dovetail anchor slot

D. Openings:

Openings may be framed in the field, cast-in during manufacture or sawn (either in plant or field). In cases where insulation extends to the opening windows/Doors frames for insulated panels must be of sufficient width to cover insulation and allow anchorage into structural portion. The supplier shall provide for openings 12" (round or square) or larger as shown on the structural drawings. Other openings shall be located and field drilled or cut by the trade requiring them after the precast, prestressed products have been erected. All openings shall be approved by the architect/engineer and precast manufacturer before drilling or cutting. General contractor, GM and/or owner responsible for finishing panel edges where insulation is exposed.

E. Patching:

Shall be acceptable, provided the structural adequacy of the product and the appearance are not impaired.

F. Fasteners:

Manufacturer shall cast-in or field install structural inserts, bolts and plates as detailed or required by the loads specified in the contract drawings.

3. EXECUTION

3.01 ERECTION

A. Site Access:

General contractor shall be responsible for providing suitable access to and around the building, proper drainage and firm, level bearing for the hauling and erection equipment to operate under their own power.

B. Preparation—General Contractor Shall Be Responsible for:

1. Providing true, level bearing surfaces on all field-placed bearing walls and other field-placed supporting members. Maintain bearing surface in "clean" condition until precast is installed.

2. Placement and accurate alignment of anchor bolts, plates or dowels in column footings, grade beams and other field placed supporting members.

3. Projects specifying a flat footing require the contractor to establish and install permanent control points for location of panels. Control points at corners, and grid lines, and not less then 40' on center.

4. The removal or covering of power lines, the marking of underground utilities and for securing airport access permits on the project.

C. Installation:

Installation of precast, prestressed concrete shall be performed by the manufacturer or a competent erector. Members shall be lifted by means of suitable lifting devices at points provided by the manufacturer. Temporary shoring and bracing, if necessary, shall comply with the manufacturer's recommendations.

D. Protection:

Following installation the general contractor shall be responsible for protecting the product from the elements to prevent damage or moisture infiltration.

E. Alignment:

Members shall be properly aligned and leveled as required by the approved shop drawings. Variations between adjacent members shall be reasonably leveled out by jacking, loading or any other feasible industry-standard method as recommended by the manufacturer

3.02 FIELD WELDING

Field welding is to be completed by qualified welders using equipment and materials compatible to the base material. (See Section 1.02 E.2)

3.03 ATTACHMENTS

Subject to approval of the architect/engineer, and manufacturer, precast, prestressed products may be drilled or "shot" provided no contact is made with the prestressing steel. Should spalling occur, any repairs as determined by the manufacturer and acceptable to the architect shall be required by the trade doing the drilling or fastening.

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