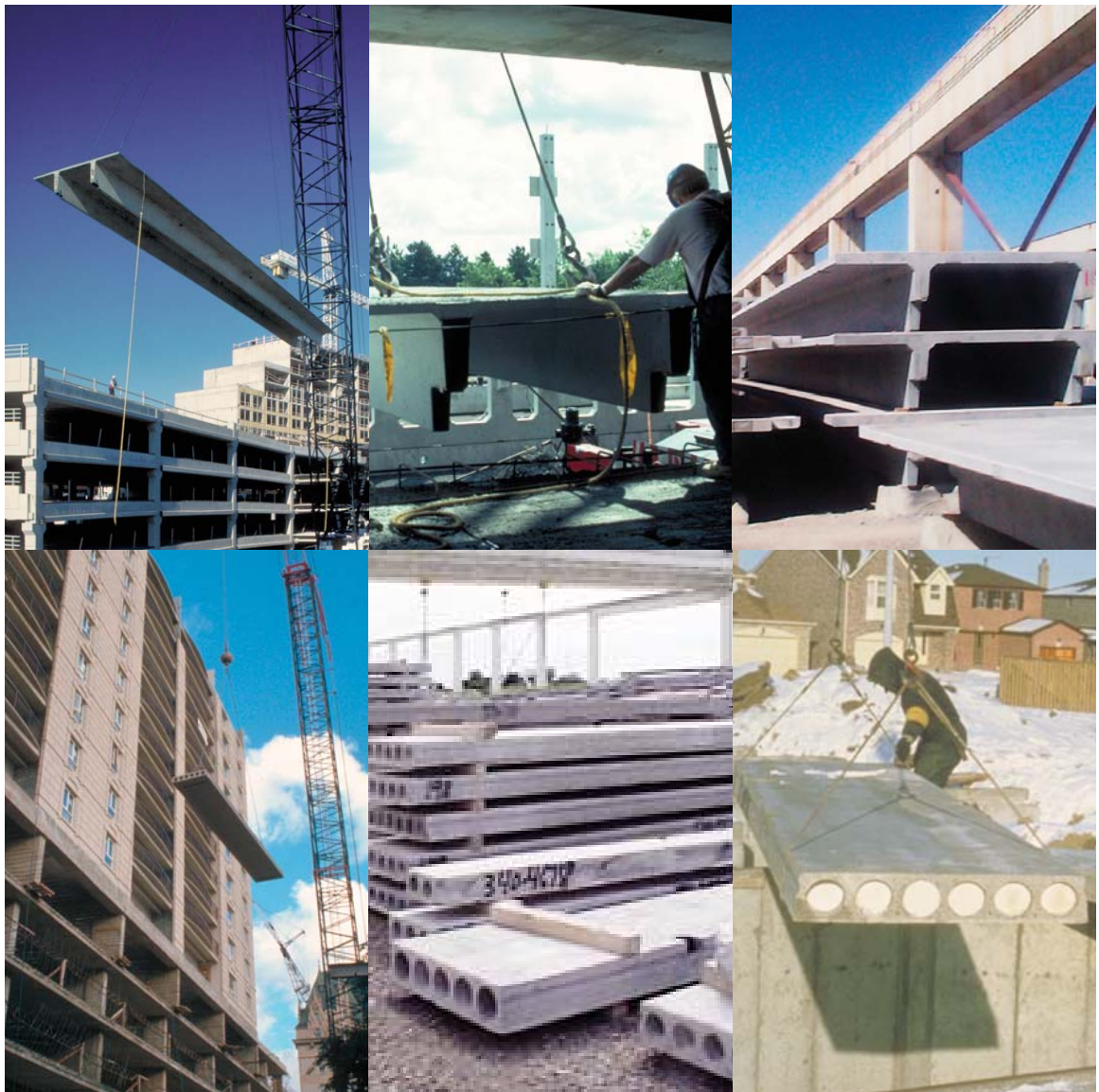


# Structural Floor & Roof Systems Precast/Prestressed Concrete

Technical Brochure



Canadian Precast/Prestressed Concrete Institute



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# About Structural Precast Concrete

## Speed

Structural precast concrete elements are manufactured under controlled plant conditions at the same time as site foundation work is being prepared. When the site is ready, the precaster can immediately commence with the erection of precast components, dramatically shortening construction time. This reduces on-site congestion, financing costs, while accelerating the occupancy date.

## Quality/Durability

The lasting benefits of precast concrete are inherent; high strength, high density, quality controlled precast concrete is superior to other building products for durability, corrosion resistance, impact resistance, fire resistance, security and long lasting low maintenance. The assurance of concrete product quality is achieved through environmentally controlled manufacturing conditions, a skilled workforce and a stringent inspection program. Precast concrete is CPCI Certified in accordance with the requirements of CSA A23.4 "Precast concrete – Materials and construction". When precast concrete is prestressed, the further benefits of durability and slenderness of construction can be realized. Prestressing keeps the concrete in compression, minimizes cracking and increases the load carrying capacity.

## Long Spans/Heavy Loads

High quality plant cast/controlled concrete produced with optimum curing conditions translates to a high strength, high quality product resulting in increased load capacities and more efficient sections.

## Structural Precast/Prestressed Concrete Flexibility

Custom manufactured precast units are easily incorporated into a building to accommodate non-typical shapes or sizes. Precast elements can be designed for removal and/or reuse to accommodate future building expansions and renovations.

## All Weather Construction

Plant precast concrete units minimize construction delays due to weather.

## Economy

Precast reduces costly maintenance shutdowns for painting and other repairs. This translates into reduced costs and ensures maximum productivity over the life of a structure. Few materials have the cost benefit advantages of precast, prestressed concrete when life cycle costs are considered. Faster construction time, low maintenance, long life and potential reduced insurance premiums all contribute significantly to overall savings.



# Floors & Roofs

## Hollow Core Slabs

Hollow core slabs are economical. Slabs are produced using patented dry cast or extrusion systems where very low slump concrete is forced through a machine. The concrete is compacted around cores formed with augers or tubes. The continuous slab voids can be used as heating/cooling ducts and as raceways for electrical wiring. Hollow core slabs reduce sound transmission and vibrations between floors and eliminate floor squeaks.



## Applications

Hollow core slabs are available from CPCI members all across Canada. Hollow core slabs can be used for most applications requiring a solid floor or roof system. Schools, office buildings, condominiums, hotels, senior citizen's apartments, commercial buildings, residential dwellings, houses of worship, nursing homes and educational facilities are all ideal applications. For hotels, motels and apartments, the hollow core slabs are oriented to either span between load bearing shear walls or to span from a central corridor to the exterior walls.

Slabs can be cantilevered up to 1.5 m (5 ft) under typical residential floor loading.

Consult your local CPCI producer for specific design assistance with cantilevers.

*Durability Note:* Hollow core is produced using no-slump, dry-cast concrete. Slabs should not be used for exterior residential applications when the slabs are directly exposed to moisture and freeze/thaw cycles (exterior balconies, etc.) due to the low air entrainment properties of no-slump concrete. Wet-cast slabs can be manufactured to accommodate air entrainment for freeze / thaw durability for exterior use.



## Sizes

Modular precast concrete floor and roof slabs are machine manufactured under controlled conditions in modern precast plants. Slabs are 1220 mm (4'-0") or 2440 mm (8'-0") nominal widths and 203 mm (8 in) deep – other sizes available for special applications are 152 mm (6 in), 254 mm (10 in), 305 mm (12 in), 355 mm (14 in) – consult your local CPCI member for available sizes.

## Manufacturing

For efficiency, slabs are cast on long line beds, normally 100 m to 200 m long (300 ft to 600 ft). Slabs are then cross-cut at 90° to the exact length for each project. Angle cuts are possible. The most economical building layout is achieved when the plan dimensions of the hollow core bays fit the slab module, typically 1220 mm (4'-0") or 2440 mm (8'-0"). Non-module plan dimensions can be accommodated using partial width slabs.



## Prestressing

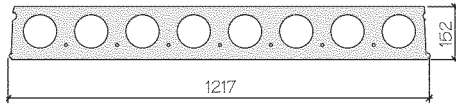
Hollow core slabs are prestressed. This means long spans, shallow depth and the ability to carry heavy loads are easily accommodated. This also means better space planning and a lower floor/floor storey height. Lengthening the span may be economical (fewer slabs to make and install). Maximum span/depth ratios of 45 are recommended for floors. CPCI member's load tables define the allowable live load that a given slab can safely support in addition to the slab self weight. The load capacity is a function of the slab thickness, the amount of prestressing provided and the location of the prestressing strands.

Superimposed Load	3.6 kN/m <sup>2</sup> 75 psf	4.8 kN/m <sup>2</sup> 100 psf	6.0 kN/m <sup>2</sup> 125 psf
203 mm HC x 1220 or 2440 mm* 8 in HC x 4'-0" or 8'-0"*	11 m 35 ft	10 m 32 ft	9 m 30 ft
305 mm HC x 1220 or 2440 mm* 12 in HC x 4'-0" or 8'-0"*	14 m 45 ft	13 m 42 ft	12 m 40 ft
357 mm HC x 1220 or 2440 mm* 14 in HC x 4'-0" or 8'-0"*	17 m 56 ft	16 m 52 ft	15 m 50 ft

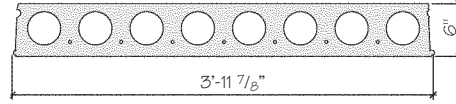
*\*Consult your local CPCI member for the sizes/capacities in your area.*

### Prestressed Hollow Core Slabs

152mm slab

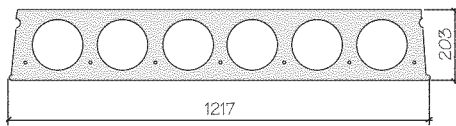


6" slab

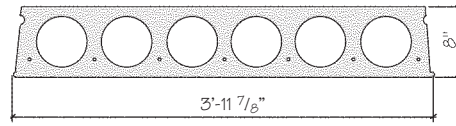


Spans to 7m (23')

203mm slab

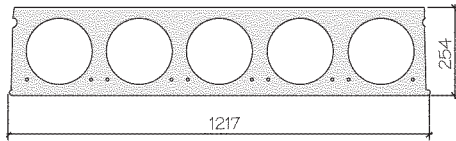


8" slab

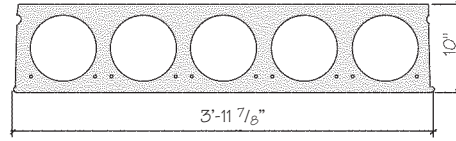


Spans to 9.75m (32')

254mm slab

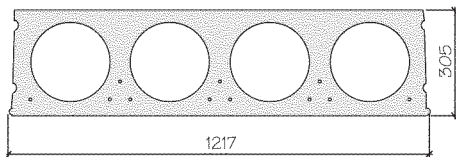


10" slab

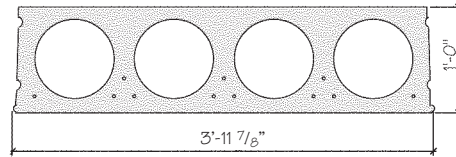


Spans to 11.25m (37')

305mm slab

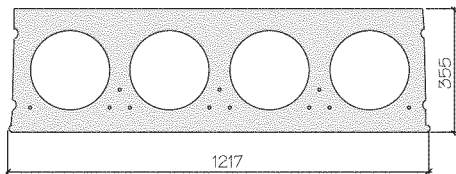


12" slab

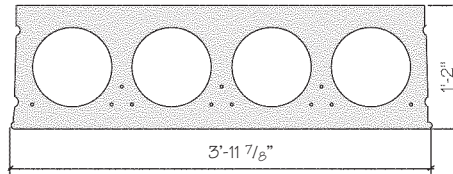


Spans to 13.70m (45')

355 mm slab



14" slab



Spans to 16.15m (53')

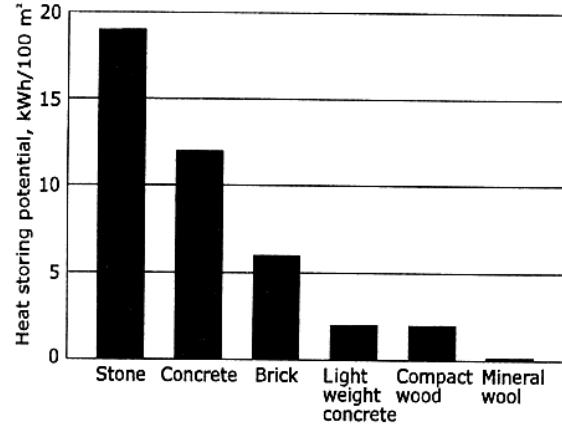
Contact your local CPCI member for specific sizes, span/loading and detailing information.

## Use of Slab Voids

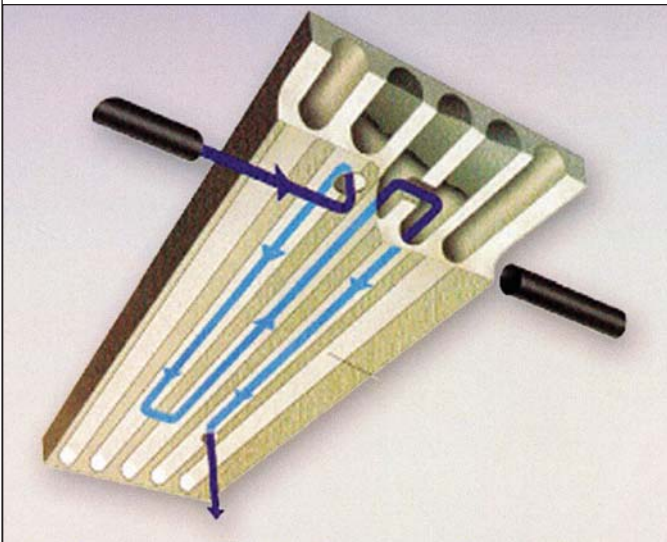
Hollow core slabs are cast with continuous voids to reduce cost and weight. When properly coordinated for alignment, the voids in the hollow core can be used as electrical or mechanical ducts. For example, routing of a lighting circuit through the cores will allow fixtures to be located in an exposed slab ceiling without unsightly surface mounted conduit.

## Thermal Mass

Slabs detailed to distribute heated air through the cores can be used as the thermal mass in a passive solar application. From an operating energy perspective, the thermal inertia of heavy materials is well known, both in warm and cold climates.



Comparative thermal inertia of various building materials



## Termodeck

Termodeck ([www.termodeck.ca](http://www.termodeck.ca)) is a thermal mass system developed in Scandinavia in the 1970s. The circular voids in precast concrete hollow core flooring and roof slabs are connected to air-handling ducts, that constantly pump clean fresh air into the building, expelling the old air, and radiating warm air in the winter and cool air in the summer, to significantly reduce energy consumption.

## Finished Ceiling

Hollow core, cast on smooth steel forms, has a finished underside. The smooth ceiling provided by a hollow core slab requires only caulking of the longitudinal joints. The underside of slabs can be used as a finished ceiling as installed by applying textured paint or an acoustical spray.



## Bearing Supports for Hollow Core

Hollow core slabs can be supported on many types of structural systems designed to carry the required dead and live loads. Precast beams, precast walls, poured concrete beams and walls, masonry walls, insulated concrete forming system walls, wood and steel stud walls and structural steel beams are all suitable for use as load bearing systems with hollow core slabs - consult your local CPCI member for details.



The minimum bearing width is 75 mm (3 in). Hollow core in double bearing on a beam or wall will require at least a 150 mm (6 in) wide bearing surface.

For bearing hollow core on wood walls, it is recommended that a steel stud track plate be used at the top and bottom of all wood bearing walls in lieu of the traditional wood double top plate and single bottom plate. This will eliminate the possibility of wood top plate crushing under the weight of the slabs and the cumulative shrinkage that occurs in a multi-storey wood stud wall.

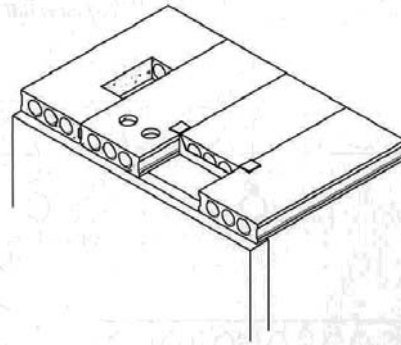
Recommended detailing of non-load bearing wood walls:

- a) interrupt floor to floor by the hollow core, or
- b) eliminate the wood plates in these walls if the wood wall is a multi-storey wall (running by each hollow core floor).

This will eliminate differential shrinkage in the wood wall between the bearing and non-load bearing wood walls.

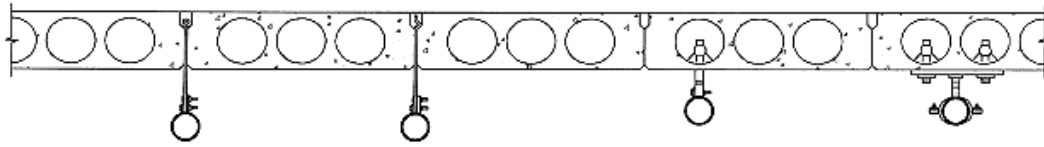
## Holes and Openings

Holes and openings larger than 150 mm (6 in) diameter should be located on the approved shop drawings. Openings can be provided in hollow core systems by forming or sawing the openings in the plant or by installing short slabs with steel headers at the jobsite. In laying out openings for a project, the least structural effect will be obtained by orienting the longest dimension of an opening parallel to a span, or by coring small holes that cut the fewest prestressing strands. Installing large openings after a floor or roof deck has been installed and grouted, by shoring and saw cutting, should be done only if unavoidable.

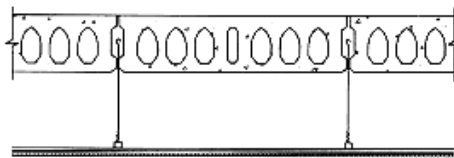


## Fastenings

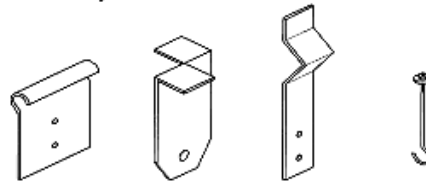
Suspended ceilings, crane rails, mechanical and electrical equipment and other sub-systems can be accommodated with standard manufactured hardware and embedded plates.



Pipes Hung from Hollow-Core Slab Systems



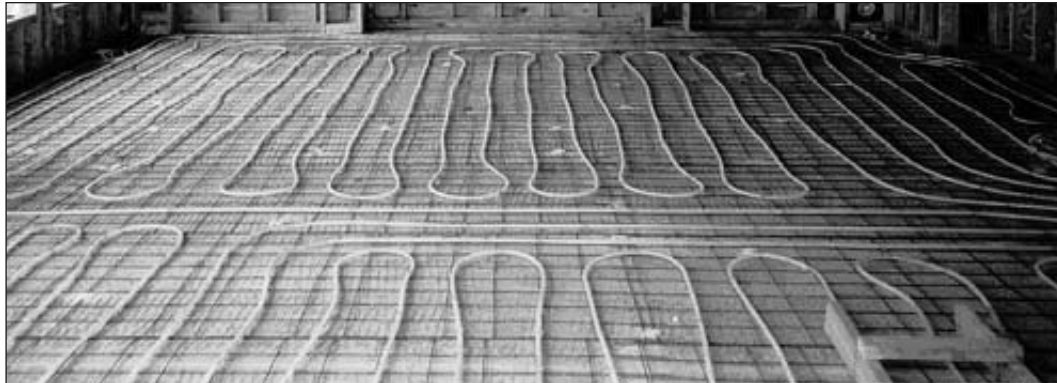
Suspended Ceiling Below Hollow-Core Slab



Assorted Hanger Hardware

## Underfloor Radiant Heat

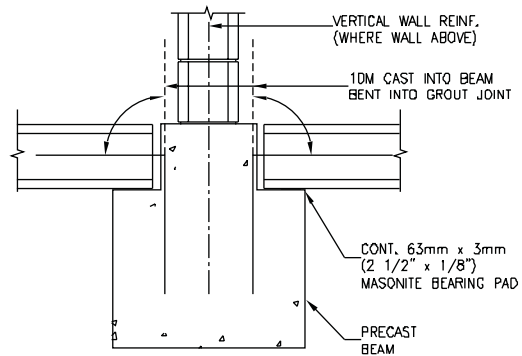
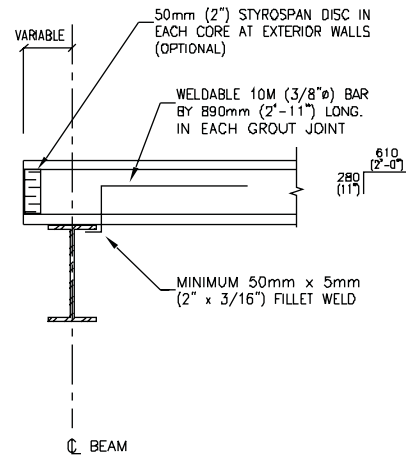
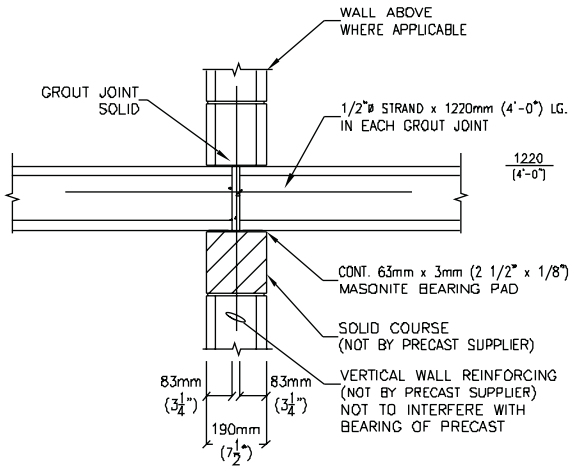
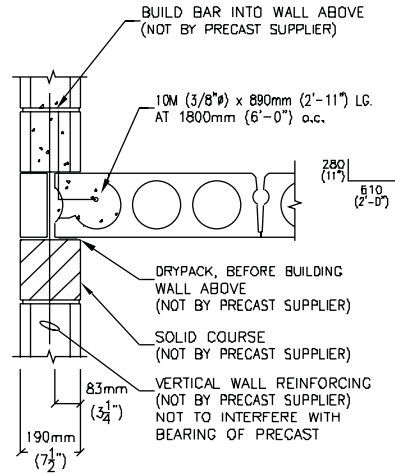
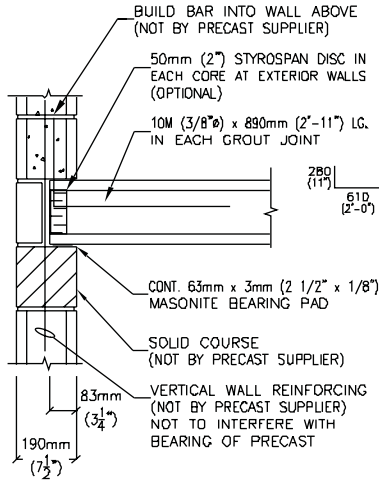
Underfloor radiant heat uses the floor to heat the building above by raising the floor temperature until the heating output of the floor matches the amount of heat that the building is losing. Radiant heating systems use a boiler or hot water heater to heat water (or an antifreeze solution) which is circulated through in-floor tubing. Precast floor slabs are ideal for use with radiant heating. A topping slab containing radiant heating tubes is cast over hollow core or double tee floor slabs.



## Load Distribution

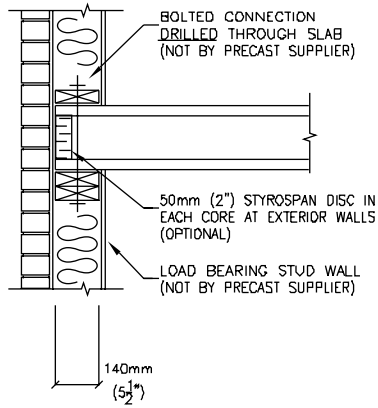
Hollow core slabs are designed as individual, one way, simple span slabs. When the slabs are installed and grouted together at the keyways, the individual slabs become a system that behaves similarly to a monolithic slab. A major benefit of the slabs acting together is the ability to transfer forces from one slab to another. In most hollow core slab deck applications, non-uniform loading occurs in the form of line loads, concentrated loads, or load concentrations at openings. The ability of individual slabs to interact allows these load concentrations to be shared by adjacent slabs (as demonstrated in published tests).

## Connections to Masonry/Steel/Precast

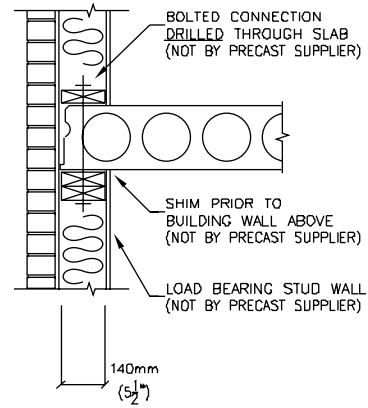


All connections shown are to be used for concept design only.

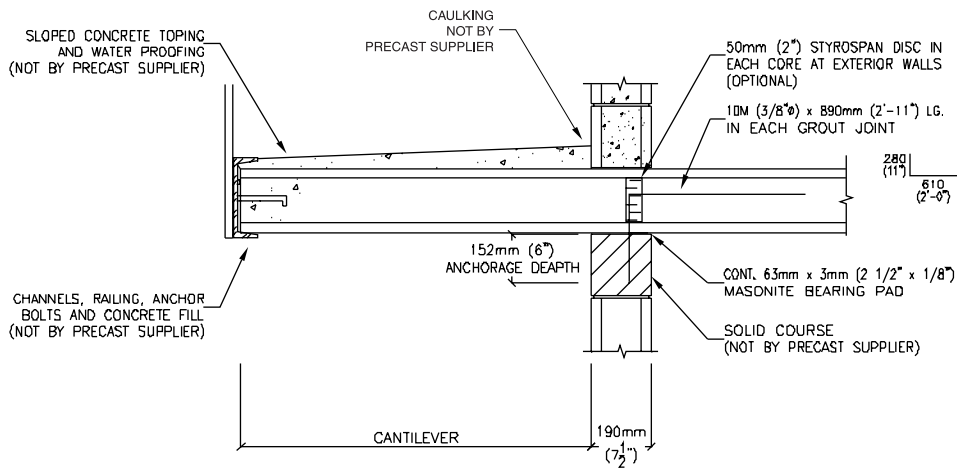
## Connections to Structural Wood & Balcony Details



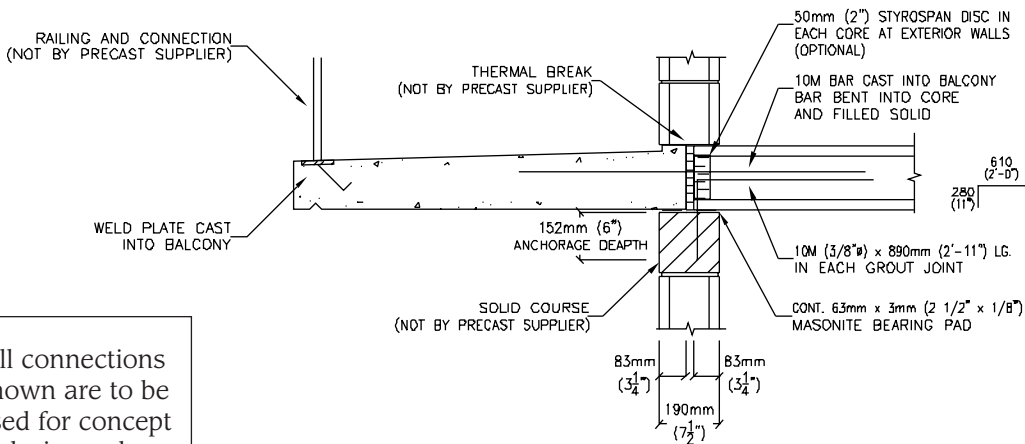
End Bearing On Wood Studs - Bolted Connection  
N.T.S.



Side Bearing - Bolted Connection  
N.T.S.



Cantilevered Balcony - Tie Down  
N.T.S.



Solid Precast Balcony (Supported On Wing Walls) - Tie Across & Down  
N.T.S.

All connections shown are to be used for concept design only.



## Diaphragms

A series of hollow core slabs can resist lateral loads in the form of a grouted slab assembly, provided proper connections and details are installed. The function of a diaphragm is to receive wind loads, seismic loads and lateral earth pressures from the building elements and transmit these loads to lateral-resisting elements that carry the loads to the foundation.

## Top Surface Preparation

Untopped hollow core slabs are the most economical system (where applicable). The top surface of

untopped hollow core slabs can be prepared for the direct installation of floor coverings by applying a cement-based skim coat to the top surface of the slabs. Non-structural leveling concretes can be installed ranging from 3 to 50 mm (1/8 to 2 in) thick depending on the material used, or by casting a composite structural concrete topping.

Structural toppings are often used in high seismic zones and where heavy loadings are to be supported. A rough finish can be created on the top surface of the hollow core, just after the slabs have been extruded, to improve the bonding of the structural topping.

## Fire Resistance

Hollow core slabs provide excellent fire resistance. Fire ratings of 1 to 2 hour endurance can be readily achieved depending on slab thickness and strand cover. A fire rating is based on equivalent thickness for heat transmission, concrete cover over the prestressing strands for and end restraint. Fire ratings of up to 4 hours can be achieved (where required) using deeper slabs, increased cross sections and increased strand cover – consult your local CPCI member. The NBCC and provincial building codes specify the required fire ratings.

## Sound Transmission

Hollow core slab concrete floor-ceiling assemblies have excellent sound transmission characteristics. Sound Transmission Class (STC) ratings range from about 50 to 57 without topping. The Impact Insulation Class (IIC) ratings start at about 23 for a plain slab and can be increased to over 70 with the addition of resilient materials such as under padding and carpeting.

## Design Stage Assistance Available

CPCI members who manufacture hollow core slabs and building systems are available to provide technical assistance (load tables, typical details, etc.) and budget pricing and at the preliminary design stage for your next project.



## Double Tee Slabs

Double tee slabs are produced on long line casting beds, normally 100 m to 150 m long (300 ft to 450 ft). Bulkheads are placed to form the required double tee lengths for individual projects. Prestensioning strands and carbon steel reinforcement and connection hardware are placed in the form to suit individual slab requirements prior to placing the concrete.

### Applications

Double tee slabs are available from CPCI members all across Canada. Double tee slabs can be used for most applications requiring a long span floor or roof system (10 m to 30+ m) and/or additional load carrying capability. Double tee slabs are resistant to moisture and corrosion. Parking garages, office buildings, commercial buildings, gymnasiums, pool roofs, food processing plants, paper mills, industrial buildings, and sewage and water treatment plants are all ideal applications. Slabs can be cantilevered at one or both ends for up to 4 times the slab depth. Consult your local CPCI member for specific design assistance with cantilevers.



### Sizes

Double tee slabs are available in modular widths (typically 2400 mm, 3000 mm and 3660 mm nominal widths). Slab depths can vary from 500 mm to 1000 mm. Stem widths are sized to suit structural and fire rating requirements. Consult your local CPCI member for available sizes.

### Prestressing

Double tee slabs are prestressed. This allows for longer spans, shallow depth and the ability to carry heavy loads. This also permits better space planning and a lower floor/floor height. Lengthening the span may be economical (fewer slabs to make and install). Maximum span/depth ratios of 40 are recommended for floors.

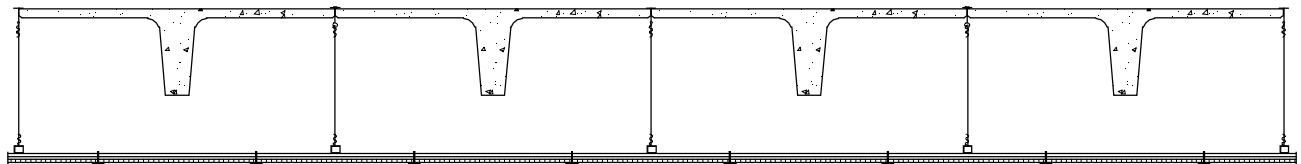
The load capacity is a function of the double tee cross-section, the amount of prestressing provided and the location of the prestressing. CPCI member's load tables will define the allowable live and dead loads that a given slab can safely support in addition to the slab self weight.

Superimposed Load	3.6 kN/m <sup>2</sup> 75 psf	4.8 kN/m <sup>2</sup> 100 psf	6.0 kN/m <sup>2</sup> 125 psf
450 mm Double Tee x 3000 mm* 18 in Double Tee x 10'-0"*	13 m 42 ft	12 m 38 ft	10 m 33 ft
600 mm Double Tee x 3000 mm* 24 in Double Tee x 10'-0"*	15 m 50 ft	14 m 46 ft	12 m 38 ft

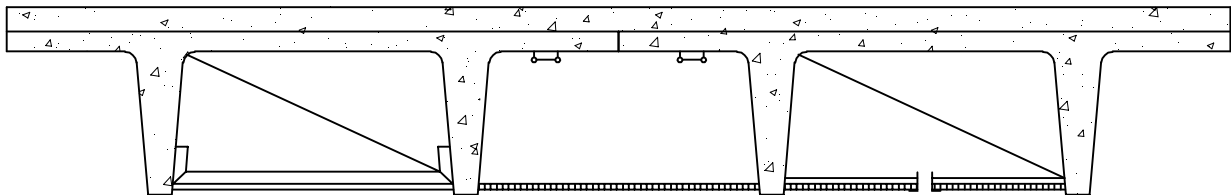
*\*Consult your local CPCI member for the sizes/capacities in your area.*

## Finished Ceiling

Double tee slabs, cast on smooth steel forms, have a finished underside. The smooth ceiling provided by a double tee slab may require only the caulking of the longitudinal joints. The underside of slabs can be specified as Standard Grade, Finish Grade B and Finish Grade A as described in CSA A23.4-05, Clause 26.



Suspended Ceiling Below Double Tees

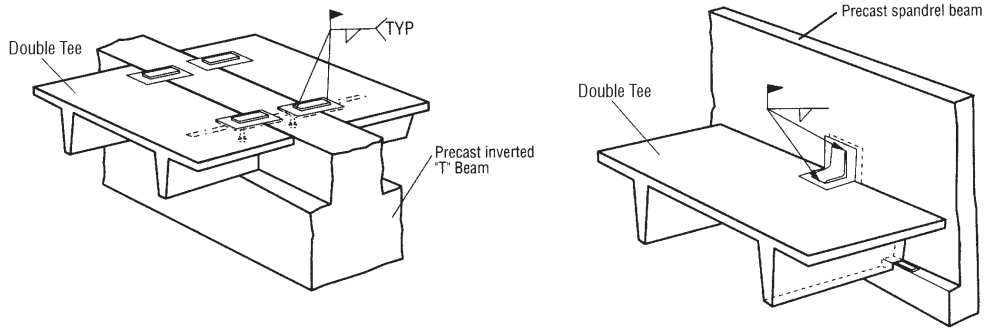


*Metal panels attached to the bottoms of the stems create ducts. Diffuser panels provide a flush ceiling.*

## Bearing Supports for Double Tee Slabs

Double tee slabs can be supported on many types of supports designed to carry the required dead and live loads. Precast beams, precast walls, poured concrete beams and walls, masonry walls, insulated concrete forming system walls and structural steel beams are all suitable for use with double tee slabs as load bearing systems - consult your local CPCI member for details.





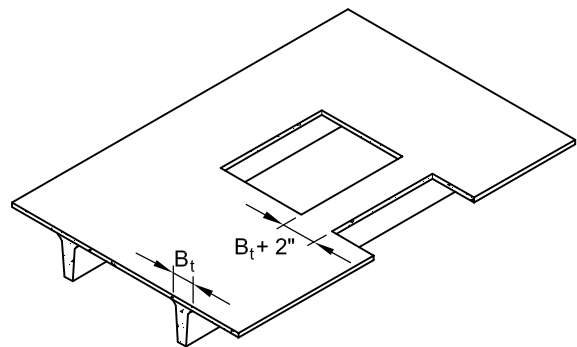
Typical Double-Tee Detail

*Note: Double Tees may or may not receive a field applied topping.  
Contact your local CPCI member for further details.*

The minimum recommended bearing width is 150 mm (6 in). Double tee slabs in double bearing on a single support beam or wall will require at least a 300 mm (12 in) wide bearing surface.

## Holes and Openings

Flange openings larger than 200 mm (8 in) should be formed at the precast plant. Large openings to accommodate mechanical ducts and skylights can be accommodated during manufacturing. Openings through double tee stems can be provided for piping and electrical conduits. These openings should be kept to a minimum and located at the top of the stem (underside of the flange).



## Load Distribution

Double tee slabs are designed as individual, one way, simple span slabs. When the slabs are installed and welded together at the flange edges, the individual slabs become a system that can behave similarly to a monolithic slab to transfer forces from one slab to another (particularly in floor applications where a cast-in-place topping is placed over the double tee slabs). In most double tee slab applications, non-uniform loading occurs in the form of line loads, concentrated loads, or load concentrations at openings. The ability of individual slabs to interact allows these load concentrations to be shared by adjacent slabs.

## Diaphragms

A series of double tee slabs can resist lateral loads in the form of a welded slab assembly, provided proper connections and details are installed. The function of a diaphragm is to transmit wind loads, seismic loads and lateral earth pressures from the building elements to lateral-resisting elements such as shear walls that carry the loads to the foundations.



## Top Surface Preparation

Untopped double tee slabs are generally used for roof applications and some parking garage floors. The top surface of untopped double tee slabs is screeded off and finished with a wood float.

Double tee floor slabs in buildings require a 50 mm to 75 mm cast-in-place topping depending on the floor loading and embedded conduit to be installed. The top surface of double tee slabs receiving concrete topping is rough broomed to allow bonding of the topping to the double tees.



Structural toppings are often used in high seismic zones and where heavy loadings are to be supported.

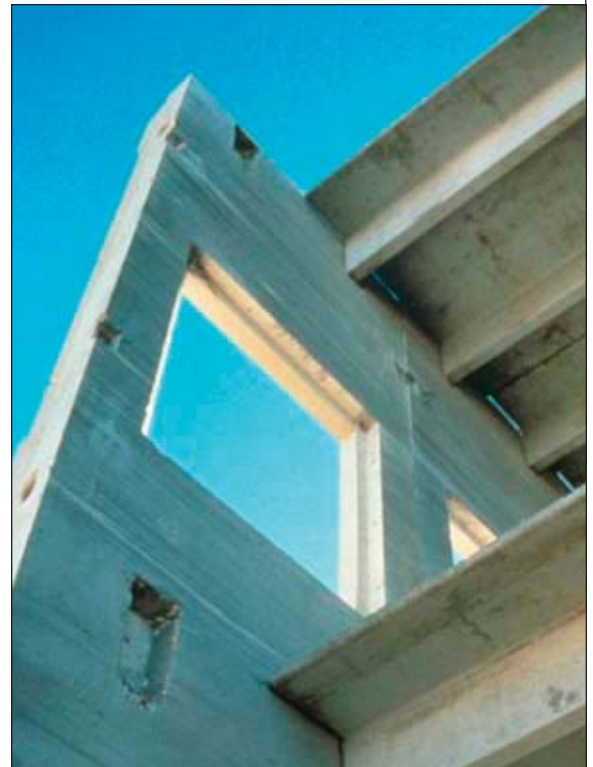
## Fire Resistance

Double tee slabs provide excellent fire resistance. Depending on slab thickness and strand cover, fire ratings of 1 to 2 hour endurance can be readily achieved. A fire rating is dependent on equivalent thickness for heat transmission,

concrete cover over the prestressing strands for strength and end restraint. The NBCC and provincial building codes specify the required fire ratings.

## Sound Transmission

Double tee slab concrete floor-ceiling assemblies have excellent sound transmission characteristics. Sound Transmission Class (STC) ratings for double tees are about 54 with topping. The Impact Insulation Class (IIC) ratings start at about 24 for a plain topped slab and can be increased to over 70 with the addition of resilient materials such as under padding and carpeting.



# General Requirements

## Hollow Core Slabs and Double Tee Slabs

### Design Responsibilities

It is customary for CPCI members to perform the final engineering for double tee and hollow core slabs supplied to a project. This can include design for vertical loads and lateral loads specified by the Engineer of Record, embedded items for specified connection forces and handling, shipping and erection loads.

The Engineer of Record plays a very important role in the design process. Enough preliminary planning should be done to ensure that the specified floor and roof system is achievable. The project should be engineered in enough detail to avoid requiring changes from the contract documents.

The contract documents must clearly indicate design criteria that the double tee and hollow core slabs will have to conform. This is especially important when the precast slabs must interface with other construction materials. The forces to be transmitted through connections must be specified in the contract documents. CPCI members are best able to determine the most efficient types of connection elements to be embedded in a slab. However, the balance of connections that interface with other materials should be detailed in the contract documents, with input from local CPCI members.

The Engineer of Record also has a responsibility in the review and approval of erection drawings prepared by the precast producer. Review of these drawings is the last opportunity to assure that the precaster's understanding of the project coincides with the intent of a design. Erection drawings should be checked for proper design loads, proper details and bearing conditions, conformance with specified fire ratings, and the location of openings.

### Code/Quality Requirements

Double tee and hollow core slabs supplied by CPCI members meet or exceed the requirements of the National Building Code of Canada, the Canada Mortgage and Housing Corporation and are designed, constructed and installed in accordance with CSA A23.3 Design of Concrete Structures, CSA A23.4 Precast concrete – Materials and construction and CSA S413 Parking Structures. Precast concrete plant cast products supplied by CPCI members are CPCI Certified in accordance with CSA Standard A23.4.

### Camber

Most hollow core slabs and double tee slabs have camber - an upward deflection produced by the effects of prestressing. Consideration should be given to the effects of differential camber in the planning stages of a project. Joints between slabs of unequal spans or joints at which a change in the span direction occurs will have differential camber. This must be recognized and dealt with in the design layout. Walls may be located to hide some of these joints. Actual cambers will vary from the calculated values

due to the many variables that affect camber. Calculated camber values should be considered estimated values, suitable for preliminary planning purposes.

Camber must also be accommodated when a topping is provided. The quantity of topping required must consider the amount of camber and the function of the floor. In occupancies where flat floors are not a requirement, a constant topping thickness may be used to follow the curvature of the slab. At the other extreme, if a "flat floor" is required in a structure consisting of multiple bays of varying length and changes in slab direction, the highest point will determine the top elevation of the topping. A greater amount of topping will then be required in "low areas".

When a composite bonded concrete structural topping is required, the thickness specified on the drawings is the minimum topping thickness required at the mid-span of the slabs, not at the supports. For example, a 50 mm (2 in) composite concrete topping should have a minimum of 50 mm of topping placed at the mid-span of the slabs, with more than 50 mm being placed near the ends (for slabs with a camber).

Camber, camber growth, and deflections must also be taken into account in roofing details. In occupancies that require drainage, slopes should be large enough to overcome expected camber. Where changes in relative slab position can occur, counter flashings are suggested to accommodate these changes.

## Connections

Generally, all precast to precast connections are designed and supplied by the precast manufacturer. The connections between the precast components and other building systems are generally designed and detailed by the Engineer of Record, with input by the precast supplier, prior to finalizing the project documents. In some cases, the precast supplier may be required to design and supply the connection hardware embedded into cast-in-place concrete on-site by the general contractor, and into the precast components at the precast plant.

## Speed of Construction

Fast construction means earlier completion and resulting cost savings. Double tee and hollow core slabs can help to speed up construction schedules. Manufacturing of the slabs can proceed in a CPCI member's high efficiency plant while site construction is underway. Slabs can be delivered to the jobsite and installed to meet the client's schedule regardless of weather conditions.

An installed double tee or hollow core deck provides a working platform for other trades. The

combination of double tees or hollow core slabs with a structural precast concrete frame and/or precast concrete bearing walls will speed construction even more. The entire building shell can be supplied and installed under a single precast concrete contract.

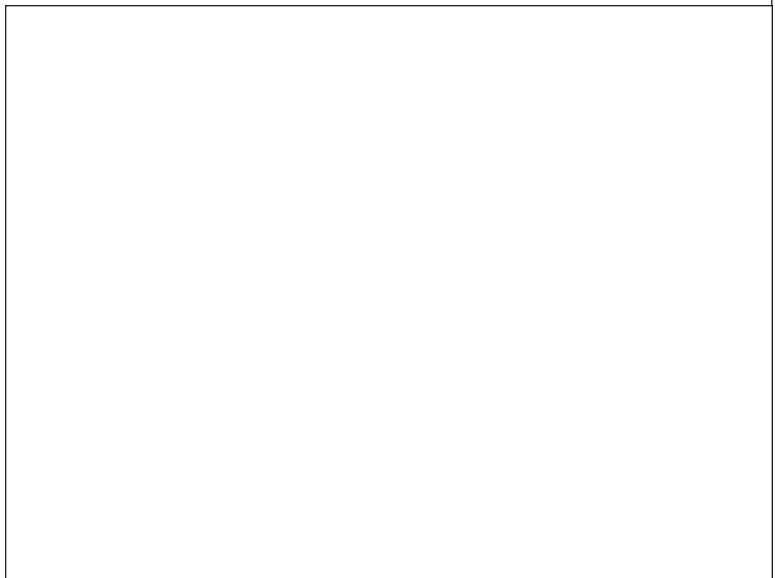
## Erection

CPCI members have their own forces available to install double tee and hollow core slabs. Services are also available to cut holes and openings up to 150 mm (6 in) diameter for mechanical trades. Openings larger than 150 mm (6 in) should be located on the shop drawings at the time of approval.



## Design Stage Assistance Available

CPCI members who manufacture hollow core, double tee slabs and building systems are available to provide technical assistance (load tables, typical details, etc.) and budget pricing at the preliminary design stage for your next project.



# CPCI Members

## Institute:

The Canadian Precast/Prestressed Concrete Institute (CPCI) is a non-profit corporation founded in 1961 for the purpose of advancing the design, manufacture and use of structural and architectural precast/prestressed concrete in Canada.

- CPCI is unique: a combination of a trade and professional association, with a representative mix of companies and individuals.
- Membership includes precast producers (Active Members), industry suppliers (Associate and Supporting Members), engineers and architects (Professional Members), plus affiliate and student members.
- These members receive CPCI & PCI technical information and discounts on industry publications, conventions, etc.
- Consult the CPCI website ([www.cpci.ca](http://www.cpci.ca)) for more information and application forms.



## Technology:

CPCI members are committed to developing innovative solutions to meet the demands of the construction industry. Technical committee meetings are held to collect and disseminate knowledge, statistics, ideas and information relating to the design, manufacture, and use of precast/prestressed concrete. Through investigations and research, new engineering processes are established to ensure quality and aid in product design.

## Professional Development:

CPCI Pathways to Our Future seminars and workshops study systems and procedures to improve the coordination and dissemination of information relevant to our member's manufacturing processes. In addition, these seminars seek to improve managerial aspects of precast manufacturing and marketing through education and professional development. CPCI's aim is to improve to the efficiency and effectiveness of the industry as a whole.

## CPCI Members:

CPCI member companies are precast professionals; capable and willing to help you successfully complete your next project. Involve your CPCI partner at the early stages of project planning. Whether the challenges are structural, aesthetic, timing or economic, CPCI members can provide invaluable input. You will find CPCI members are dedicated, committed and competent to contribute to the realization of the standards you have set for your projects. They will be there to advise and assist you from concept to completion. Consult the CPCI website: [www.cpci.ca](http://www.cpci.ca) for the members near you.

# CPCI Certification

*How Precast Certification is a Requirement of the National Building Code*

CSA A23.3 – Design of concrete structures:

A23.3-04 Clause 16.1.3 – For elements produced in manufacturing plants certified in accordance with Clause 16.2, the concrete material resistance factor,  $\phi_c$ , specified in Clause 8.4.2 may be taken as 0.70.

*A23.3 allows an increased material resistance factor,  $\phi_c = 0.70$  for precast concrete members that are certified in accordance with A23.4 in recognition of the quality control and accurate placement of forms and reinforcement. The material resistance factor,  $\phi_c = 0.65$  applies to cast-in-place and non-certified precast concrete members*

CSA-A23.3-04 - Clause 16.2.1 – All precast concrete elements covered by this standard shall be manufactured and erected in accordance with CSA A23.4.

CSA A23.4 – Precast concrete – Materials and construction:

CSA-A23.4-05 - Clause 4.2.1 – Precast concrete elements produced and erected in accordance with this standard shall be produced by certified manufacturers, with certification demonstrating the capability of a manufacturer to fabricate precast concrete elements to the requirements of this Standard.

CPCI Precast Concrete Certification Program for Architectural and Structural Precast Concrete Products and Systems

The CPCI Certification Program qualifies precast concrete manufacturers who fabricate architectural and structural precast concrete and meet CPCI certification requirements.

Manufacturers are evaluated on their quality system, documentation, production and erection procedures, management, engineering, personnel, equipment, finished products and assemblies. Independent professional engineers conduct audits twice annually.

Certification confirms a manufacturer's capability to produce quality products and systems.

**The CPCI Certification Program assures project specifiers and owners of a manufacturer's comprehensive in-house quality assurance program and acceptable production methods.**

Manufacturers are required to:

- Establish and maintain the highest standard of integrity, skill and practice in the design and fabrication of their products and systems.
- Undertake the performance of only those services and produce only those products for which they are qualified.
- Be in compliance with current governing codes and regulations, and
- Supply products only from a manufacturer that is certified under the CPCI Certification Program.

Audits are performed to:

- Determine the conformity or nonconformity of the manufacturer's quality system and finished products with the specified requirements,
- Determine the effectiveness of the implemented quality system in meeting specified quality objectives,
- Provide the manufacturer with an opportunity to improve their quality system,
- Confirm that the manufacturer meets the regulatory requirements.

Program Requirements

The manufacturing of precast concrete must be in accordance with the requirements of the latest editions of CSA Standard A23.4 and the PCI Quality Control Manuals MNL-116 and 117 (US equivalent), with the more stringent requirements being the governing criteria.

## CPCI Resources

### CPCI Guide Specifications

Download these specifications at: [www.cpci.ca](http://www.cpci.ca) - click on: Specifications

- Section 03410 - Hollow Core Precast/Prestressed Concrete
- Section 03410 - Structural Precast / Prestressed Concrete
- Section 03450 - Architectural Precast Concrete
- Section 03450 - Insulated Precast Concrete Wall Panels

These online specifications are updated to reflect changes in codes, standards and industry practices.

### Detailed Design Information:

#### CPCI Design Manual

Manual contains comprehensive design and construction information in accordance with industry practice and Canadian design and construction codes and standards.

Order from: [www.cpci.ca](http://www.cpci.ca)

#### Architectural Precast Concrete Walls

##### Best Practice Guide

Guide contains details and information covering precast walls as both cladding and load bearing assemblies.

Order from: [www.cmhc.ca](http://www.cmhc.ca)

#### Designer's Knowledge Bank

The Designer's Knowledge Bank is a site created to assist design and construction professionals in understanding precast, prestressed concrete products and structures. Much of the material here is free-of-charge and downloadable on demand. Other material such as comprehensive hardcover design manuals may be purchased through this site.

To access the Designer's Knowledge Bank, go to: [www.cpci.ca](http://www.cpci.ca)

### CPCI Members Near You / Your Project

To access CPCI members, go to:  
[www.precastsearch.com](http://www.precastsearch.com)



For More Information:

*CPCI Design Manual,  
Fourth Edition  
order from [www.cpci.ca](http://www.cpci.ca)*



Canadian  
Precast/  
Prestressed  
Concrete  
Institute

196 Bronson Avenue, Suite 100, Ottawa, Ontario K1R 6H4  
Telephone (613) 232-2619 Fax: (613) 232-5139  
Toll Free: 1-877-YES-CPCI (1-877-937-2724)  
E-mail: [info@cpci.ca](mailto:info@cpci.ca) Web: [www.cpci.ca](http://www.cpci.ca)

*DISCLAIMER: Substantial effort has been made to ensure that all data and information in this publication is accurate. CPCI cannot accept responsibility of any errors or oversights in the use of material or in the preparation of engineering plans. The designer must recognize that no design guide can substitute for experienced engineering judgment. This publication is intended for use by professional personnel competent to evaluate the significance and limitations of its contents and able to accept responsibility for the application of the material it contains. Users are encouraged to offer comments to CPCI on the content and suggestions for improvement. Questions concerning the source and derivation of any material in the design guide should be directed to CPCI.*

