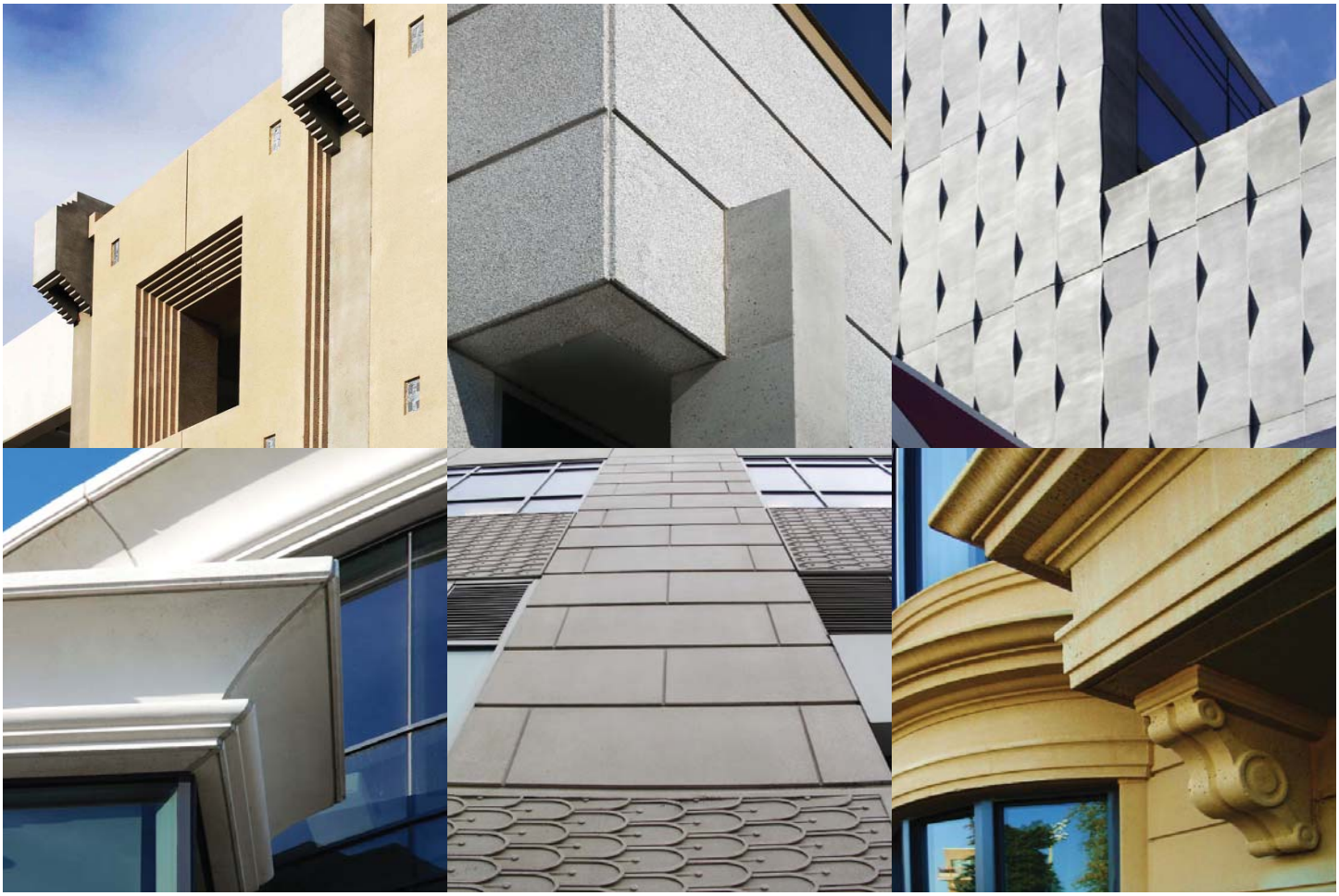
ARCHITECTURAL Precast Concrete

Technical Brochure



Precast Concrete...
Sustainable Structures for Tomorrow!

Canadian Precast/Prestressed Concrete Institute

Microsoft 99 Building ▪ Redmond, WA ▪ Callison Architecture

Introduction

The Canadian Precast/Prestressed Concrete Institute is proud to provide you with this brochure. We trust you will find it beneficial in assisting you with your design of future architectural precast concrete applications.

This brochure illustrates the wide range of products available from the CPCI members across Canada, and their product capabilities and diversity. The focus of this publication is to illustrate the use and design of architectural precast concrete.

Architectural precast concrete is the cladding material of choice whenever superior aesthetics and/or construction economy is required. Precast cladding combines the benefits of high durability, low maintenance, excellent fire resistance and energy efficiency. All precast is factory manufactured ensuring consistent quality.

The versatility provided by architectural precast concrete is appropriate for use on both high-rise office buildings, where the emphasis is on prestige and aesthetic appeal, and on low-rise industrial structures, where economy and durability are paramount.

Aesthetic Versatility

The true benefit of architectural precast concrete is found in the virtually limitless architectural effects that can be achieved with its use.

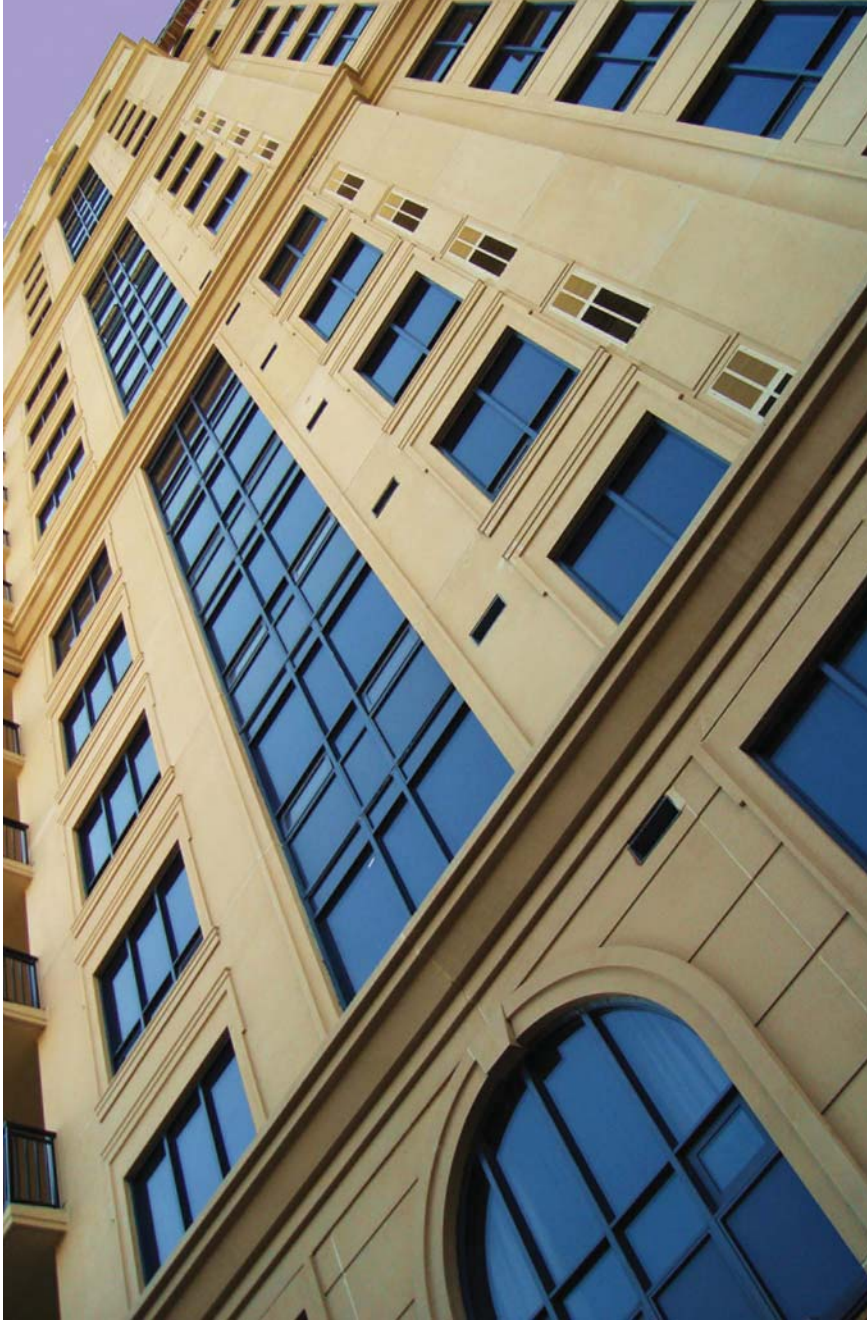
Custom made forms can be used to create precast panels in the exact size and shape, utilizing reveals, joint patterns and other architectural detailing specified by the designer.

Specific colour effects can be achieved using various coloured sands, cements and aggregates.

Granite, marble, stone, tile or brick veneers can be cast into the panels at the time of fabrication, allowing the designer to achieve prestigious visual effects at reasonable additional cost.

Textures can be customized through the use of chemical retarders, acid washes and sandblasting.

Combinations of the above finishes can be realized within individual panels.



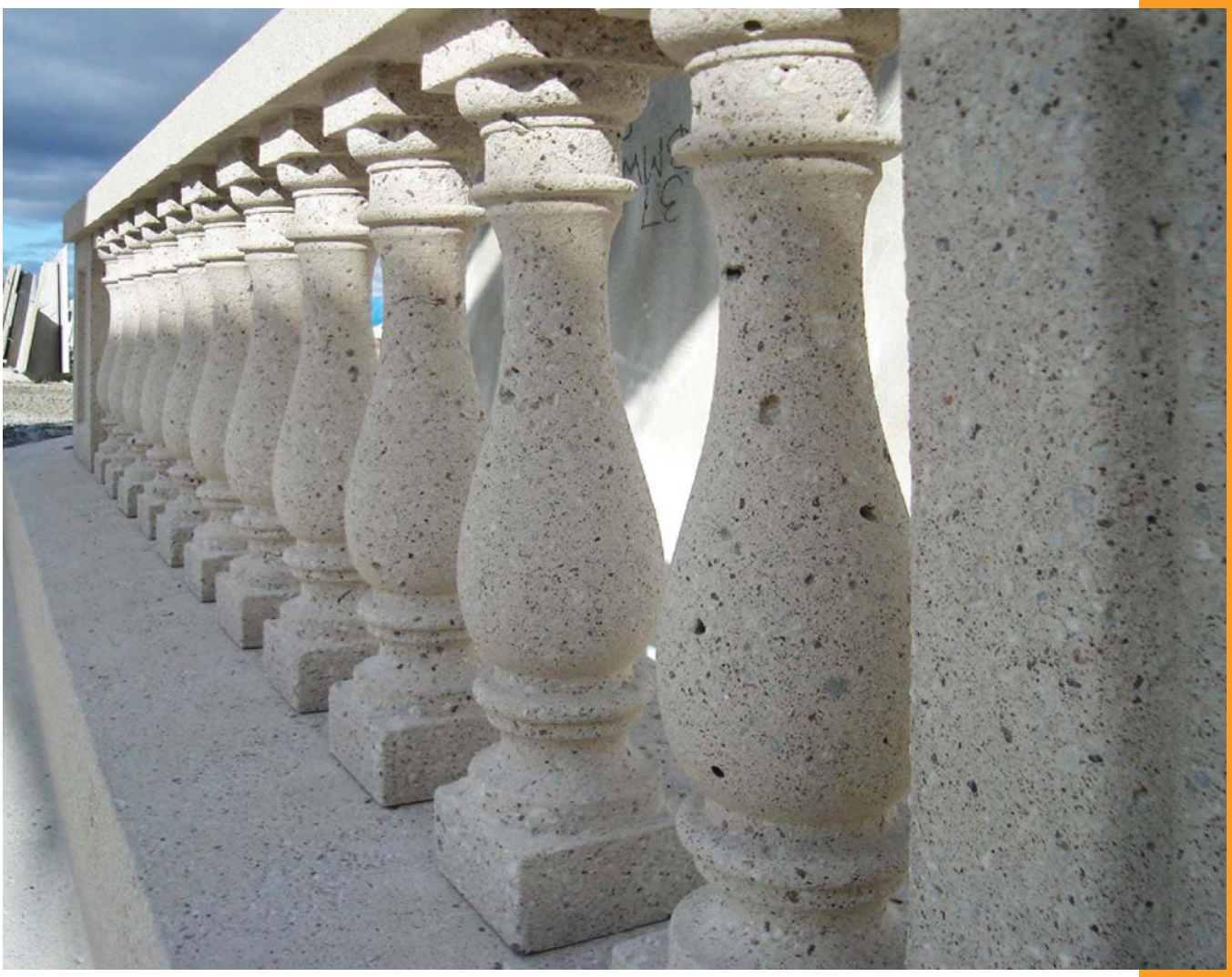
St Ghabriel Terraces ▪ Toronto, ON ▪ Rafael & Bigauskas Architects

CO-OP Mall ▪ Aidrie, AB ▪ Riddell Kurczaba Architecture

The Economical Choice

Architectural precast wall panels are economical to produce, erect and maintain. Early consultation with a CPCI member will assure the most cost-effective approach.

Visit www.cpci.ca for a listing of CPCI members.



Precast Concrete Finishes

Architectural precast concrete flat panels are often composed of two concrete mixes (face concrete and back-up concrete).

The face concrete can contain special decorative aggregates, coloured sand, and grey or white cement. These natural materials are used in combination to achieve the desired colour and surface texture. It should be noted that natural materials vary in colour and texture and, therefore, may contain some colour variation. The back-up concrete is composed of conventional aggregates, sands, and grey cement. This reduces material costs by eliminating the need for full depth decorative face concrete.

Face Concrete Finishes

Exposed Aggregate:

Exposed aggregate finishes are achieved by coating the concrete form with a chemical retarder. The retarder slows the hardening of the concrete which comes in contact with it, to a depth determined by the strength of the retarder (up to 1/3 the depth of the coarse aggregate). Once the panel has cured and is stripped from the mold, the panel is moved to a wash area where high pressure water removes the uncured matrix (cement and sand) leaving the coarse aggregates in place and embedded in the hardened concrete.

Light Exposure: Only the surface skin of cement and sand is removed, exposing the edges of the coarse sand or aggregate closest to the surface.

Medium Exposure: A further removal of cement and sand causes coarse aggregates to appear approximately equal to the matrix in area.

Deep Exposure: Cement and fine aggregates are removed from the surface so that coarse aggregate becomes the major surface feature.

Sandblasting:

Sandblasting removes the cement-sand matrix by abrasion, a result of the impact of sand on the panel surface. Coarse aggregate exposure will not be as pronounced, with a greater percentage of matrix showing than that found in exposed aggregate finishes.

Light Exposure: Only the surface skin of cement and sand is removed, exposing the edges of the closest coarse sand or aggregate. It is difficult to get a uniform texture using this method.

Medium Exposure: A further removal of cement and sand causes coarse aggregates to appear approximately equal to the matrix in area.

Deep Exposure: Cement and fine aggregates are removed from the surface so that coarse aggregate becomes the major surface feature.

Acid Etching:

Acid etching of precast panels removes the cement film by chemical action to expose the aggregates. The resulting finish can simulate many of the natural stone finishes.

Light Exposure: Only the surface skin of cement is removed, exposing the edges of the coarse sand or aggregate closest to the surface.

Medium Exposure: A further removal of cement and sand causes coarse aggregates to appear approximately equal to the matrix in area.

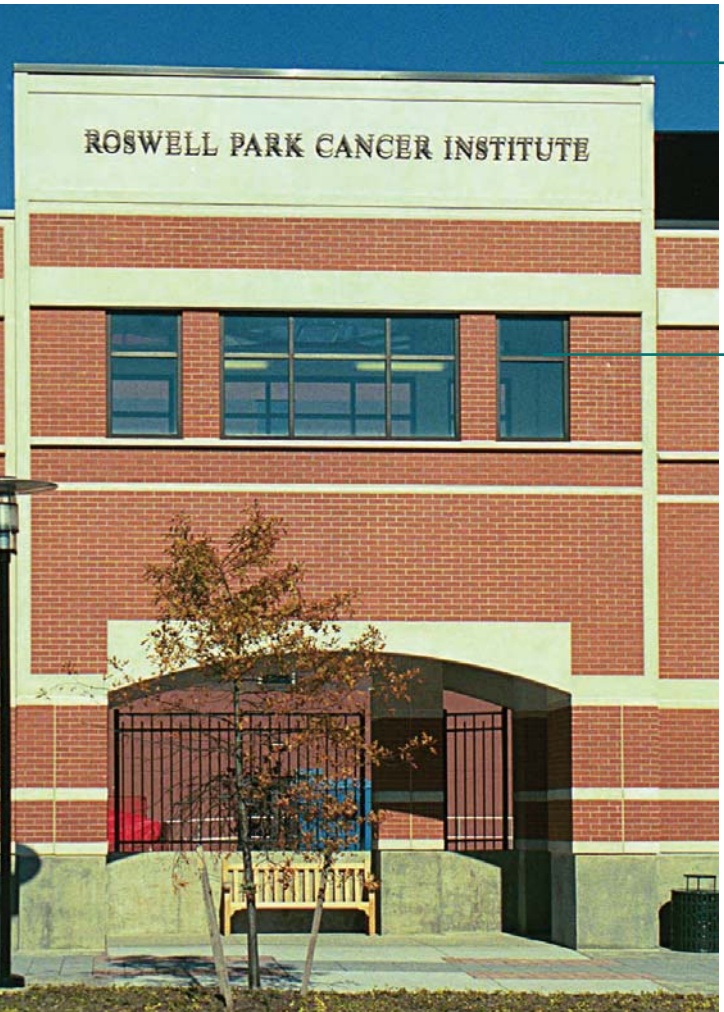
Deep Exposure: Cement and fine aggregates are removed from the surface so that coarse aggregate becomes the major surface feature.

Pigments:

The use of natural sands and aggregates to achieve the desired colour is preferable for long term colour stability. Special circumstances might dictate the need to use pigment in the face concrete.

Form Liners:

Interesting patterns can be achieved in precast concrete panels through the use of form liners. These liners are fabricated with a variety of textures such as sandblasted wood, rough sawn lumber, both small and large ribbed patterns, and running course brick.



Veneer Faced Panels

Granite, stone and brick faced precast concrete panels allow architects to incorporate the natural beauty of these materials economically onto the face of large precast panels.

Panel Sizes

Generally the bigger the better, less cost, fewer joints.

Considerations

- Panel thickness increases with longer, wider panels.
- Panel crane capacity at precast plant.
- Shipping constraints and availability of A-frame trailers.
- Type and size of cranes to be used at jobsite.

Consult your local CPCI members for advice.

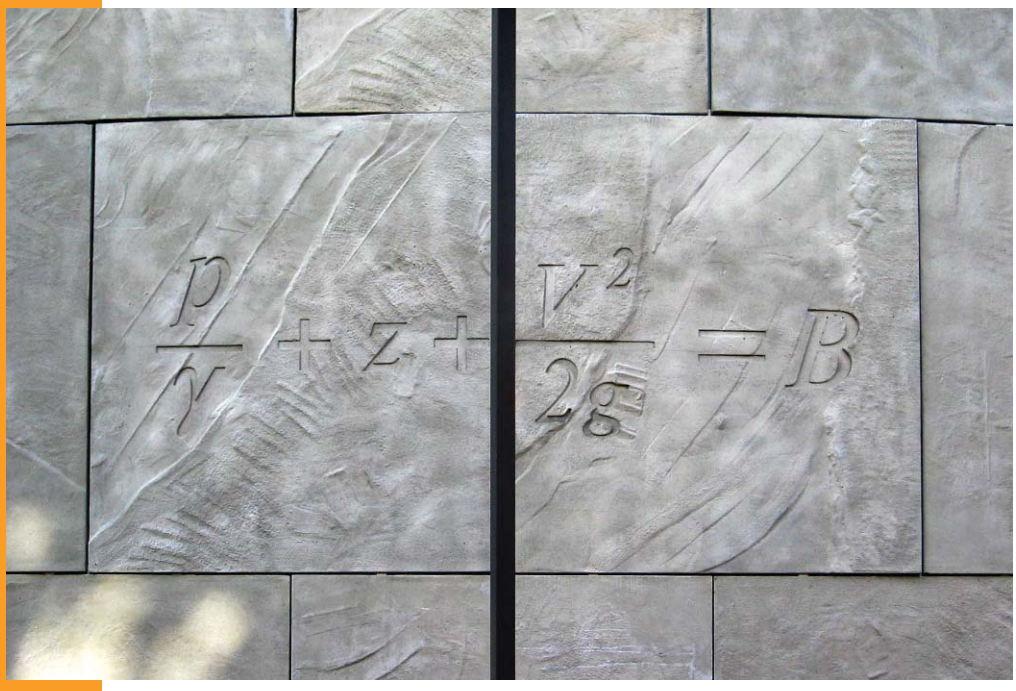
Roswell Park Cancer Institute ▪ Buffalo NY ▪ HOK Architects

La Tohu Pavilion ▪ Cirque du Soleil ▪ Montreal, QC ▪ Architectural Consortium: Schème consultants, architect Jacques Plante and Jodoin, Lamarre, Pratte & Associates

Custom Form Liner

The precast contractor had to innovate and work as artisans to make the architect's vision for this concert hall enclosure a reality. They crafted a shell patterned with tree branches, stones and sand that was then inserted into the mold to create the features that would appear on the surface of the panels. Not only are the textures and motifs the architect had envisioned for these panels evocative of the former quarry's geological strata, they also recall wood, canvas and stone, materials from which the circuses of old made their tents.

Lettering



Natural Resources Engineering Facility ▪ University of Alberta ▪ Edmonton, AB ▪ Cohos Evamy Architects

The application of lettering in precast concrete panels is no different than that of any other incised element. Appropriate draft or taper for stripping must be established for all lettering unless the characters are flexible or destructible. The pattern for letters is reversed in the mold. The architect used equations as a design element in the rough cut exterior of this university building.

Samples

1

Use of three aggregates with a white background matrix. “Deep exposure” using a form retarder.

2

Use of two aggregates with a white background matrix. “Deep exposure” using a form retarder.

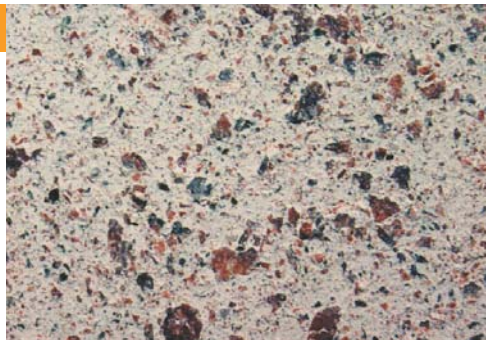
3

Limestone aggregate with a grey background matrix. “Deep exposure” using a form retarder.

4

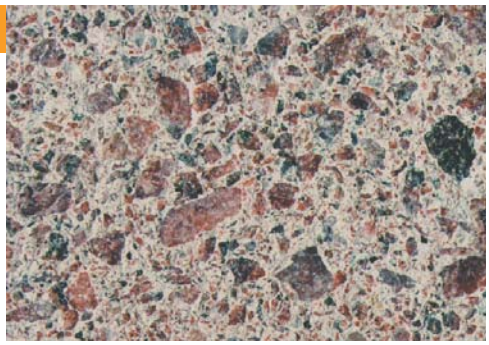
Alabama aggregate with a white background matrix. “Deep exposure” using a form retarder.

5



Use of two aggregates with a white background matrix. “Light exposure”. Light sandblast finish.

6

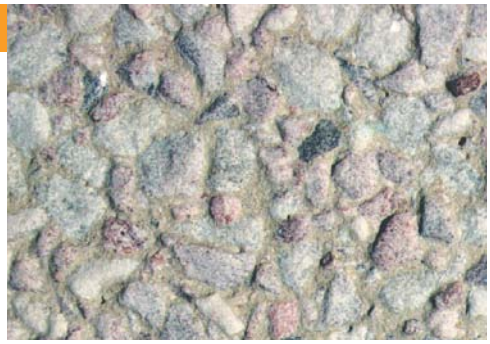


Use of two aggregates with a white background matrix. “Medium exposure”. Medium sandblast finish.

7

Use of two aggregates with a white background matrix. “Deep exposure”. Heavy sandblast finish.

8

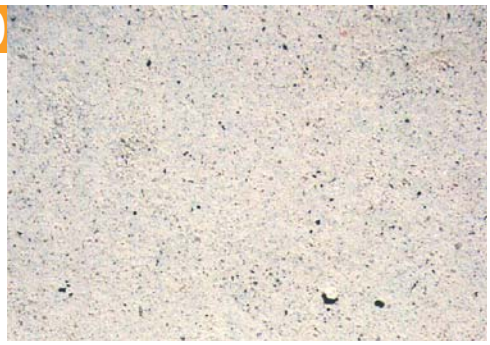


Flamingo quartz aggregate with a white background matrix. "Deep exposure". Heavy sandblast finish.

9

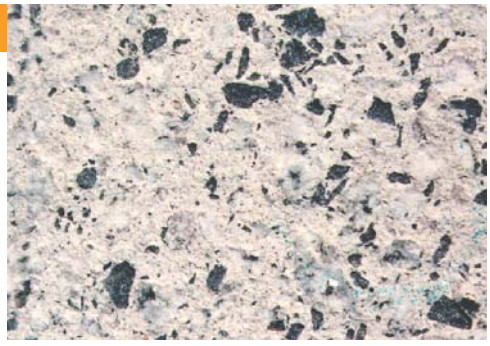
Flamingo quartz aggregate with a white background matrix. "Deep exposure". Using a form retarder.

10



Use of two aggregates with a white background matrix. "Light exposure". Light sandblast finish.

11

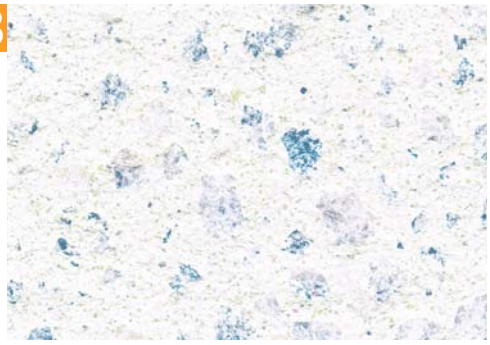


Use of two aggregates with a white background matrix. "Medium exposure". Medium sandblast finish.

12

Calcite aggregate with a white background matrix. "Light exposure". Light sandblast finish.

13



Calcite aggregate with a white background matrix. "Medium exposure". Medium sandblast finish.

14

Calcite aggregate with a white background matrix. "Deep exposure". Using a form retarder.

15

Use of aggregates and coarse sand with a white background matrix. "Light exposure". Acid etched finish.

Rain Screen & Modified Rain Screen Principles

Architectural precast concrete cladding, when combined with a properly designed joint, is an effective barrier to both the infiltration of air and rain, and the exfiltration of air and moisture.

The concrete panel itself will not permit the passage of water due to momentum of rain drops, capillarity action, gravity and air pressure. Hence, although concrete provides a completely impervious outer skin, it is essential that these same forces be controlled at the joints between precast components and at the interface between the precast panels and other building materials such as windows, doors, curtain walls, masonry, etc.

This can be done most readily by providing an air chamber behind the wetted face to ensure that the air pressure in this chamber is always equal to that on the face of the wall. For this balance of pressures to occur, it is essential that there be a good air seal on the building side of the chamber and suitable ventilation to the outside.

The better approach to wall construction is the TOTAL PRECAST WALL which combines all the essentials of the rain screen principle but none of the draw backs. This total wall is comprised of an outer wythe (precast concrete or stone veneer), a vented and pressure equalized cavity (if the stone veneer is porous), rigid insulation (to provide the necessary thermal resistance) and an inner concrete wythe which fulfills the structural and the air vapour barrier requirements for the performance of a complete wall system.

An effective rain screen and modified rain screen design relies on three factors:

- an interior airtight seal
- a vented air chamber or vented air space
- an exterior rain barrier, properly vented

Brampton Civic Hospital ▪ William Osler Health Centre ▪ Brampton, ON ▪ Adamson and Associates

Rain Screen System

With a true rain screen system, the non-insulated precast wall panels merely act as a veneer providing a “rain screen” for those materials behind which comprise the air/vapour barrier, a vented drainage cavity, an insulation component and a structural support system of the wall assembly. The exterior of the precast joints are caulked and vented to act as an initial moisture block and provide a finished appearance. The cavity between the back face of the precast and exterior face of the insulation is flashed and vented to drain any moisture to the exterior of the system and to encourage the exchange of air in the cavity to dissipate any accumulated condensation.

A difficulty with a single facee precast rain screen panel system is that the precast concrete may need to be installed after the completion of the building envelope. The connectors must penetrate the insulated air/vapour assembly to connect to the structural supports. Due care must be taken to ensure these connection pockets are properly sealed and made weathertight after precast installation.

Total precast rain screen panels can be manufactured with a facing of precast brick or stone veneer, an air gap, insulation and a structural concrete backing panel.

Modified Rain Screen

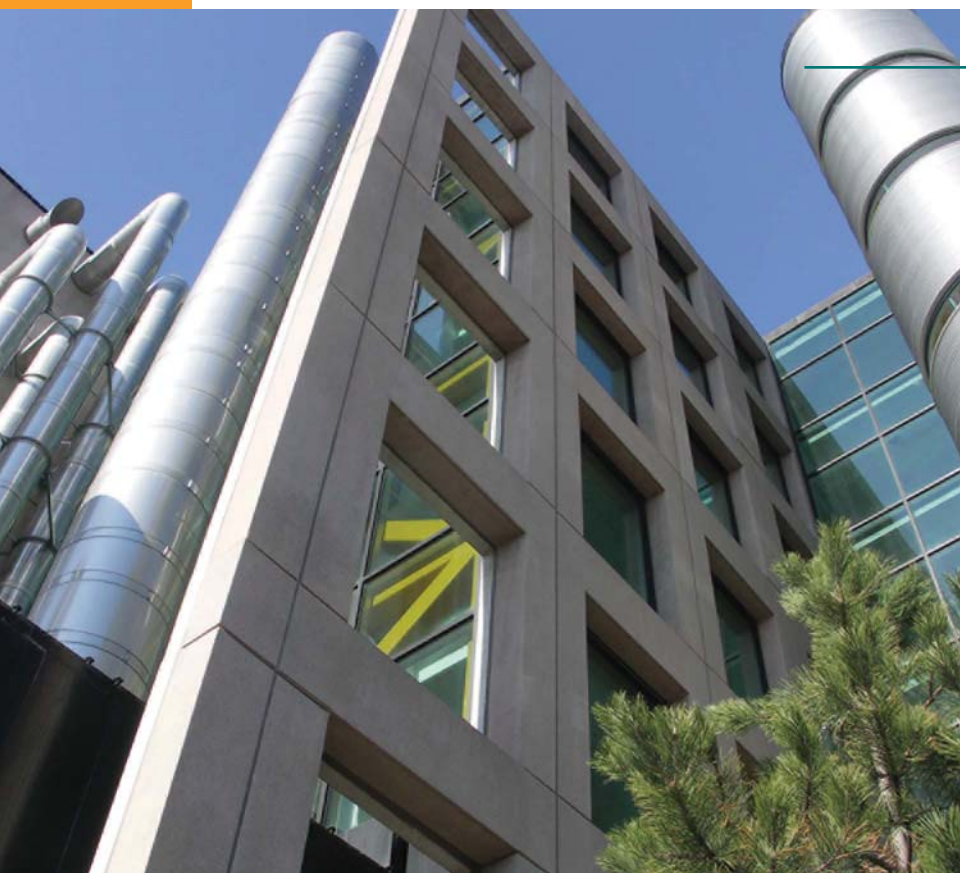
Modified rain screen assemblies have been successfully used for many years. A modified rain screen is the development of the previously mentioned rain screen principles, but within the confines of the precast joints. The back face of the precast joints are caulked tight, developing the air/vapour barrier. The exterior joints are caulked but allow for the exchange of air through the introduction of weep holes and breather openings. The result is an air chamber within the precast joint that is vented to the outside. With air chamber pressure equalization to the exterior, there is no force to drive rain into the joint. Any moisture entering the joint will cling to the joint walls and then be drained out by a transverse seal. Insulation is applied to the back surface of the precast, along with an air-vapour barrier. The finished interior surface then completes the wall assembly.

Bankers Hall ▪ Calgary, AB ▪ Cohos Evamy Architects

Stone, Granite or Marble Faced Precast Wall Assemblies

In addition to providing weather tight caulked joints at precast to precast real joints, consideration must be given to the proper caulking of veneer panels. Only one properly vented exterior bead is required between the veneer panels. At precast panel joints, the following beads of caulking are all required to complete the assembly: an interior seal (precast to precast), a vented exterior transverse seal (precast to precast), and a vented bead of caulking, veneer panel to veneer panel.

University of Ottawa School of Information Technology and Engineering ▪ Ottawa, ON ▪ IKOY Architects

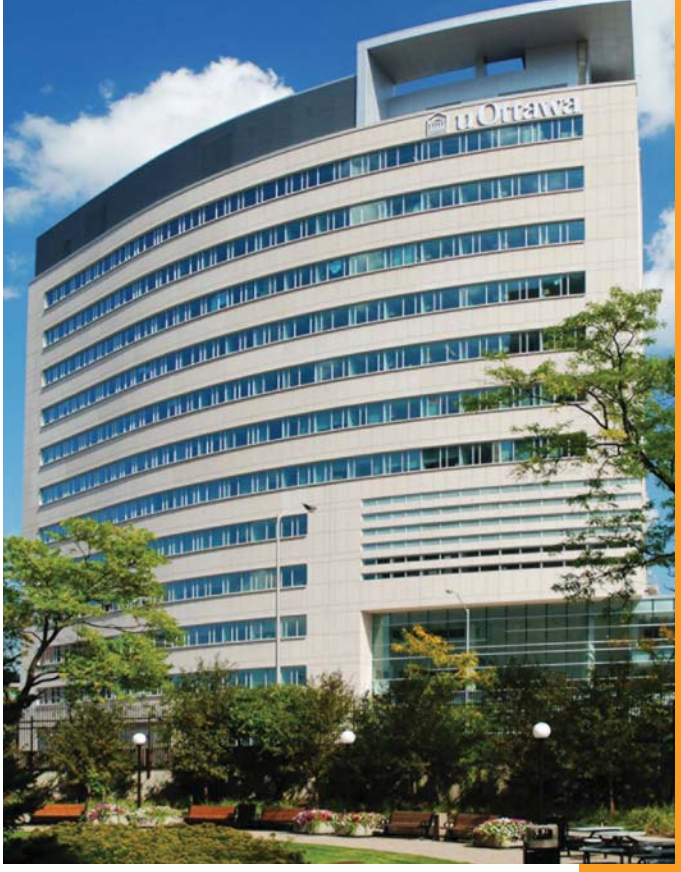


Summary

Modification of the panel profile, panel edges, knowledgeable use of panel connectors, proper joint widths, and the correct use/application of sealant materials are all essential for the proper performance of a rain screen or a modified rain screen joint system.

Please contact your local CPCI member, joint sealant supplier and professional precast sealant applicator for more specific details, or for information about fire rated joint assemblies.

Sustainable Design



Pavillion Desmarais Building ▪ University of Ottawa ▪ Ottawa, ON ▪ Moriyama & Teshima Architects

Precast concrete components can contribute in an integrated design process to achieve sustainable designs. Precast concrete construction can assist architects to achieve as many as 23 to 26 points in the LEED building rating system by the CaGBC.

- Precast concrete walls used with integral insulation can provide energy benefits that exceed the benefits of mass or insulation used alone in most climates.
- Precast concrete sandwich wall panels used as an interior surface can save materials by eliminating the need for interior framing and drywall.
- The raw materials used in precast concrete manufacturing are generally sourced locally. Precast panels are usually shipped locally as well.
- Precast concrete walls can be designed to be disassembled, saving materials and extending the service life of the panels.
- Precast concrete's durability creates a long life-cycle with low maintenance, reducing the need for replacement and maintenance during a building's life.
- Precast concrete is manufactured in plants under tight quality controls. Precast concrete eliminates construction waste and minimizes transportation and disposal costs.
- Using plant-manufactured precast concrete components with just-in-time delivery reduces site disturbance and material storage requirements.
- Precast concrete contains recycled steel content and may contain recycled supplementary cementitous materials (fly ash, slag or silica fume).

Thermal Mass Not Appreciated

One of precast concrete's key benefits is its high thermal mass, a property that allows concrete to both cool down and to store heat to help moderate daily temperature swings. Recent studies by the U.S. Department of Energy (DOE), have demonstrated that mass in exterior walls reduces annual energy costs in buildings. Thermal mass helps shift peak loads from mid-afternoon in the summer to after 5 PM, reducing energy consumption. In winter, energy can be saved by storing heat in the concrete at night to be released during the daytime.

The Environmental Council of Concrete Organizations (ECCO) reports: "The guiding principle for all thermal-mass standards has been performance. These standards have successfully translated the behavior of thermal mass into understandable and easy-to-use terms. The result is that thermal mass has become a feasible element of building design."

Visit www.sustainableprecast.ca for more information.

Precast Helps Projects Attain LEED Certification

Precast concrete's local manufacturing, energy efficiency, recyclability and minimal waste are key factors in meeting environmental standards.

Many owners are constructing sustainable buildings. Attention has been spurred by the Leadership in Energy & Environmental Design (LEED) standards specified by the Canadian Green Building Council (CaGBC). With attention to climate change and a desire to lower the consumption of energy and materials, the use of precast concrete construction can assist designers with "green" advantages.

Durability

Buildings constructed using very robust materials can withstand the elements and occupant use for a very long time. Precast concrete building structures with precast cladding can have life expectancies of over a hundred years.

Le Vistal ▪ Montreal, QC ▪ Jean-Pierre Bart Architects

Precast Concrete Sandwich Wall Panels

Precast concrete sandwich wall panels can help achieve LEED certification in a variety of ways; their ability to be recycled, being locally manufactured, having high thermal mass and incorporating integral insulation. These attributes reduce the expended energy needed to manufacture, transport and erect precast concrete panels, key LEED requirements.

Minimum Energy Use

Precast concrete sandwich wall panels can be constructed with high R values that will lower HVAC demands. Large precast concrete panels have fewer, better sealed joints, reducing uncontrolled air infiltration. These attributes can help a project earn many of the LEED credits in the Optimize Energy Performance category.

M-Tech Headquarters ▪ Calgary, AB ▪ McKinley Dang Burkart Design Group

The One King West tower in downtown Toronto is the most slender building in the world and at 51 stories is the tallest residential building in Canada. ▪ Stanford Downey Architects

Leon's Retail Store ▪ Edmonton, AB ▪ Murphy Hilgers Architects

Indoor Air Quality

Mold:

Mold and a lack of air circulation can cause considerable damage to a building. The proper design of building envelopes built with the correct construction materials is a key way to reduce the presence and potential damage from mold.

The concrete, foam and steel in concrete wall systems are not a food source for mold growth. However, organic materials such as floor decking, paper faced drywall and carpet used inside buildings can provide a food source for mold growth and should be treated accordingly.

Woodmont High School ▪ Piedmont, SC ▪ Perkins & Will, Design Architect, Craig Gaulden Davis, Architect of Record

Increased energy costs and a limited supply of fuel have forced the construction of more energy efficient buildings. Past construction practices allowed moisture from occupant activities to readily escape, along with conditioned air. Sealing a building envelope against air loss is critical in achieving superior energy performance. Problems can arise when moisture and humidity levels are uncontrolled.

Controlled Production:

Precast concrete is produced in a controlled and protected environment in a process that resists moisture intrusion. Precast concrete is made of 35 MPa concrete that is virtually impermeable to moisture migration.

Quicker Close-in:

The speed of construction allows a precast concrete structure to be completed faster, leaving the interior exposed to humidity and moisture for a shorter time. This is particularly vital for the installation of the heating, ventilation, and air-conditioning (HVAC) system, that is a common location for mold formation.

Fewer Entry Points:

Because of their panelized construction and 2 stage joint seals, fewer points of potential moisture penetration exist with precast concrete cladding panels. Maintenance requirements are also minimal.

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

CPCI has reintroduced an updated audit based process certification program to ensure conformance to CSA A23.4 and related standards. This program reintroduces strict measurable nationwide standards for precast certification. CPCI Certification is a superior program at no additional cost.

Important benefits:

1. Easy identification of plants committed to fulfill the highest level of certification available in North America.
2. Assurance that precast manufacturers have demonstrated their ability to manufacture quality products and have an ongoing quality system in place.
3. Certified manufacturers have a confirmed capability to produce superior products and systems.
4. Get the job done right the first time by qualified manufacturers - saving time, money and headaches.
5. Quality products will help speed installation and reduce construction time.
6. Deal with established precast manufacturers who have earned a reputation for superior, reliable workmanship.
7. No additional cost to you – CPCI Certified Manufacturers pay the certification fees.
8. Assurance that CPCI Certified Manufacturers will furnish products ideally suited for each project.

Program requirements

The manufacturing of precast concrete products must conform to the requirements of:

- CSA Standard A23.4-05 Precast concrete — Materials and construction
- PCI Quality Control Manual; MNL-116 - Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products
- PCI Quality Control Manual, MNL-117 - Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products.

The more stringent requirements of these specifications are the governing criteria.

Eligibility

Any qualified manufacturer located in Canada or the United States that produces precast concrete structural and architectural precast concrete products and complies with the requirements of the CPCI Certification Program is eligible for participation.

How is precast certification a requirement of Canadian building codes?

National Building Code of Canada (2005) – Division B:

Clause 4.3.3.1.(1) - Buildings and their structural members made of plain, reinforced and prestressed concrete shall conform to CSA A23.3, Design of Concrete Structures.

Clause A-4.3.3.1(1) - Precast Concrete- CSA A23.3, Design of Concrete Structures, requires precast concrete members to conform to CAN/CSA-A23.4, *Precast Concrete – Materials and Construction*

CSA A23.3-04 – Design of Concrete Structures:

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 A23.4-05 – 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.

Audits

Quality Audits are the heart of the precast certification program. Audits ensure manufacturers have a quality system in place that is consistently adhered to. Audits ensure conformance to standards, A23.4, MNL-116 and MNL-117. Audits evaluate and identify areas requiring upgrading or corrective action (continual improvement).

There are a minimum of two regular audits in each full calendar year.

- The audits determine the conformity of the manufacturer's quality system and compare the finished products with the specified requirements.
- The audits determine the effectiveness of the implemented quality system and confirm that the manufacturer meets the regulatory requirements.
- The audits provide manufacturers with the opportunity to improve their quality system.
- A detailed audit determines the grade for each division of the audit manual together with a grade for each product group to determine the overall plant performance.

Auditor

Adherence to the certification program is monitored by an independent certification organization responsible to conduct quality audits in a fair and objective manner with equal treatment of all manufacturers.

The auditors are professional engineers, trained and knowledgeable in the evaluation of precast concrete manufacturing plants and procedures.

Quality Assurance Council

A multidisciplinary body oversees the certification program with representation by an independent architect, engineer and building official to oversee the certification program.

How to specify CPCI Certification?

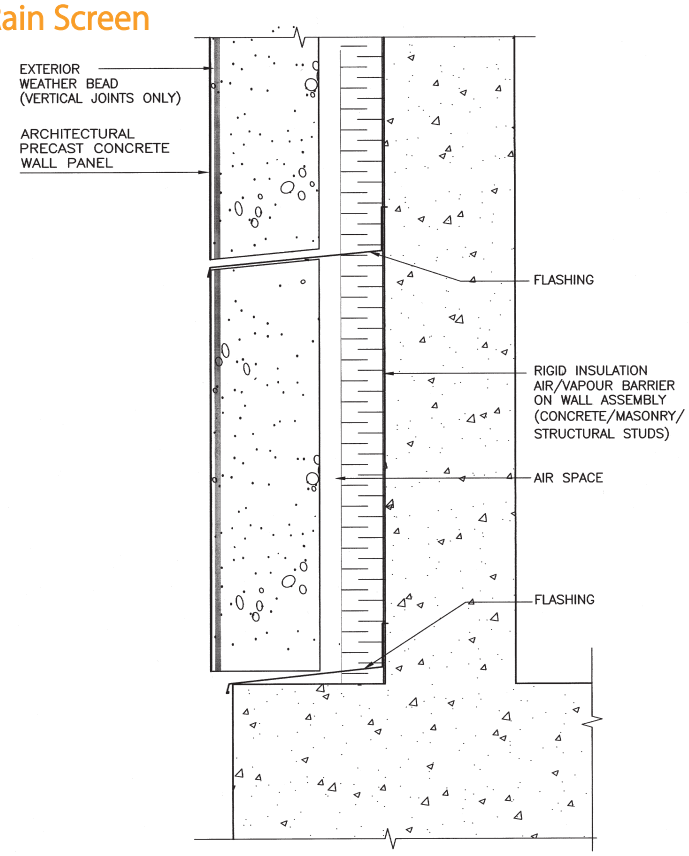
The Construction Specifications Canada (CSC) TEC-AID for 03 45 00 Architectural Precast Concrete and 03 41 00 Structural Precast/Prestressed Concrete contains the following Clause 1.8 Quality Assurance:

.2 Manufacturer: certified to Canadian Precast/Prestressed Concrete Institute (CPCI) Certification Program.
  .1 Manufacturer must meet requirements of CSA A23.4, including Appendices A and B, together PCI MNL-116 and 117 and CPCI certification requirements.

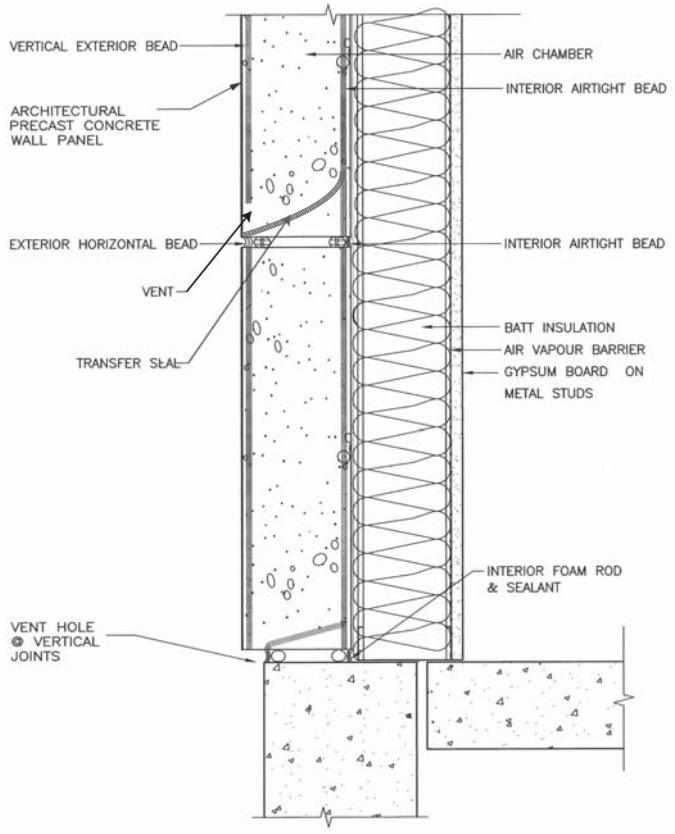
See www.precastcertification.ca for a listing of certified plants.

Precast Concrete Caulking Details

Rain Screen

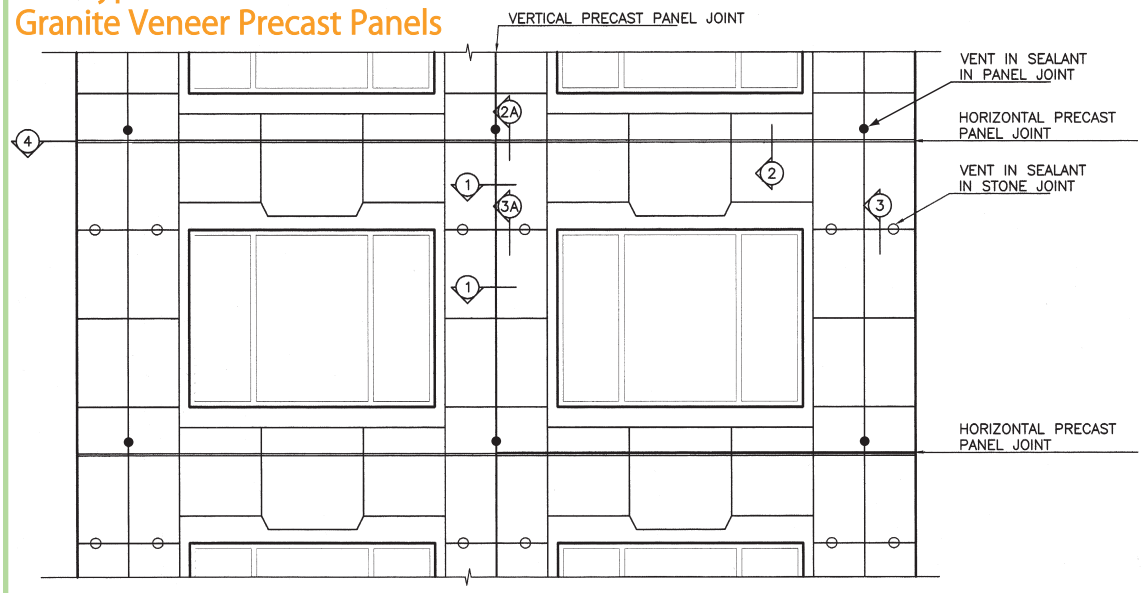


Modified Rain Screen

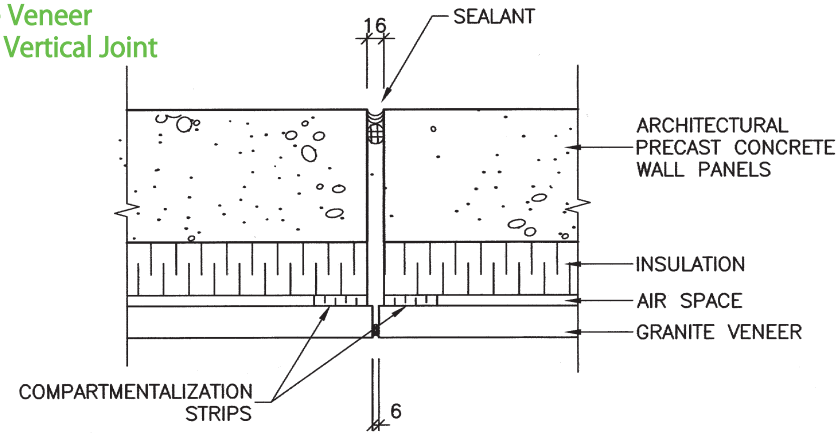


Precast Concrete Caulking Details

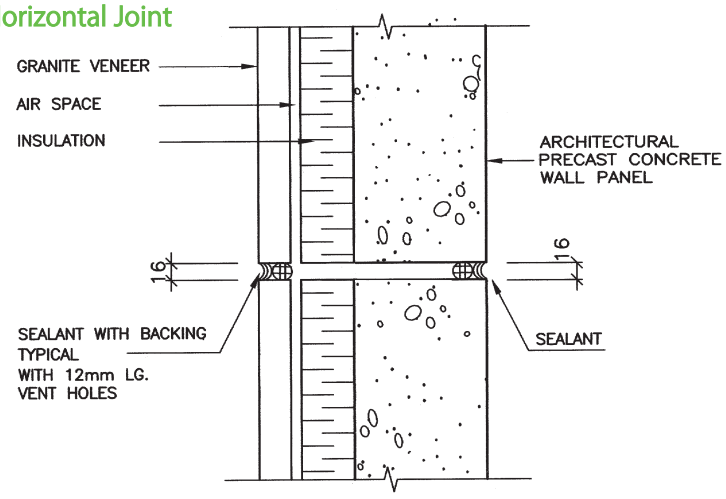
Part Typical Elevation of Granite Veneer Precast Panels



1 Granite Veneer Typical Vertical Joint

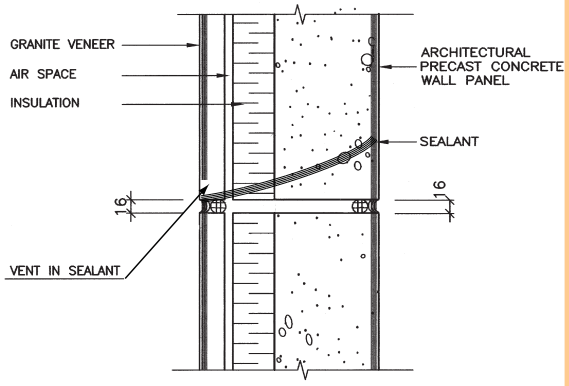


2 Granite Veneer Typical Horizontal Joint

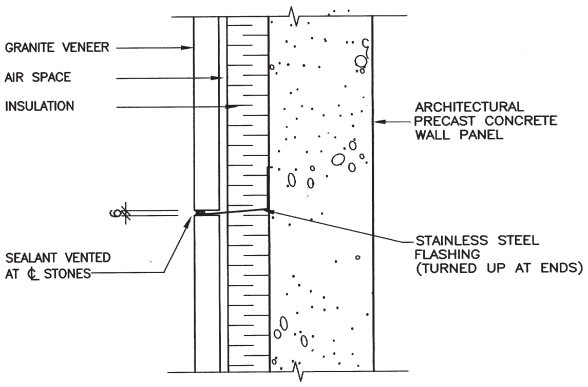


Precast Concrete Caulking Details

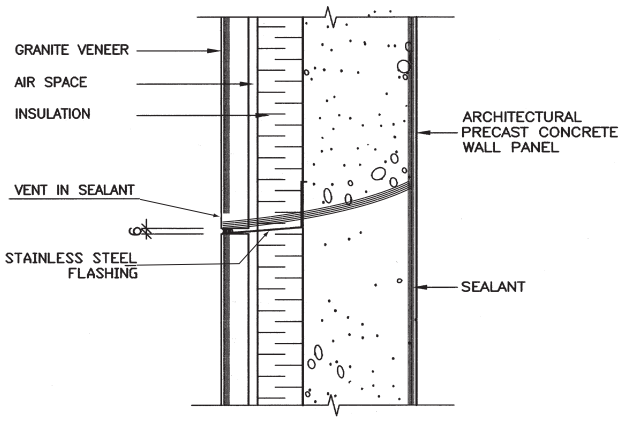
2A Granite Veneer Vertical Seal at Horizontal Joint



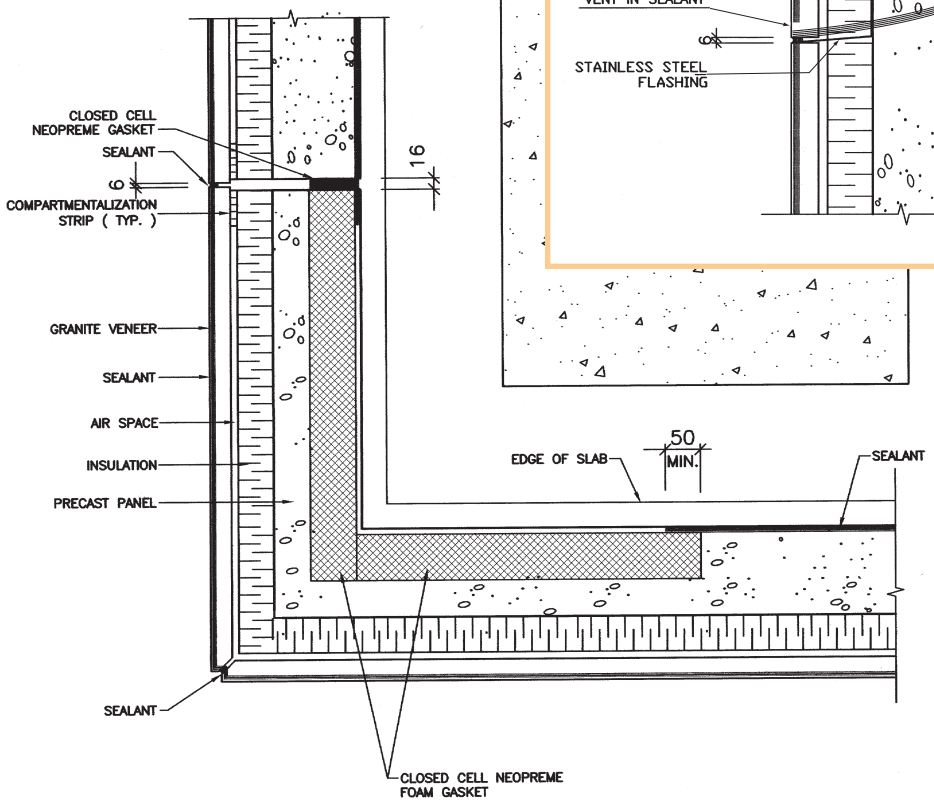
3 Granite Veneer Detail at Flashing



3A Granite Veneer Vertical Seal at Flashing

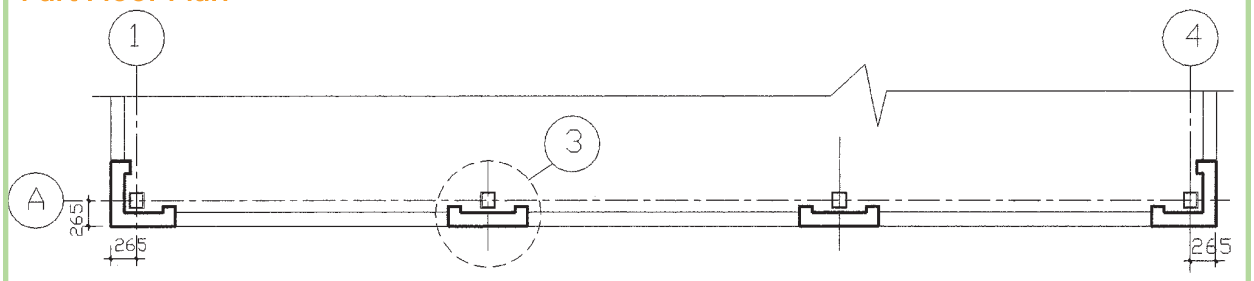


4 Granite Veneer Plan Detail at Corners

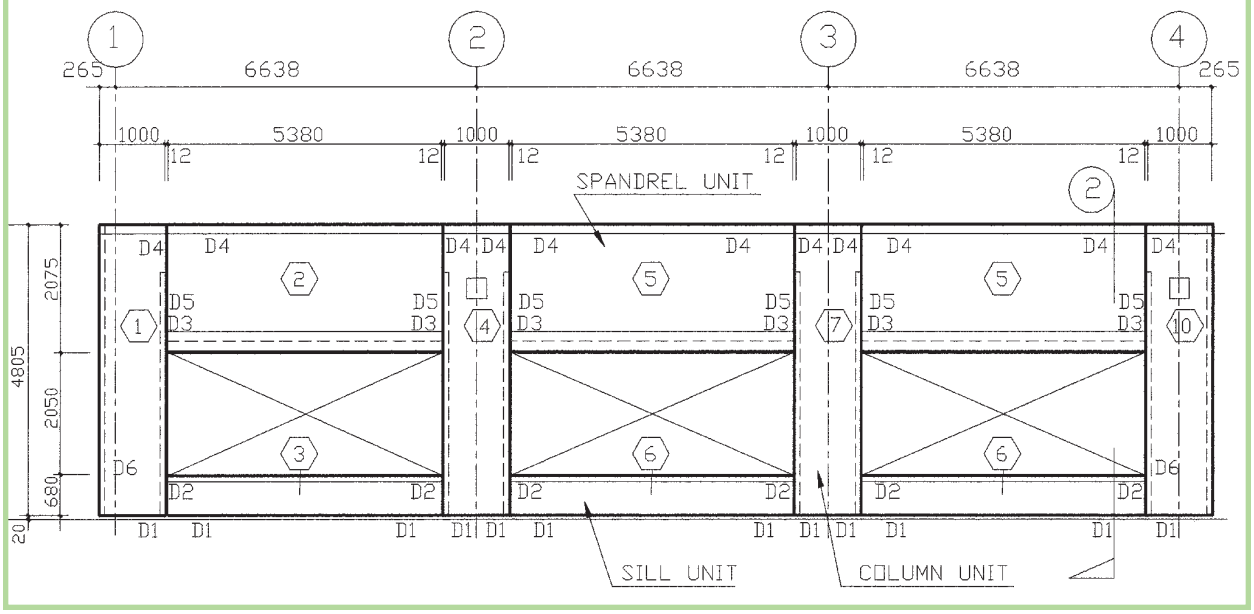


Architectural Precast Panels Connected to a Steel Structure

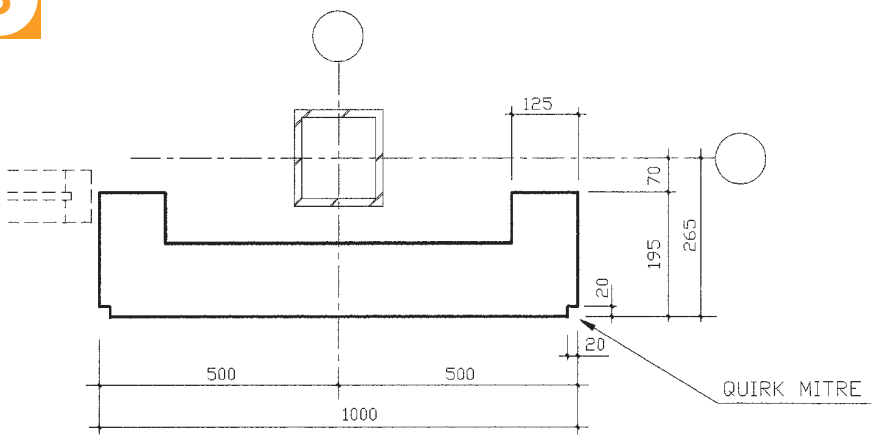
Part Floor Plan



South Elevation

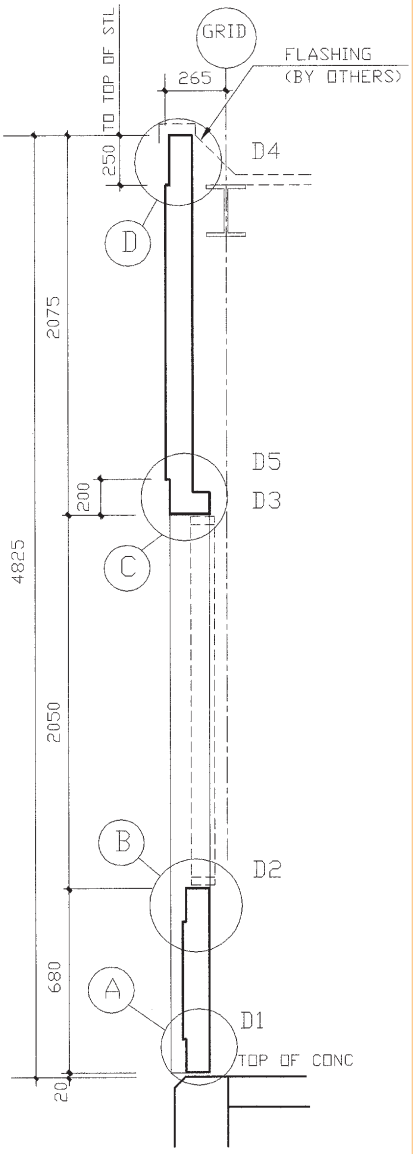


3 Plan Detail

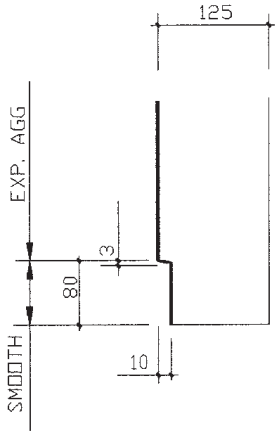


Architectural Precast Panels Connected to a Steel Structure

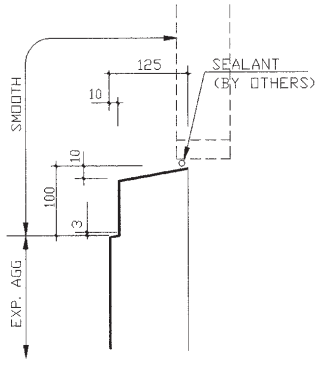
1 Section - 1



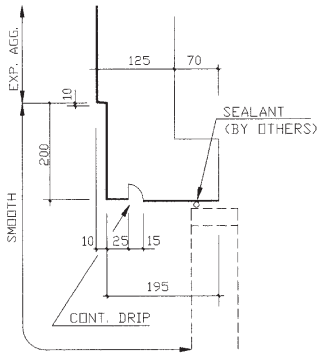
A Suggested Detail



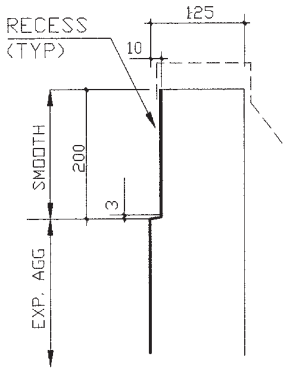
B Suggested Detail



C Suggested Detail

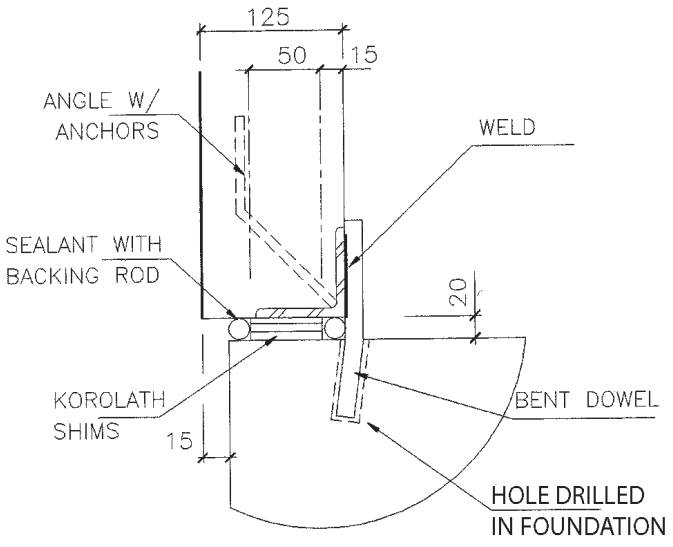


D Suggested Detail



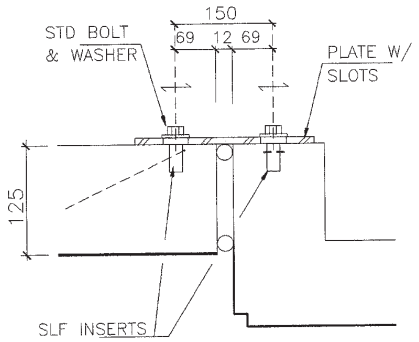
Connection Details for Architectural Precast Panels Connected to a Steel Structure

D1 Section
Panel to Foundation Connection



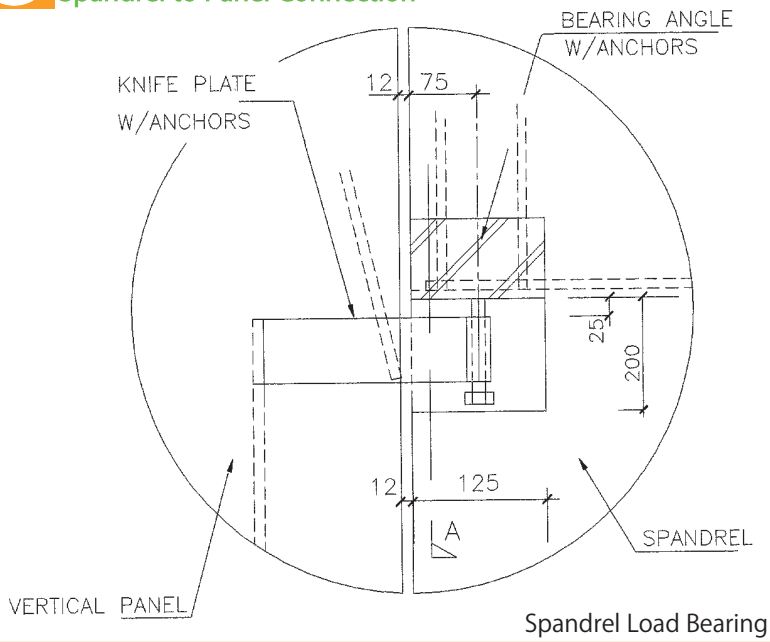
Load Bearing & Lateral

D2 Plan
Panel to Panel Connection



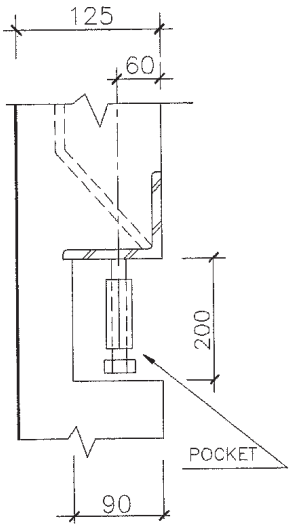
Lateral

D5 Back View
Spandrel to Panel Connection



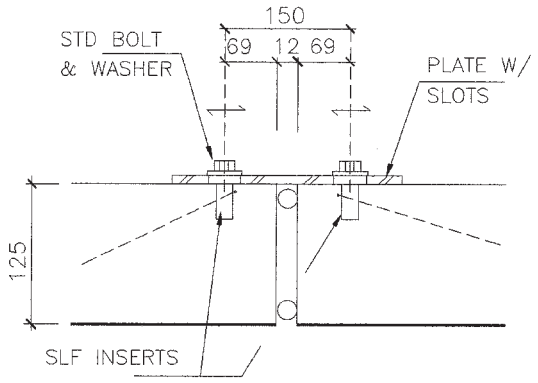
Spandrel Load Bearing

A Section



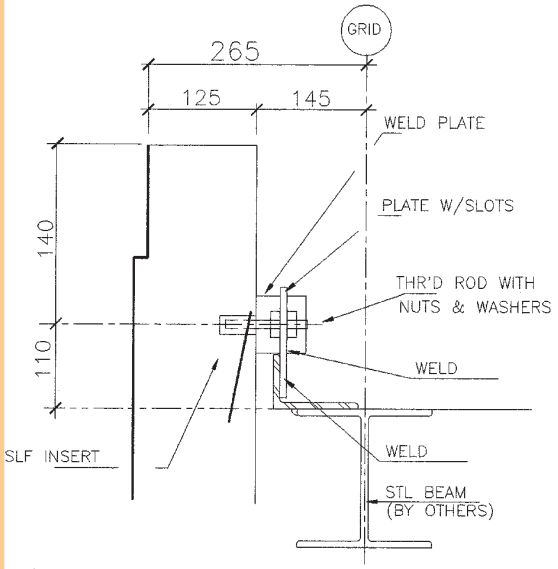
Connection Details for Architectural Precast Panels Connected to a Steel Structure

D3 Plan
Panel to Panel Connection



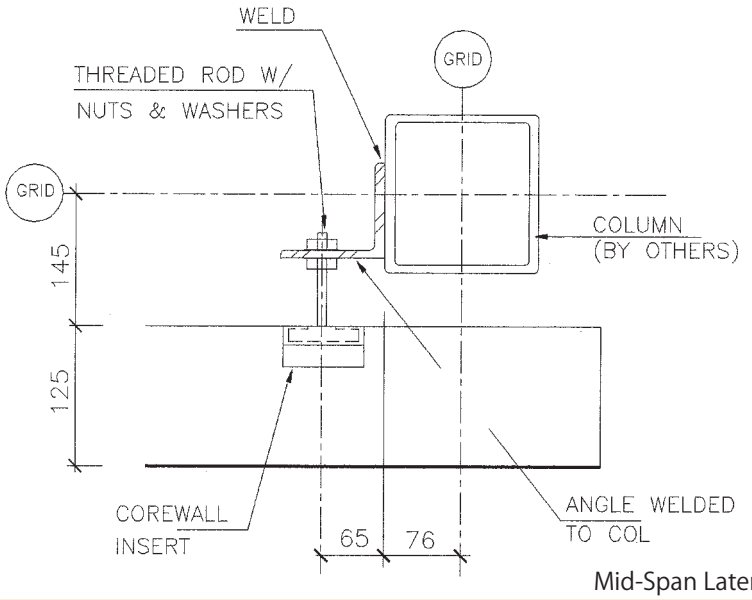
Spandrel Lateral

D4 Section
Top Panel to Beam Connection



Top Lateral

D6 Plan
Column Connection



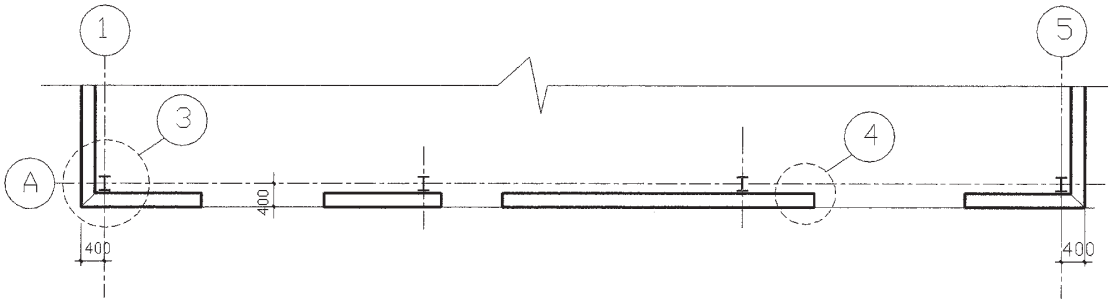
Mid-Span Lateral

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

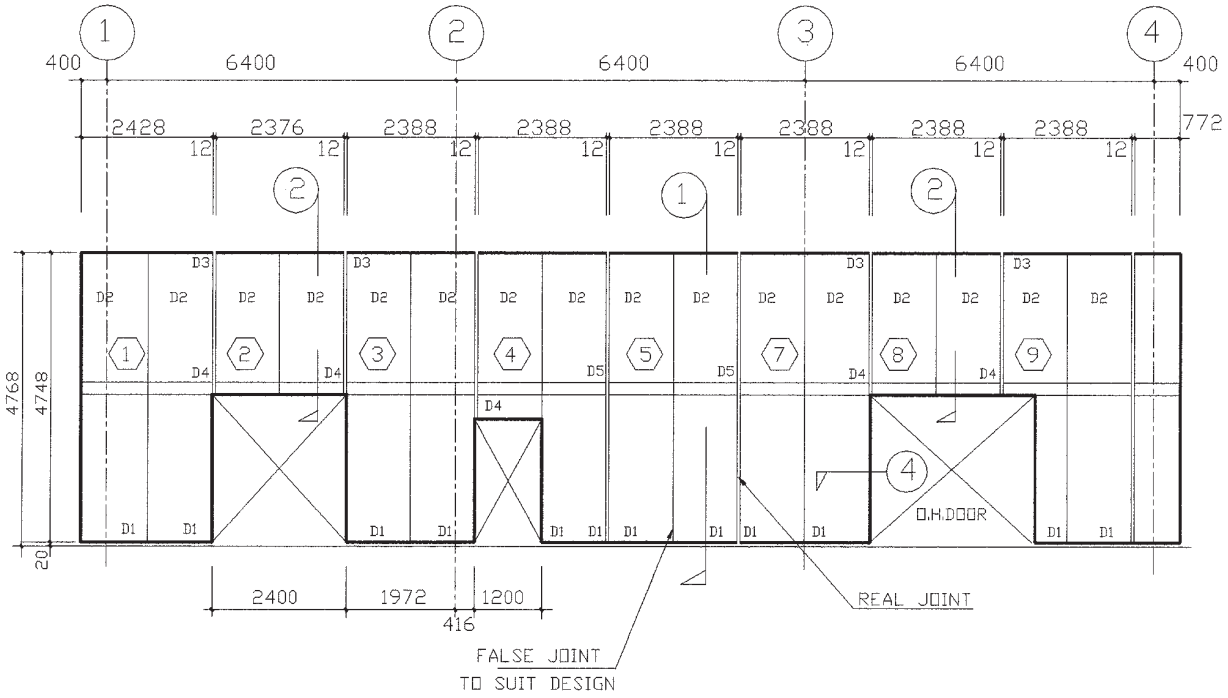
Panel connections will be heavier in seismic regions.

Single Storey Insulated Precast Panels

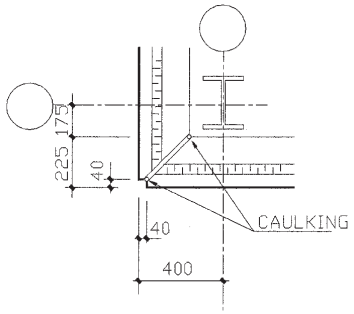
Part Floor Plan



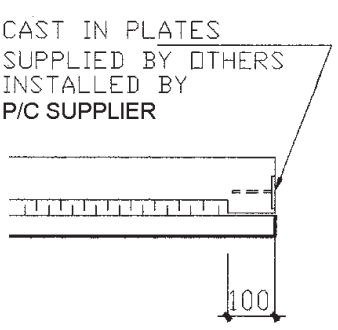
North Elevation



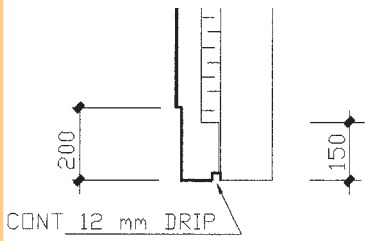
3 Plan Detail



4 Plan Detail

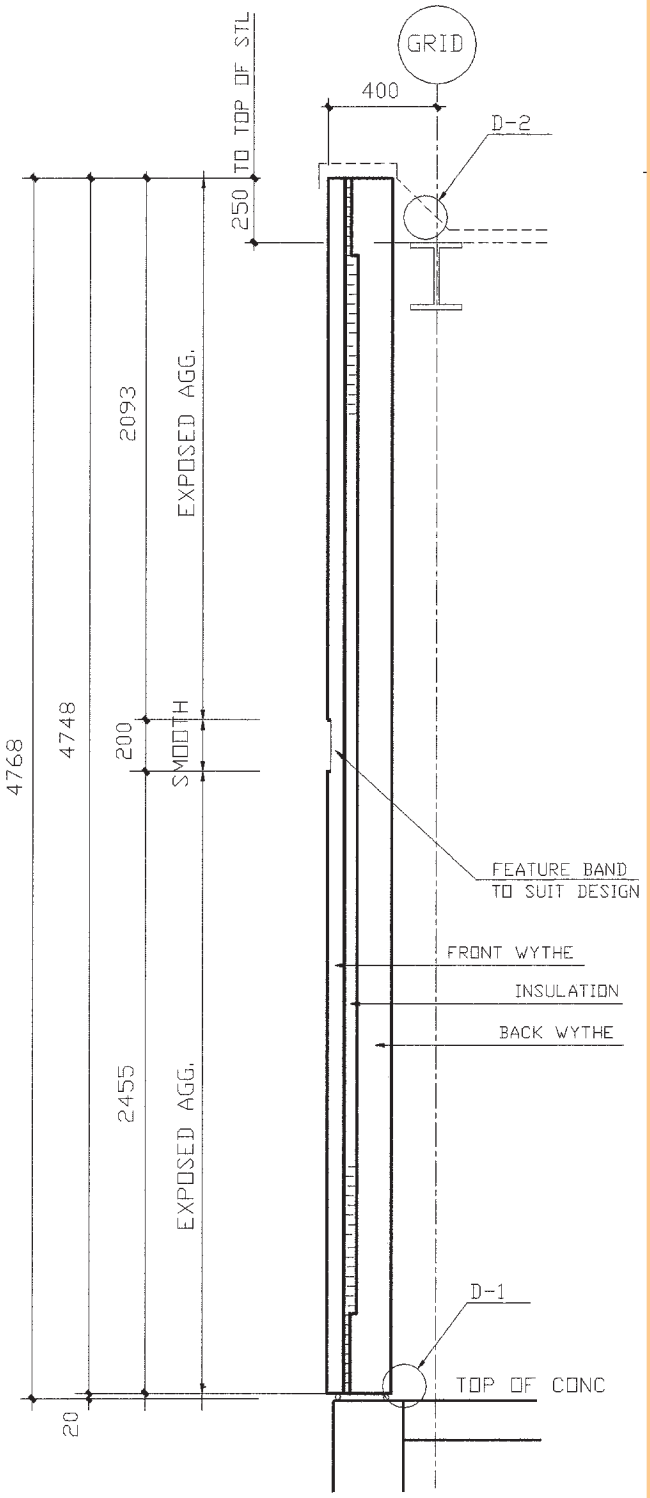


5 Section

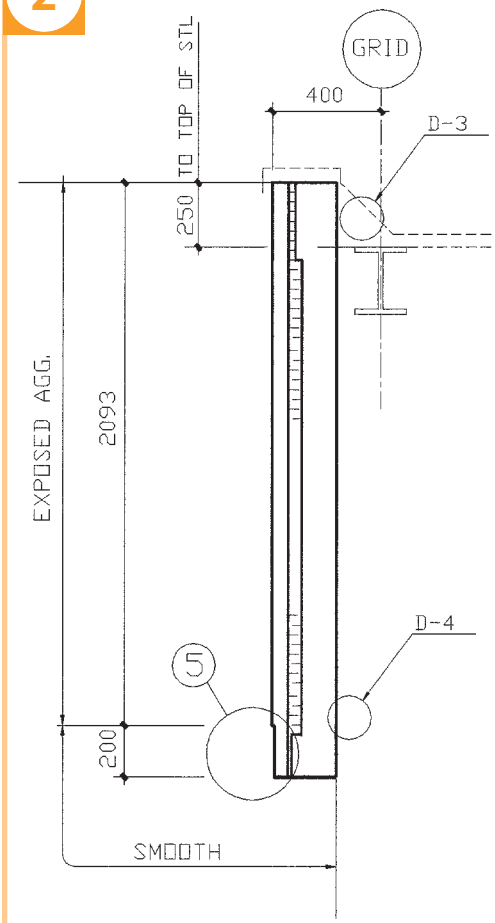


Single Storey Insulated Precast Panels

1 Section

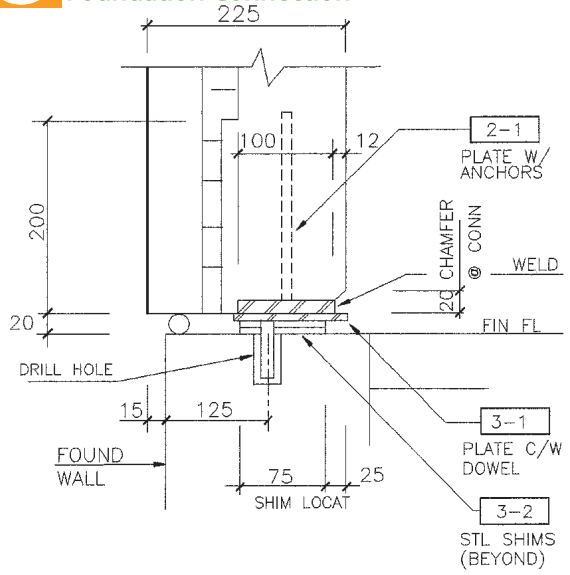


2 Section



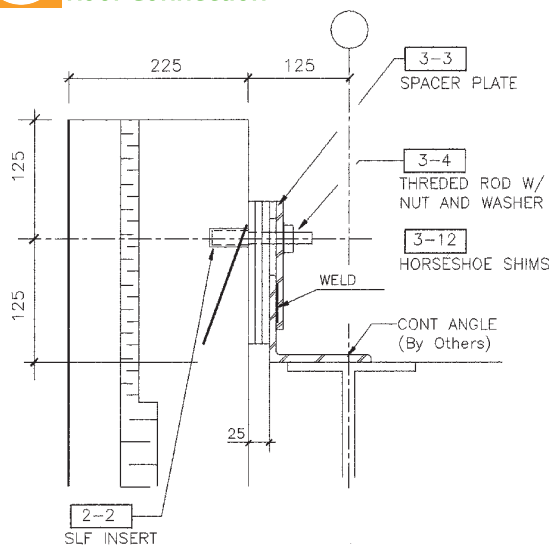
Connection Details for Insulated Precast Panels

D1 Section Foundation Connection



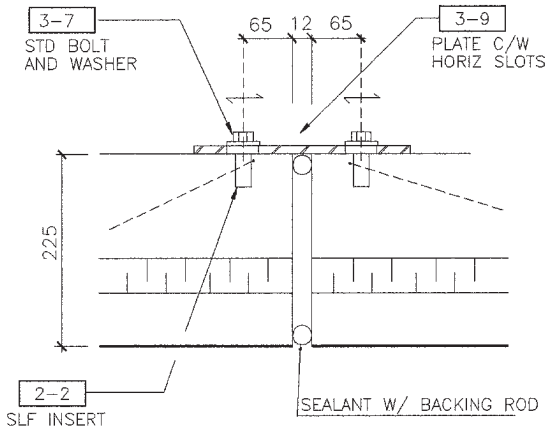
Load Bearing and Lateral

D2 Section Roof Connection



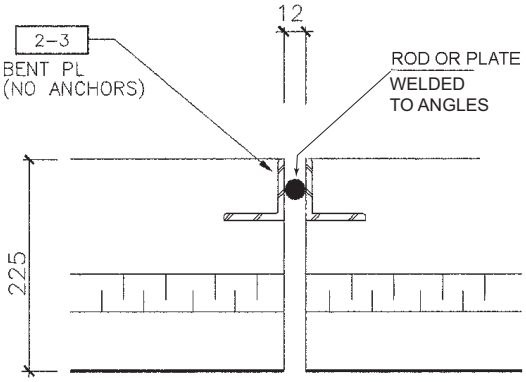
Top Lateral

D4 Plan Panel to Panel Connection



Lateral

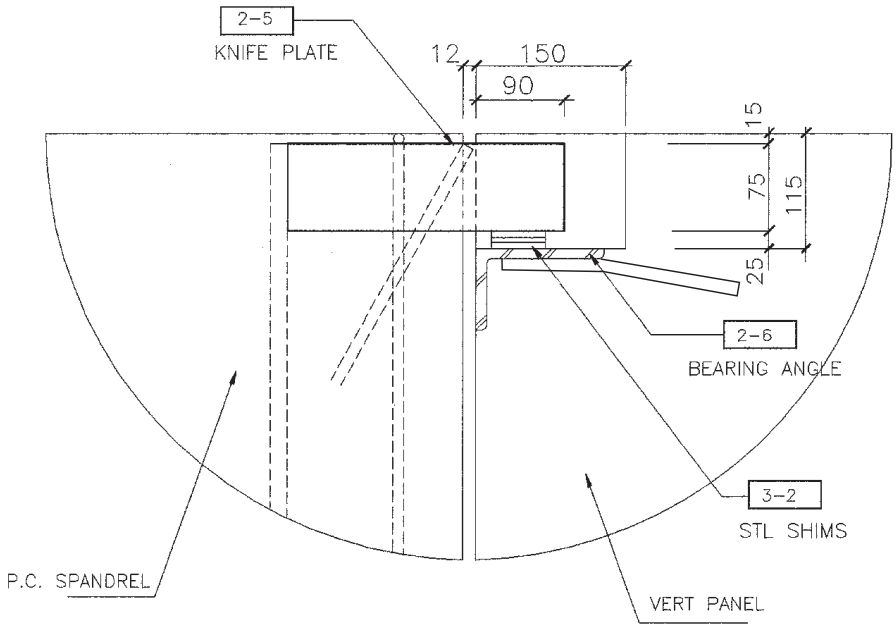
D5 Plan Panel to Panel Connection



Lateral

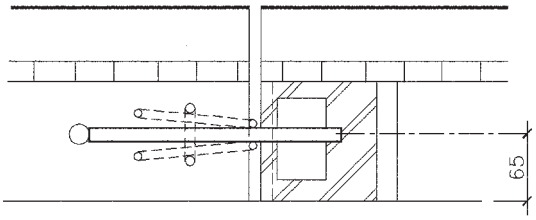
Connection Details for Insulated Precast Panels

D3 Back Elevation



Load Bearing Connection at O.H. Doors

D3 Top View

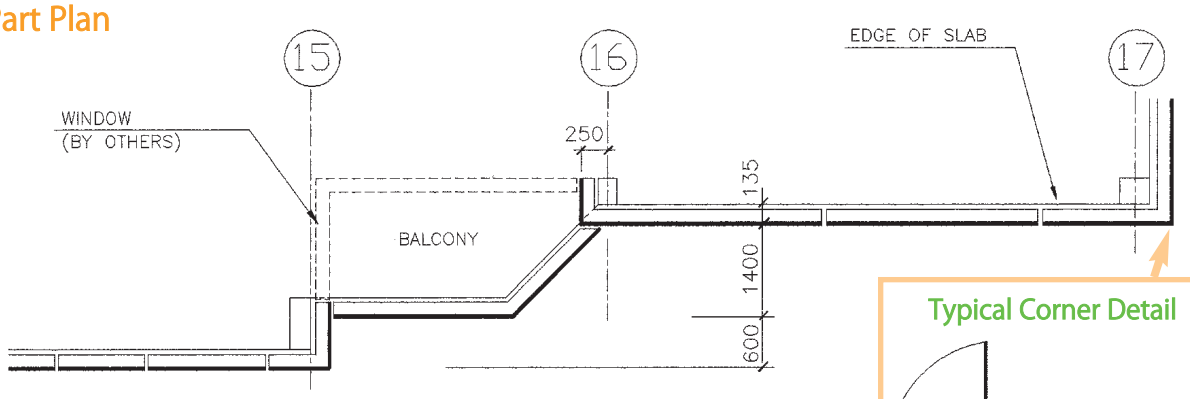


Load Bearing Connection at O.H. Doors

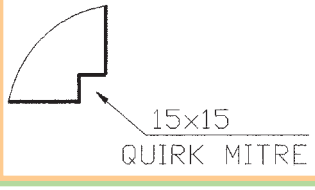
All connections shown are to be used for conceptual design only. Panel connections will be heavier in seismic regions.

Multistory Wall Panel Connected to a Concrete Structure

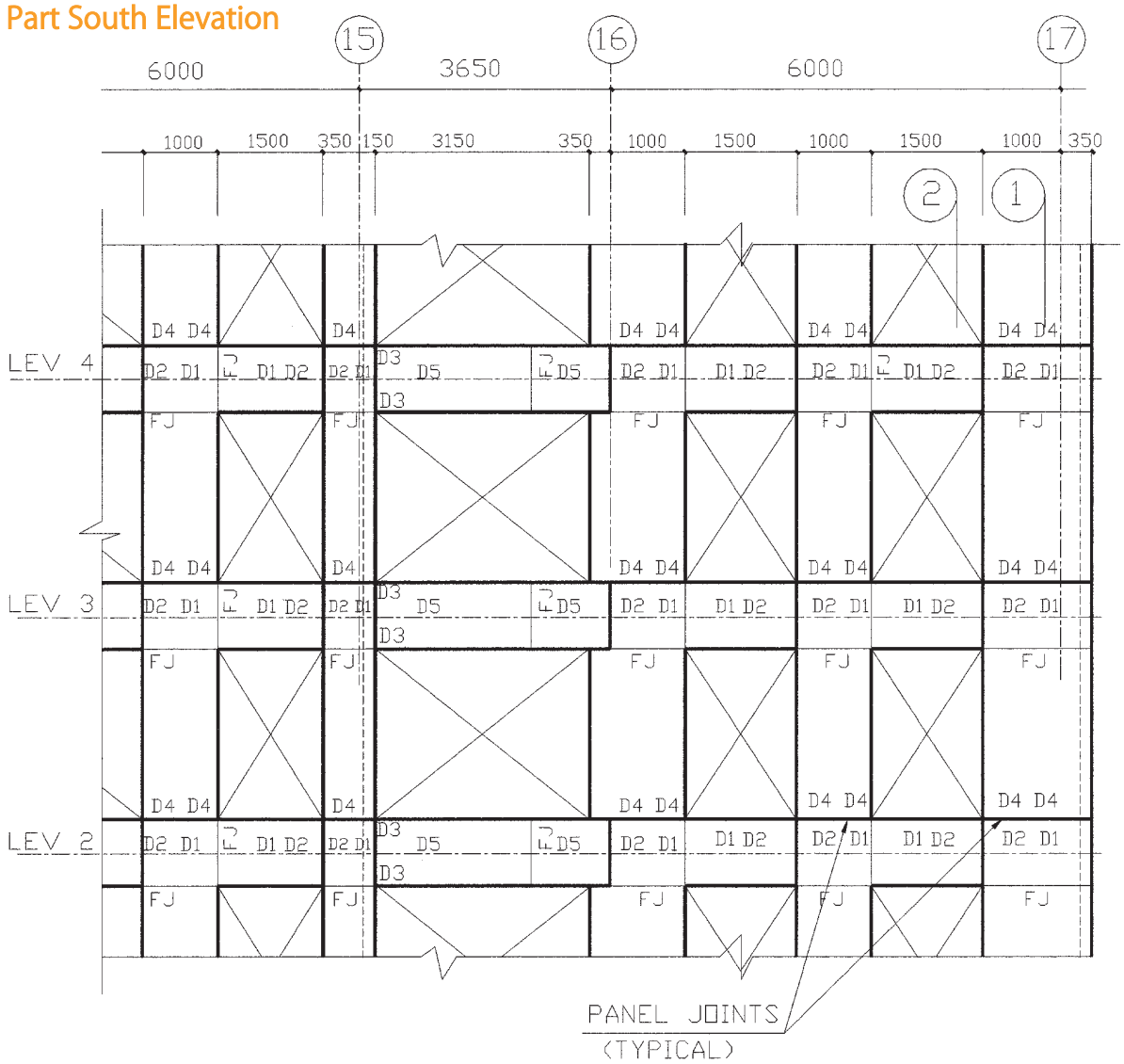
Part Plan



Typical Corner Detail

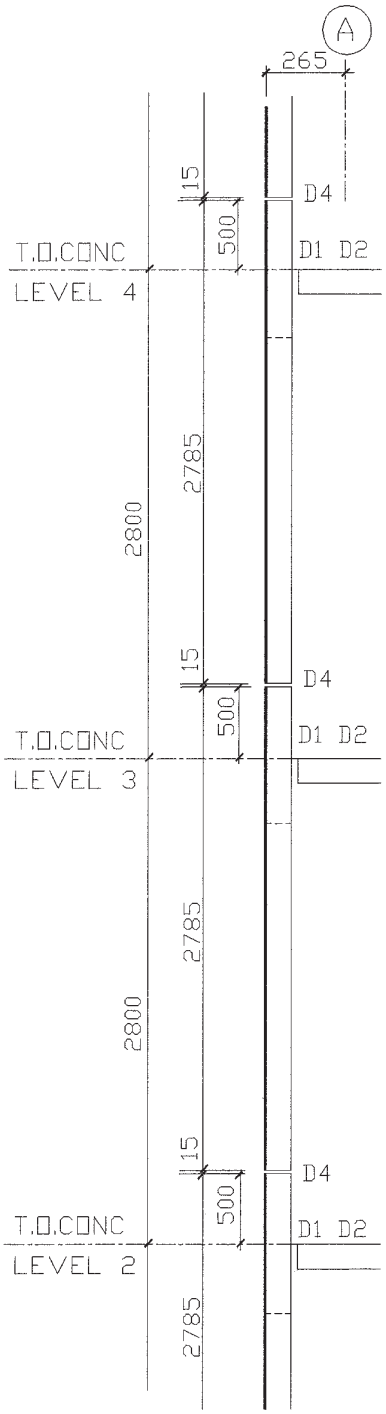


Part South Elevation

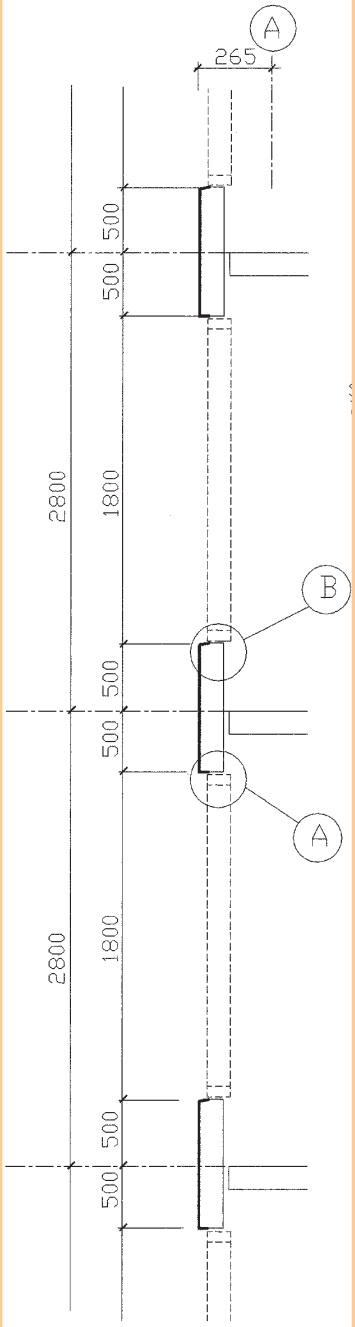


Multistory Wall Panel Connected to a Concrete Structure

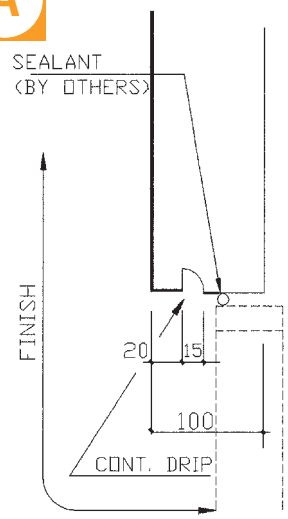
1 Section



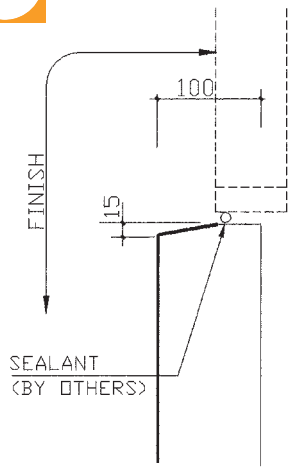
2 Section



A

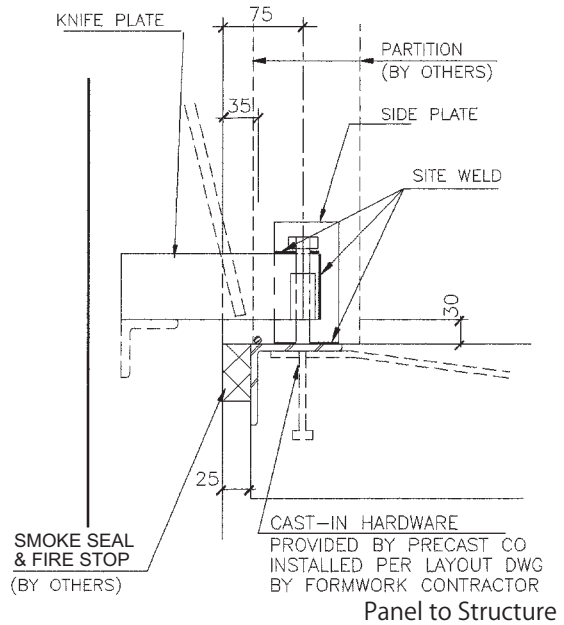


B



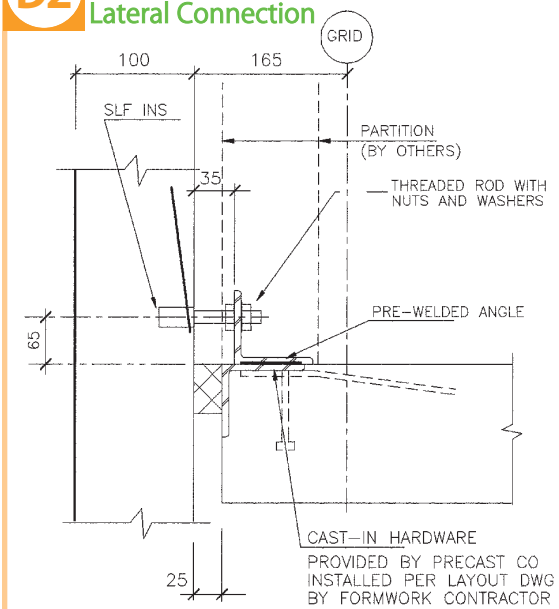
Connection Details for Multistory Wall Panels Connected to a Concrete Structure

D1 Section
Load Bearing & Lateral Connection



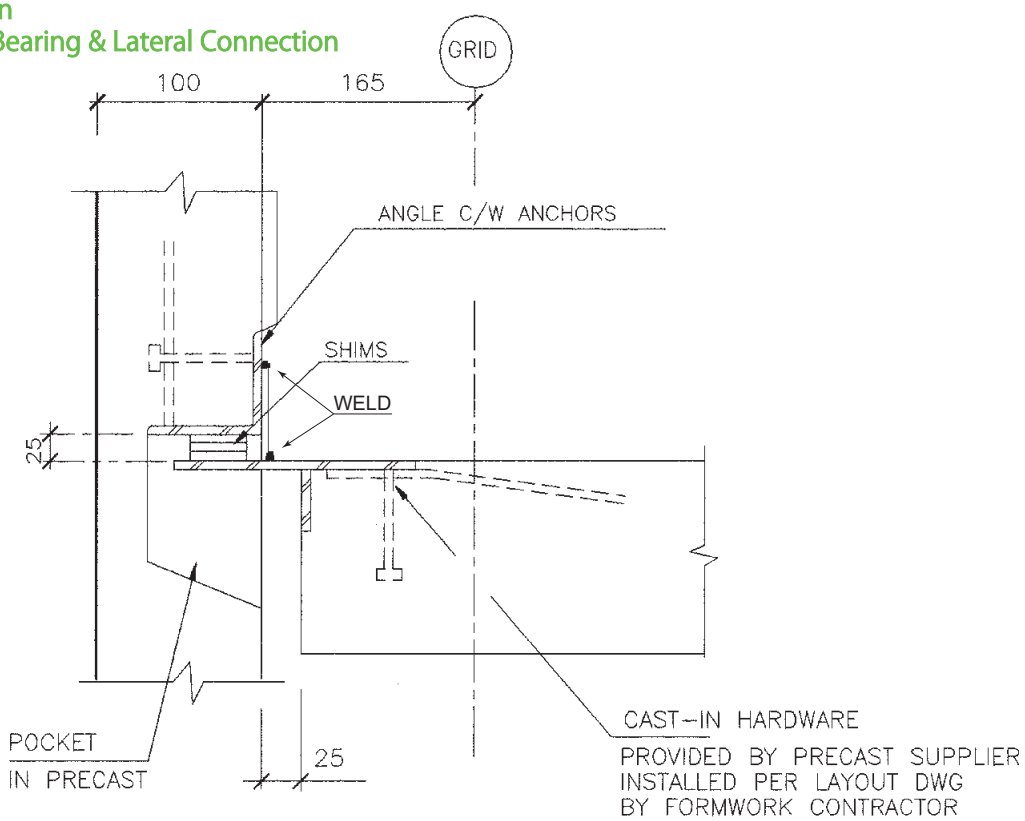
Panel to Structure

D2 Section
Lateral Connection



Panel to Structure

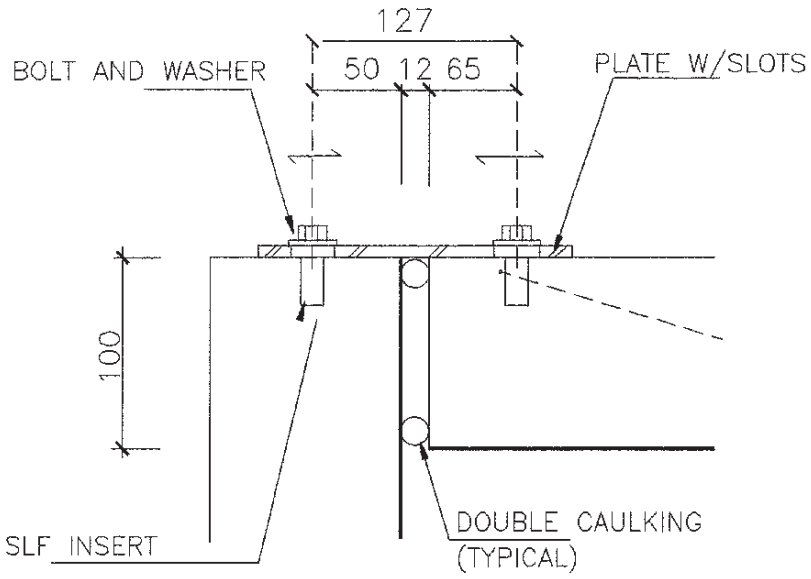
D5 Section
Load Bearing & Lateral Connection



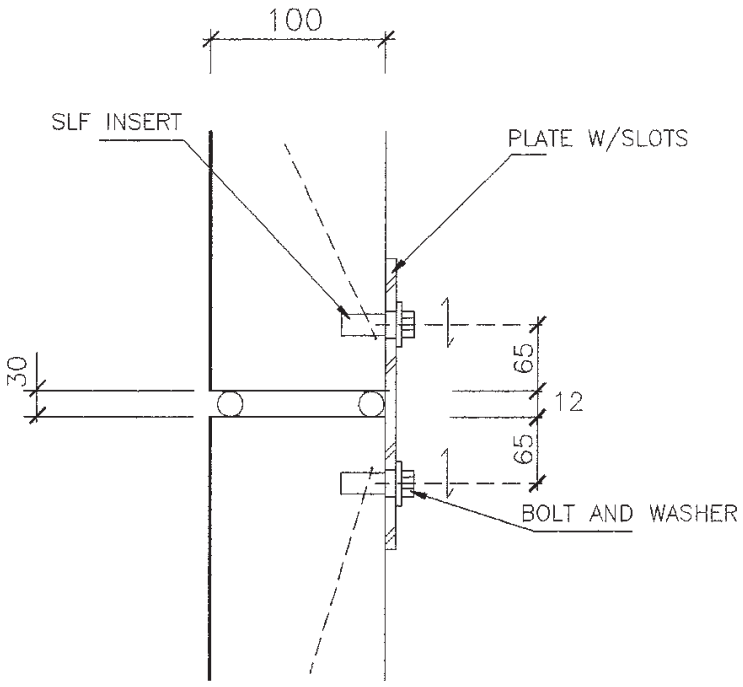
Balcony to Structure

Connection Details for Multistory Wall Panels Connected to a Concrete Structure

D3 Plan
Panel to Panel Lateral Connection



D4 Plan
Panel to Panel Lateral Connection

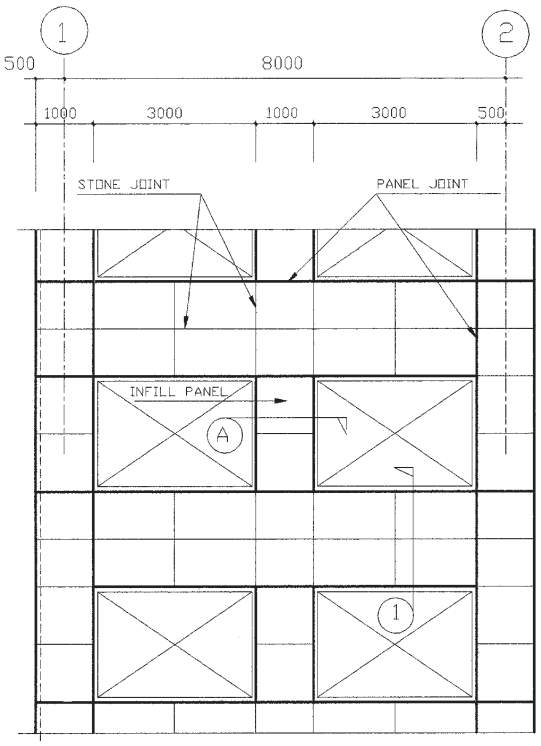


Note:
All connections shown are to be used for conceptual design only.

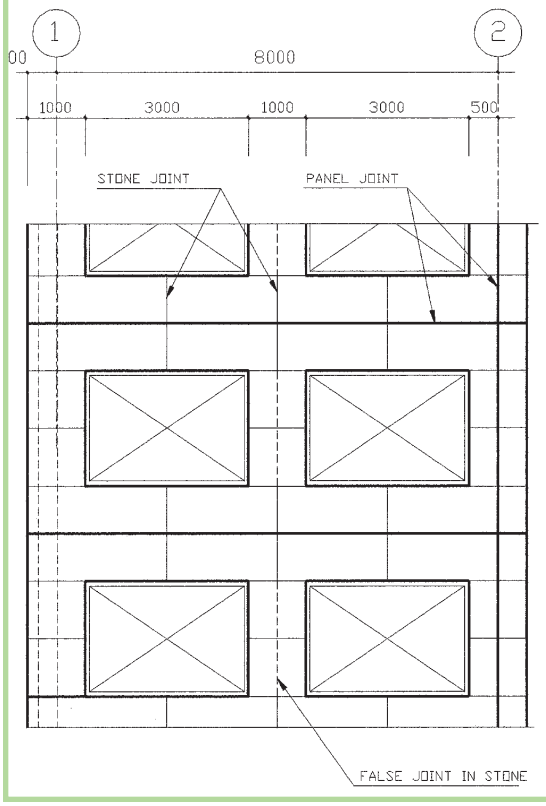
Panel connections will be heavier in seismic regions.

Granite Faced Rain Screen Panel Details (Insulated)

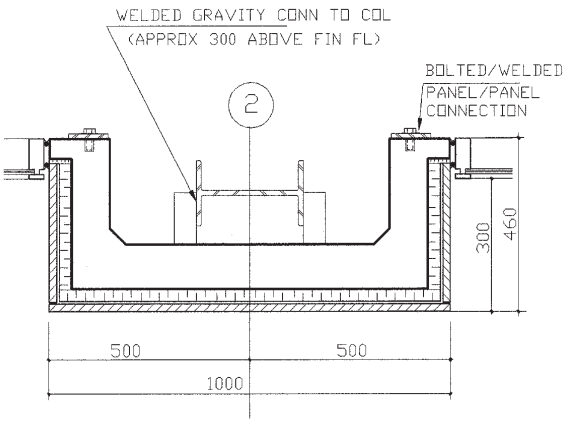
Part Elevation - Alternate 1



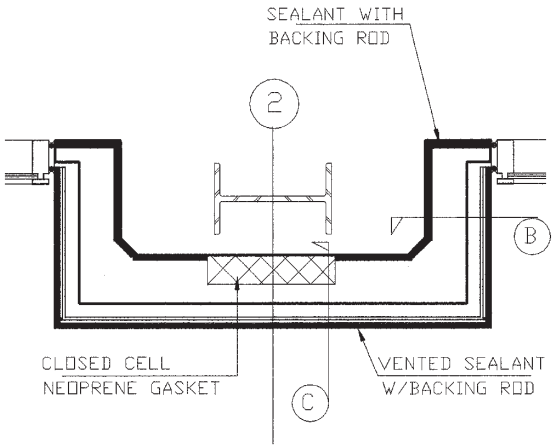
Part Elevation - Alternate 2



A Plan

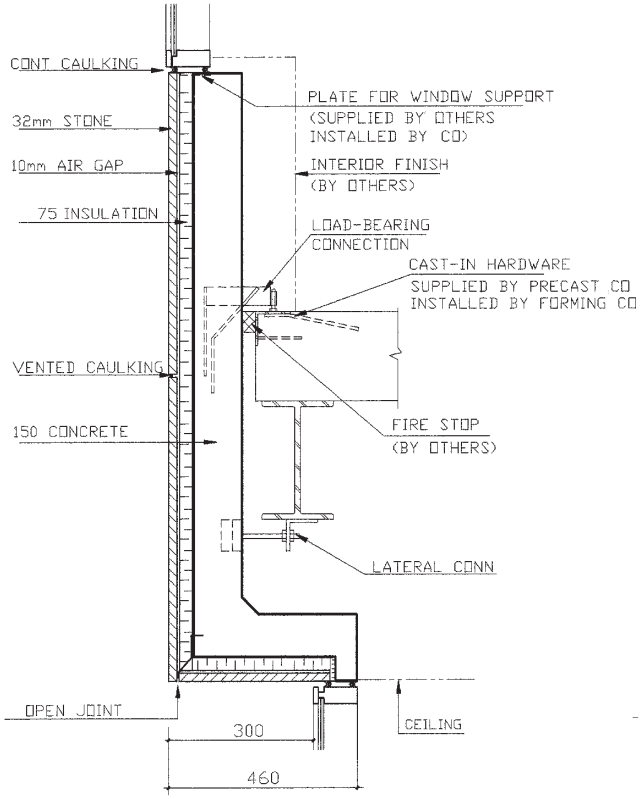


Plan at Joint

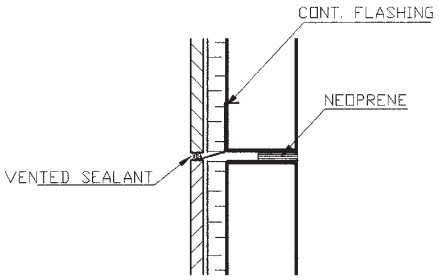


Granite Faced Rain Screen Panel Details (Insulated)

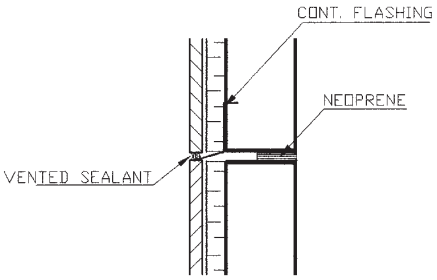
1 Section



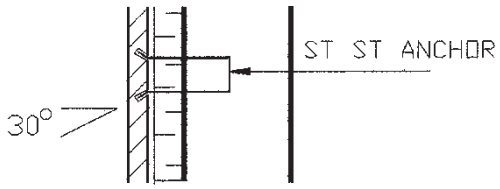
B Detail



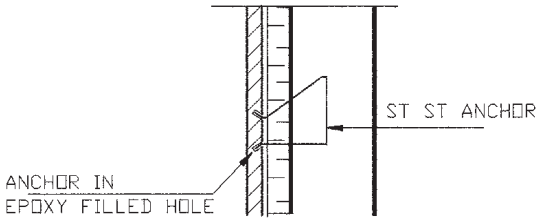
C Detail



Plan
Typical Anchor Details



Section



Maintenance of Precast Concrete Building Products

Precast Concrete is a durable and long lasting building material. If properly maintained it will stand the test of time.

The beauty of precast concrete with its variety of colours and textures, together with its versatility and function, is an integral component of a building envelope. By following a simple program of inspection and maintenance, precast concrete can guarantee the designed service life of a building.

St Ghabriel Terraces ▪ Toronto, ON ▪ Rafael & Bigauskas Architects

To ensure the continued performance of the wall system and to maintain the warranty, visual inspections should be carried out annually. Attention should be paid to the caulked joints, surface appearance and connections.

Any signs of deterioration should be documented at once with a copy of the written report sent to the manufacturer. Any applicable defects reported within the warranty period shall be remedied by the manufacturer.

The owner is urged to maintain this annual inspection program past the warranty period in order to optimize the life of the structure.

Maintenance & Protection Recommendations

1. After a building or structure is erected, it should be cleaned as required.

2. Precast expands and contracts. Ensure the precast joints are properly sealed.

3. The precast structure should be power washed every four to six years (based on the effects of the environment such as acid rain), to maintain its original appearance.

Vancouver Library Square ▪ Vancouver, BC ▪ Moshe Safdie Architect

4. If pigment is used in the manufacture of the precast units, a non-acid cleaning treatment is recommended.

5. Damaged (i.e. split or cracked) caulking should be replaced by:
   (a) Removing damaged caulking,
   (b) Cleaning area with solvent to remove oil debris,
   (c) Applying primer as required,
   (d) Re-caulking with matching caulking as per manufacturer's instructions.

6. Follow applicable by-laws regarding use of sandblasting or acid cleaning procedures.

7. If acid is used to clean surfaces, pretest a sample to ensure units will not be damaged by the treatment.

8. Precautions should be taken to avoid damaging or staining precast units by:
   (a) Ensuring access equipment does not scratch or chip precast surfaces
   (b) Ensuring window cleaning solution ("run-off") is cleaned from precast units to prevent staining

Removing Stains From Precast Concrete Surfaces

Note:
It is recommended that trained professionals be used to perform the required procedures. Appropriate public protection should be maintained at all times.

Oil Stains

Lubricating or petroleum oils readily penetrate into concrete surfaces. Remove free oil promptly by soaking it up with paper towels or clean cloths. Cover the spot with dry powdered cement absorbent for a day. Remove and repeat if necessary.

If the oil has penetrated the concrete, scrub the area with strong soap, scouring powder, trisodium phosphate or proprietary detergents specially made for removing oil from concrete.

Tar

Molten bitumen can be satisfactorily removed because it does not penetrate the concrete. Cool the bitumen with ordinary ice until it is brittle and chip off with a chisel. Scrub the surface with scouring powder to remove the residue and rinse with clear water.

Paint

Soak up freshly spilled paint with paper towels or clean cloths. Scrub the stained area with scouring powder and water until no further improvement is noted. Wait 3 days for the paint to harden before removing further.

Scrape off any hardened paint. Apply a poultice impregnated with commercial paint remover. Let stand for ½ hour. Scrub the stain gently and wash off with water. Scrub off any remaining residue with scouring powder.

Colour that has penetrated the surface can be washed out with dilute hydrochloric or phosphoric acid.

Graffiti

Commercially available products are available for removing spray paint, felt-tip markings, crayon, chalk and lipstick from concrete surfaces. Follow manufacturer's directions and repeat if necessary - try using other products. A single product may not remove all substances. Effective cleaning can also be accomplished with waterblasting and sandblasting.

After the graffiti is removed or before a structure is in service, an anti-graffiti sealer coating can be applied to prevent graffiti from entering the pores of the concrete (to facilitate any future removal).

Smoke

Carefully apply a trichloroethylene poultice after making sure the area is well ventilated. Brush off when dry and repeat if necessary. Then scrub thoroughly with clear water.

Alternately, scour the surface with pumice to remove surface deposits and wash with clear water. Follow this with a poultice of commercial sodium or potassium hypochlorite solution (Javex). Hold poultice firmly against the stain. Resaturate the poultice as necessary.

Rust

Mild rust stains can be completely removed by mopping with a solution containing 0.12 Kg of oxalic acid powder per litre of water. After 2 hours, rinse with clear water and scrub with a stiff brush.

Dirt

Some dirt can be removed by scrubbing with detergent and water or with 1 part hydrochloric acid in 20 parts water. Proprietary cleaners can remove dirt with minimal attack of the concrete. Do not use acid on white surfaces. Steam cleaning, light sandblasting and waterblasting are also effective.

Reference: "Removing Stains and Cleaning Concrete Surfaces", IS214TC, Portland Cement Association, latest edition, 16 pages, (complete and detailed information for concrete cleaning and stain removal).

CPCI Chapter Standard form of Warranty

The company, being a member in good standing of the Canadian Precast/Prestressed Concrete Institute, has completed the work under Section No. 3450 on the building described as follows:

Owner: _____

Building: _____

Location: _____

_____

_____

_____

Date of completion: _____

Date of expiration: _____

We hereby warrant that all precast components have been designed, manufactured and installed in accordance with the specifications and the contract documents for the above referenced project for a period of .....years, commencing on the date of the owner, or the owner's representative, certificate of completion of the precast work.

This warranty shall not apply to damage caused by normal wear and tear, maltreatment of materials, negligence, and acts of God.

_____
Company

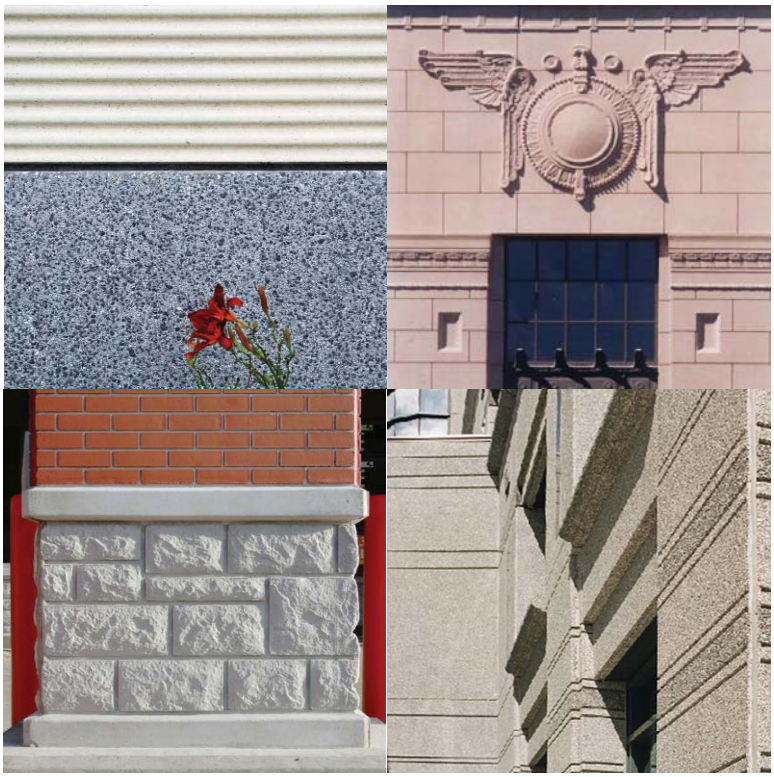
_____ _____
Date Authorized Officer

We confirm the precast described is in good condition, as of the date below, and accept this warranty as the full extent of the precast contractor's liability.

_____
Owner

_____ _____
Date Authorized Officer

Precast Concrete...
Sustainable Structures for Tomorrow!



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