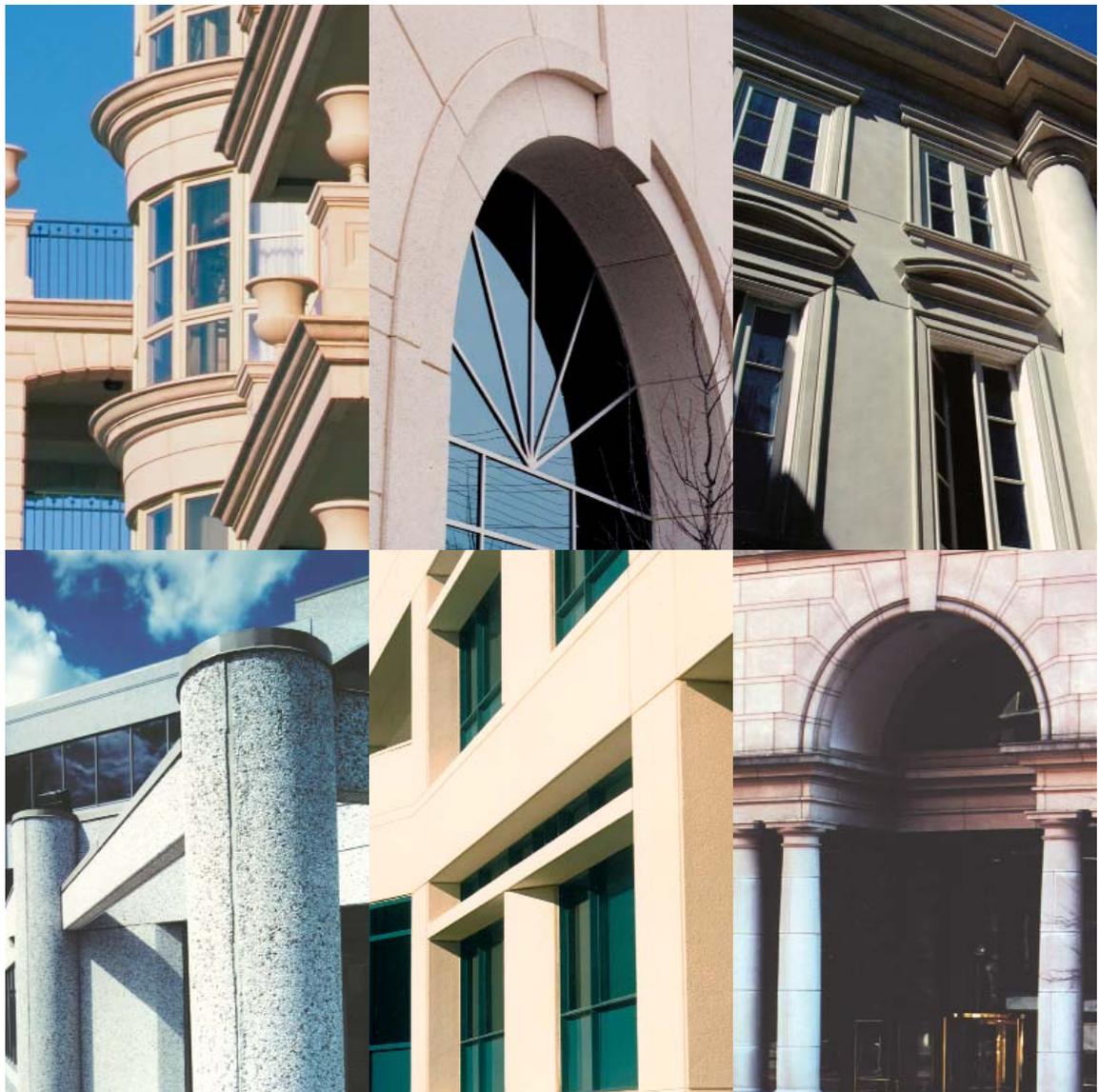
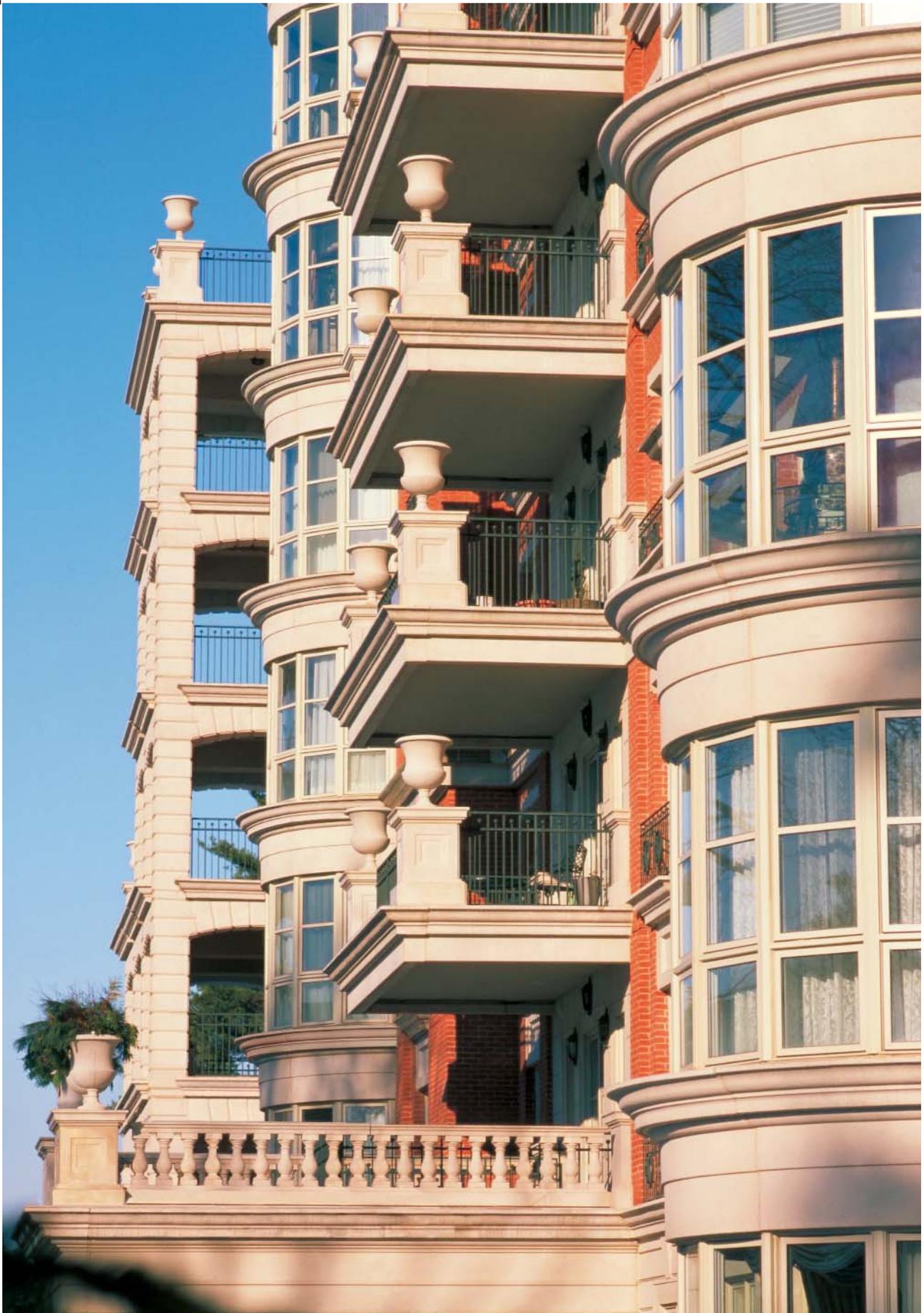


# Architectural Precast Concrete

Technical Brochure



Canadian Precast/Prestressed Concrete Institute





# Introduction

The Canadian Precast/Prestressed Concrete Institute is proud to provide you with this brochure and trust you will find it beneficial in assisting you with the design of all future Architectural Precast Concrete projects.

This brochure illustrates the wide range of products available from the precast producers across Canada, and their product capabilities and diversity. The focus of this literature illustrates the use and design of Architectural Precast Concrete.

Architectural Precast is the cladding material of choice whenever superior aesthetics 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 is appropriate for use on high-rise office buildings, where the emphasis is on prestige and aesthetic appeal, low-rise industrial structures, where economy and durability are paramount.

## Aesthetic Versatility

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

Custom made forms are 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 by 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 minimal costs.

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.

## The Economical Choice

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

# Rain Screen & Modified Rain Screen Principles

Architectural precast cladding when combined with a properly designed joint is an effective barrier for 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 by the forces that cause it (ie. momentum of the rain drop, capillarity, gravity and air pressure). Hence, although concrete provides a completely impervious outer skin, it is essential that these same forces be controlled at joints between precast components and precast and other interfacing building materials such as windows, curtain walls, masonry, etc.

This can be done most readily by providing an air chamber behind the wetted face and ensuring that the air pressure in this chamber is always equal to that of 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 openings 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, 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

## 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, insulation component and 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 condensation. The major problem with a single face precast rain screen panel system is the fact that the precast concrete is installed after the completion of the building envelope. The connectors must penetrate the insulated air/vapour assembly in order to connect to the structural supports. Due care must be taken to ensure these connection pockets are properly sealed and made weather tight after precast installation.

Total precast rain screen panels are manufactured with a facing of precast 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. Simply put, 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 and 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, vented to the outside. With air chamber pressure equalization to the exterior pressure, 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 the transverse seal. Insulation is applied to the back surface of the precast, along with an air vapour barrier and the finished interior surface which then completes the wall assembly.

## 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 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.

## 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 precast manufacturer, joint sealant supplier and professional precast sealant applicator who have proven expertise in the above applications, for more specific details, or for information about fire rated joint assemblies.

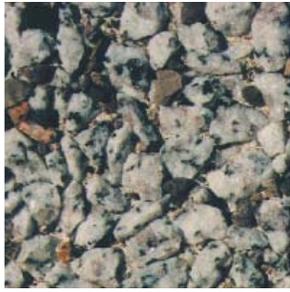


## Samples

1. Use of three aggregates on a white background matrix. "Deep exposure" using a form retarder.
2. Use of two aggregates on a white background matrix. "Deep exposure" using a form retarder.
3. Limestone aggregate on a grey background matrix. "Deep exposure" using a form retarder.
4. Alabama aggregate on a white background matrix. "Deep exposure" using a form retarder.
5. Use of two aggregates on a white background matrix. "Light exposure". Light sandblast finish.
6. Use of two aggregates on a white background matrix. "Medium exposure". Medium sandblast finish.
7. Use of two aggregates on a white background matrix. "Deep exposure". Heavy sandblast finish.



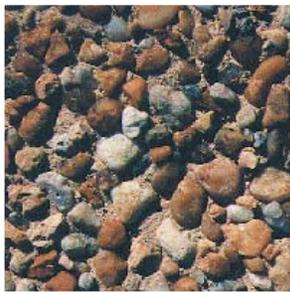
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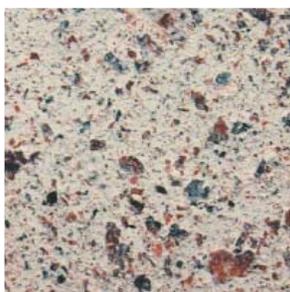
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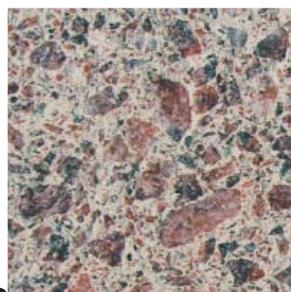
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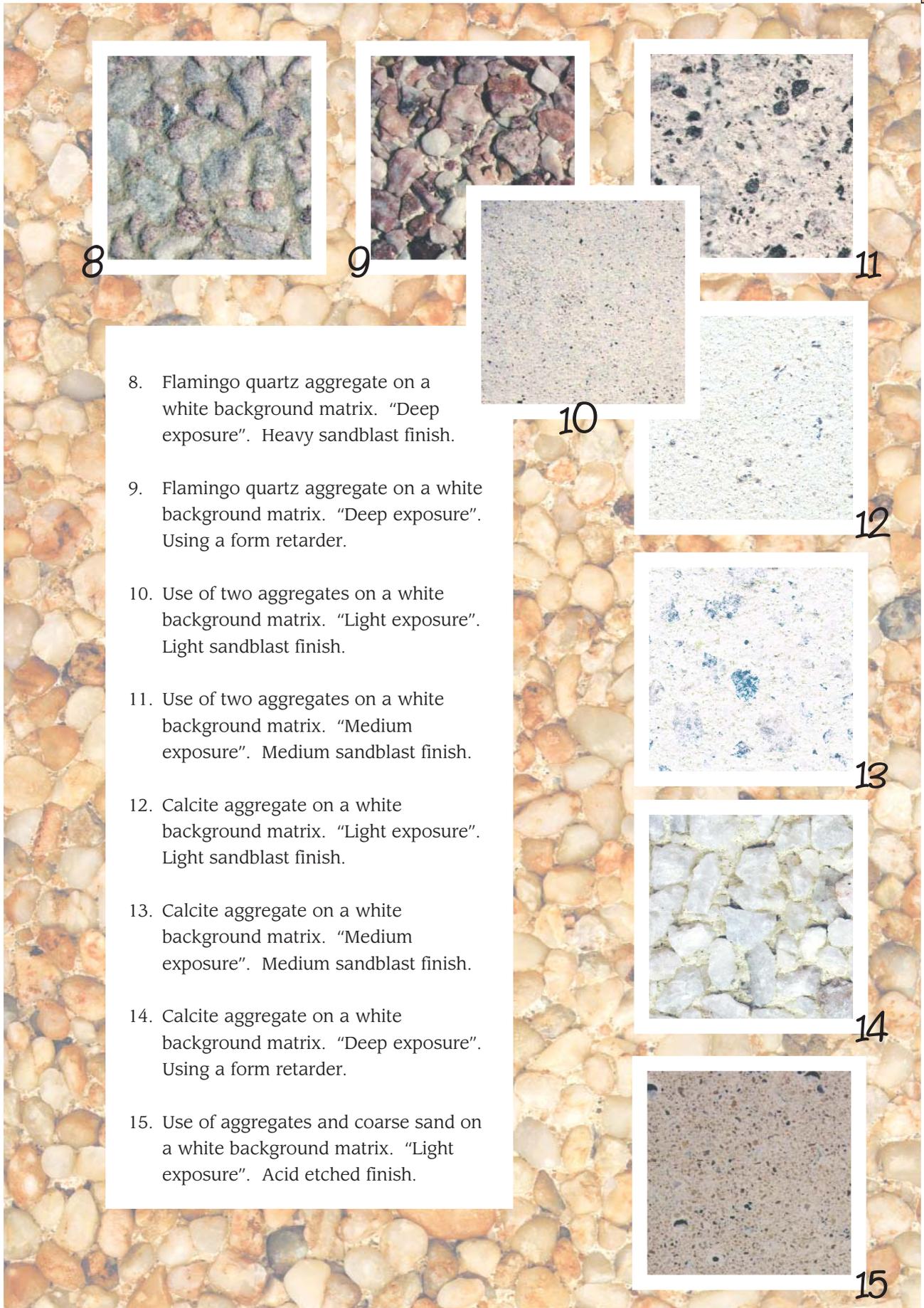
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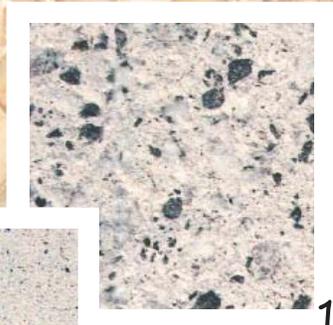
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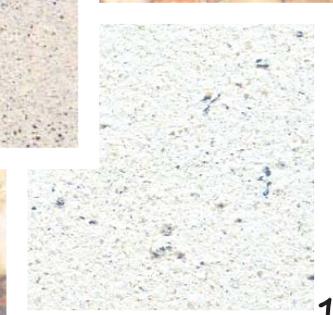
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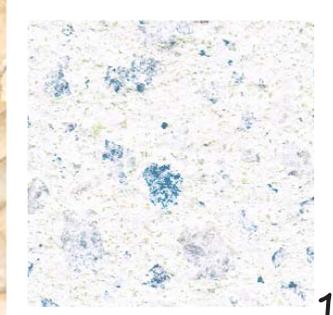
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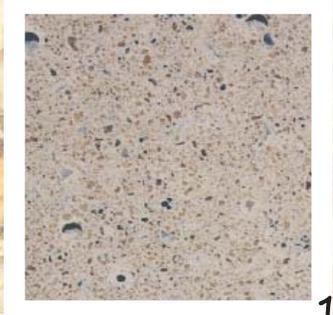
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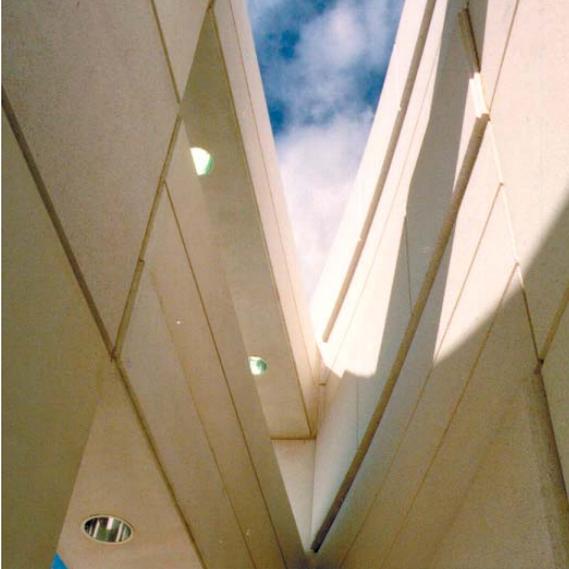
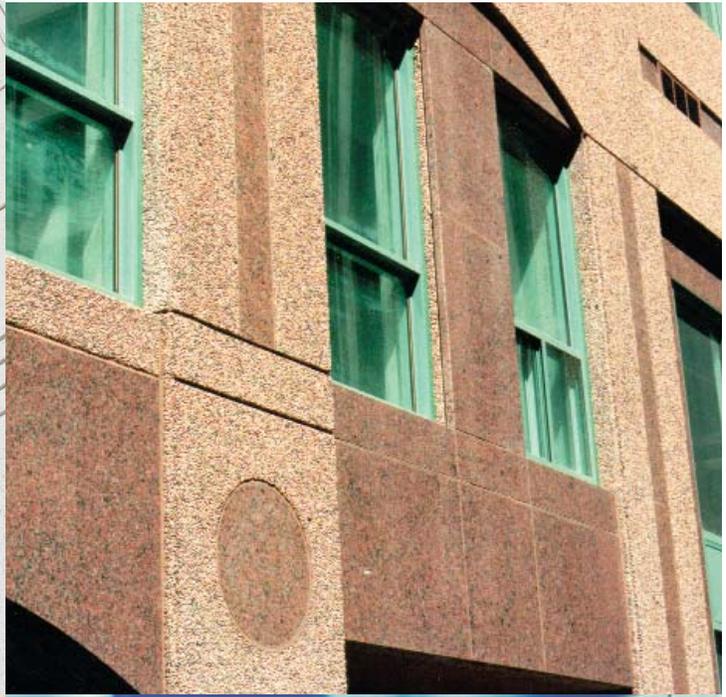


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- 8. Flamingo quartz aggregate on a white background matrix. "Deep exposure". Heavy sandblast finish.
- 9. Flamingo quartz aggregate on a white background matrix. "Deep exposure". Using a form retarder.
- 10. Use of two aggregates on a white background matrix. "Light exposure". Light sandblast finish.
- 11. Use of two aggregates on a white background matrix. "Medium exposure". Medium sandblast finish.
- 12. Calcite aggregate on a white background matrix. "Light exposure". Light sandblast finish.
- 13. Calcite aggregate on a white background matrix. "Medium exposure". Medium sandblast finish.
- 14. Calcite aggregate on a white background matrix. "Deep exposure". Using a form retarder.
- 15. Use of aggregates and coarse sand on a white background matrix. "Light exposure". Acid etched finish.



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# Precast Concrete Finishes

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

The face concrete contains 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 cause minor colour variation. The back-up concrete is composed of conventional aggregates, sands, and grey cement. This reduces material costs by eliminating the need for a full depth of decorative face concrete.

## Face Concrete Finishing

### Exposed Aggregate:

Exposed aggregate finishes are achieved by coating the form into which the concrete will be poured with a concrete retarder. The retarder arrests the hardening of the concrete which comes in contact with it, to a depth determined by the strength of the retarder, normally 1/3 the depth of the coarse aggregate. Once the panel has cured and is stripped from the mould, 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 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 sand. The resulting finish can look like many of the natural stone finishes.

**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.

## Pigments:

The use of natural sands and aggregates is desired for long term colour stability, and to achieve the desired colour. 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

The finishes described above achieve the desired aesthetics through the actual finishing of the precast concrete panels. Granite, stone and brick faced precast concrete panels allow architects to incorporate the natural beauty of these materials economically onto the face of one large precast panel.

## 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 manufacturer for advice.



# Specification

## Section 03450 - Architectural Precast Concrete

### 1.0 GENERAL

#### 1.1 Description

- .1 The General conditions of the Contract and Supplementary General Conditions apply to this Division, except as qualified herein and/or excluded.
- .2 Refer to all available drawings and specifications.

#### 1.2 Work Included

- .1 Design, supply, delivery and installation of:
  - .1 Precast concrete architectural wall panels.
  - .2 Field sealing and sealant of all precast concrete wall panels inside and outside between precast panels, between precast and foundation walls.
  - .3 Take delivery and cast into precast work boxes/inserts/openings required by other trades.
- .2 Review of shop drawings of structural steel supplier. Supply information required for installation of bracing, supports, inserts and similar accessories required for work under this contract supplied and installed by others.

#### 1.3 Related Work

- .1 Section 03300 - Cast-in-Place Concrete
- .2 Section 03300 - Cast-in-Place Concrete: Setting only of insert or Anchors unless otherwise noted on Structural Drawings
- .3 Section 07200 - Thermal Protection
- .4 Section 07900 - Joint Sealers
- .5 Section 08400 - Entrances & Storefronts
- .6 Section 08500 - Windows
- .7 Section 07800 - Fire and Smoke Protection
- .8 Supply and installation of:
  - .1 Hollow metal frames: Section 08100 - Metal Doors & Frames.
  - .2 Structural steel framing except around door openings: Section 05100 - Structural Metal Framing.
  - .3 Field caulking between precast concrete and masonry.

#### 1.4 Reference Standards

**Spec Note:** *Latest Standards are listed.  
Specifier to update specification to latest CSA Standard.*

- .1 CSA A23.1-94, Concrete Materials and Methods of Concrete Construction
- .2 CSA A23.2-94, Methods of Test for Concrete
- .3 CSA A23.3-94, Design of Concrete Structures
- .4 CSA A23.4-94, Precast Concrete-Materials and Construction
- .5 ASTM C494, Guidelines for the Use of Admixtures in Concrete
- .6 ASTM C494, Guidelines for the Use of Superplasticizing Admixtures in Concrete.
- .7 CSA A283-1980, Qualification Code for Concrete Testing Laboratories
- .8 CAN/CSA-G164-M92, Hot Dip Galvanizing of Irregularly Shaped Articles
- .9 CSA W186-M1997, Welding of Reinforcing Bars in Reinforced Concrete Construction
- .10 W47.1-97, Certification of Companies for Fusion Welding of Steel Structures

*Specification continued...*

1.5 Qualifications of Manufacturer

.1 Fabricated precast concrete elements shall be supplied by manufacturers certified by the Canadian Standards Association in the appropriate category(ies) according to CSA Standard A23.4-94 "Precast Concrete - Materials and Construction". The precast concrete manufacturer shall be certified in accordance with the CSA Certification program for Architectural and Structural Precast Concrete prior to submitting a tender and must specifically verify as part of his tender that he is currently certified in the appropriate category(ies):

- (A) Precast Concrete Products - Architectural
  - (I) Non-Prestressed or (II) Prestressed
- (B) Precast Concrete Products - Structural
  - (I) Non-Prestressed or (II) Prestressed
- (C) Precast Concrete Products - Speciality
  - (I) Non-Prestressed or (II) Prestressed

**Spec Note:**  
*Delete categories  
that are not applicable.*

Only precast concrete elements fabricated by certified manufacturers are acceptable to the Owner. Certification must be maintained for the duration of the fabrication and erection for the project.

.2 The precast concrete manufacturer shall have a proven record and satisfactory experience in the design, manufacture and erection of precast concrete facing units of the type specified. The company shall have adequate financing, equipment, plant and skilled personnel to detail, fabricate and erect the work of this Section as required by the Specification and Drawings. The size of the plant shall be adequate to maintain the required delivery schedule.

1.6 By-Laws and Codes

- .1 Conform with applicable requirements of \_\_\_\_\_(Provincial) Building Code, National Building Code and local authorities having jurisdiction.
- .2 Design and provide reinforcement, anchors and supports as required by codes and to Consultant's approval. Submit relevant design data prepared by a qualified structural engineer for approval if so requested by the Consultant.

1.7 Allowable Tolerances

- .1 Conform with requirements of CSA A23.4-Section 10, except as noted herein.
- .2 Refer to related Sections of this Specification and fabricate work to accommodate specified tolerances.

1.8 Source Quality Control

- .1 In addition to quality control test specified above, an independent inspection and testing company may be appointed by the Owner to verify compliance with this Specification.
- .2 Cooperate with Inspector to facilitate his work.
- .3 Cost to be paid from cash allowance specified under Section 01210

1.9 Shop Drawings

**Spec Note:** *It is not the Precast Manufacturer's responsibility to confirm and correlate dimensions at the job site. Precast concrete is a prefabricated material. Site dimensioning would require the structure to be complete before fabrication could commence.*

*Specification 1.9 Shop Drawings continued...*

- .1 Prepare and submit shop drawings in accordance with the General Conditions of the contract, CSA-A23.4 and CSA-A23.3, and as specified below. Submit in accordance with Section 01330.
- .2 Submit fully detailed and dimensioned drawings showing method of fastening and sealing and provisions made to receive work of other Sections. Indicate type of finish and other pertinent information on each shop drawing.
- .3 Consult reviewed shop drawings relating to interface elements and show exact location of inserts and anchors required to be cast in precast units for interface elements.
- .4 Show system of identifying units for erection purposes on shop drawings and apply similar mark on units at time of manufacture.
- .5 Provide Shop Drawings to and obtain approvals from the Authorities having jurisdiction prior to fabrication of the precast panels.
- .6 Each drawing submitted shall bear stamp and signature of qualified professional engineer registered in [Canada] [Province of \_\_\_\_\_].

1.10 Samples

*Spec Note:* See CSA A23.4-94 Re: Variation

- .1 Provide samples of precast cladding for approval. Unless otherwise noted, minimum size 300 x 300 x 25 mm. Finish exposed face as described under "finishes" elsewhere in this Section. Make samples until final unconditional Consultant's approval is obtained. All work shall match approved production run samples.

1.11 Warranty

- .1 Provide standard CPCI Chapter warranty with a duration of \_\_\_\_ year(s) in accordance with General Conditions. Warranty shall be in writing and shall warrant work under this Section to be free from defects for the period stipulated.

1.12 Delivery, Storage and Protection

- .1 Accept full responsibility for delivery, handling and storage of units.
- .2 Deliver, handle and store precast units in a near vertical plane at all times, and by methods approved by the manufacturer. Do not permit units to contact earth or staining influences or to rest on corners. Do not stockpile defective units but remove from site.
- .3 Construct easel for stacking units and place non-staining spacers between each unit. If wood is used it shall be wrapped with polyethylene.
- .4 Protect holes and reglets from water and ice during freezing weather.

1.13 Design

- .1 Requirements: Design and fabricate panels, brackets and anchorage devices so that when installed they will:
  - .1 Compensate for unevenness and dimensional differences in structure to which they are secured.
  - .2 Tolerate structural deflection of span/360 due to live load and distortion of structure, under design criteria conditions, without imposing load on panel assembly.
  - .3 Adequately sustain themselves, and superimposed wind, snow and rain loads, and seismic loads, without exceeding deflection of 1/360.

## Specification continued...

- .4 Permit no water infiltration into the building under design loads.
- .2 Design loads shall be as calculated from the Provincial Building Code based on 30 year probability.
- .3 Panels to be non-composite insulated panels providing a R\_\_\_\_\_wall assembly.

### 2.0 Products

#### 2.1 Materials

- .1 Cement, [white cement] [colouring material], aggregates, water admixture: to CSA-A23.4 and CSA-A23.1. Supplementary cementing materials: to CSA-A23.5-98

**Spec Note:** *Re 2.1.2: Due to large variety of exposed aggregate finishes for precast concrete and lack of standards, it is necessary to preselect finish texture and colour in cooperation with precast concrete manufacturers. Ensure that this is done before specification is written and include the generic name of the selected aggregate, sizes of aggregate and proportions of different colours or sizes.*

- .2 Exposed aggregate [and special facing materials]: [quartz] [dolomite] [granite] [marble] [river stone] to match selected finish sample.
- .3 Use same brand and source of cement and aggregate for entire project to ensure uniformity of coloration and other mix characteristics.
- .4 Reinforcing steel: to CSA-A23.1.
- .5 Forms: to CSA3-A23.4.
- .6 Hardware and miscellaneous materials: to CSA-A23.1.

**Spec Note:** *Re 2.1.7: Type 400W is weldable structural grade steel having a yield strength of 400 MPa. Refer to CSA-G40.21 for other grades and yield strengths available.*

- .7 Anchors and supports: to CSA-G40.21, Type [400W].
- .8 Welding materials: to CSA W47.1-97 and CSA W186-[M1997].
- .9 Steel primer: to CGSB 1-GP-40M.
- .10 Air entrainment admixture: to ASTM C260.
- .11 Bearing pads: smooth, [high impact plastic] [steel].
- .12 Bearing pads: neoprene, [60] durometer hardness to ASTM D2240, and [17] MPa minimum tensile strength to ASTM D412, moulded to size or cut from moulded sheet.
- .13 Shims: [plastic] [steel].
- .14 Zinc-rich primer: to CGSB 1-GP-181M.
- .15 Surface retardant: to ASTM C494.
- .16 Insulation: extruded polystyrene to CAN/CGSB - 51.20 - M87 Type 2 OR expanded polystyrene to CAN/CGSB-51.20, Type 1.

#### 2.2 Concrete Mixes

- .1 Unless otherwise noted or specified, use concrete mix designed to produce a minimum of 35 MPa compressive cylinder strength at 28 days, with a maximum water/cement ratio to CSA A23.4.
- .2 Use white or grey cement in facing matrix.
- .3 Air Entrainment of Concrete Mix: Refer to CSA-A23.1
- .4 Use of calcium chloride is not permitted.

#### 2.3 Reinforcement and Anchors

- .1 Attach reinforcement at intersections and weld anchors securely to reinforcement, all in accordance with CSA W.186.70.

*Specification continued...*

- .2 (Prime, galvanize, epoxy paint) anchors after fabrication and touch up anchors with (zinc rich primer, epoxy paint) after welding.
- .3 Reinforcing Steel: To CSA G30.18.

2.4 Fabrication

- .1 Production of Architectural Concrete, Fabricate units to CSA - A23.4.
- .2 Mark each precast unit to correspond to identification mark on shop drawings for location.
- .3 Mark each precast unit with date cast.
- .4 Ensure that surfaces to receive sealant are smooth and free of laitance to provide a suitable base for adhesion. Ensure that release agents do not deleteriously affect the sealing of the joints.
- .5 Cast panels face down in accurate rigid moulds designed to withstand high frequency vibration. Set reinforcing anchors and auxiliary items to detail. Cast in anchors, blocking and inserts supplied by other Sections as required to accommodate their work. Where possible, permanently attach anchors and inserts to the reinforcing. Vibrate concrete continuously during casting until full thickness is reached. Provide necessary holes and sinkages for flashings, anchors, cramps, etc. as indicated and/or required. Separately and accurately batch cement and aggregates uniformly by weight to ensure maintenance of even and uniform appearance.
- .6 Reinforce panels with steel reinforcing bars sufficient to withstand handling stresses, temperature changes, wind loads as specified in P.B.C. based on 30 year probability and deadloads. If requested, provide justifying calculations for approval of reinforcing.
- .7 Anchors, lifting hooks, shear bars, spacers and other inserts or fittings required shall be as recommended and/or designed by manufacturer for a complete and rigid installation. Each shall conform to requirements of local building By-Laws and be of type satisfactory to Consultant. Lift hooks shall be adequately sized to safely handle panels according to panel dimension and weight. Anchors/inserts shall be concealed where practical.
- .8 Burn off lift cables paint and fill in where required if unit is damaged due to burn off.

2.5 Finish

**Spec Note:** *Select from 2.5.1 to 2.5.8 for type finish required and delete remainder.*

- .1 Finish and colour of precast units to match sample in [Consultant's] office.
- .2 Fluted finish: achieve finish using trapezoidal form liners.
- .3 Smooth finish: as cast using smooth [plastic] [steel] form liners.
- .4 Exposed aggregate finish:
  - .1 Apply even coat of retardant to inside face of forms.
  - .2 Remove panels from forms after concrete hardens.
  - .3 Expose coarse aggregate by washing and brushing away surface mortar.
  - .4 Expose aggregate to depth required.
  - .5 Sandblasted finish: in order to expose aggregate face, sandblast surface to depth of [1.5] [6] mm.

**Spec Note:** *Re 2.5.8: Specify other finishes, broomed, bushhammered rib, textured form material, as required.*

*Specification continued...*

3.0 Execution

3.1 General

- .1 Erect precast work in accordance with CSA-A23.4.
- .2 Supply anchors for precast units required to be cast into the concrete frame to Concrete Subtrade for installation. Provide such items in ample time to meet construction programme. Supply layout drawings locating accurately the position of all cast in items to be installed by other Sections.

**Spec Note:** *It is not the Precast Manufacturer's responsibility to confirm and correlate dimensions at the job site. Precast concrete is a prefabricated material. Site dimensioning would require the structure to be complete before fabrication could commence.*

3.2 Installation

- .1 Set precast concrete units, straight, level and square.
- .2 Non-cumulative Erection Tolerances
  - .1 Joint dimension - Nominal 15 mm - to vary not more than +/- 6 mm.
  - .2 Joint taper - unit edges at joint not out of parallel over 0.6 mm in 300 mm (1/40" per 1 ft.) but not more than 2.9 mm total.
  - .3 Edge alignment - alignment of panel edges not to exceed 6 mm.
  - .4 Faces of adjacent panels, offset not more than 3 mm.
  - .5 Bowed panels, within allowable bowing tolerances, arranged so offset between adjacent panels does not exceed 6 mm.
- .3 Fasten units in place by welding where possible. Protect work from damage by weld splatter.
- .4 Provide temporary erection anchorage for welded anchorage system.
- .5 Where bolts used for installation, tighten with equal torque. Secure bolts with lockwashers or tack-weld nut to bolt.
- .6 Clean field welds with wire brush and touch up with galvafruid paint or zinc rich primer.
- .7 Remove shims and spacers from joints of non-load bearing panels after fastening but before sealant is applied.
- .8 Provide and install sufficient temporary bracing to brace precast units adequately, at all stages of construction, so that units will safely withstand loads to which they may be subjected. This temporary bracing shall remain in position until all connections have been completed.
- .9 Apply sealant and joint backing to exterior and interior joints to provide a complete weathertight installation in accordance with Section 07900. All exterior joints are to be vented.

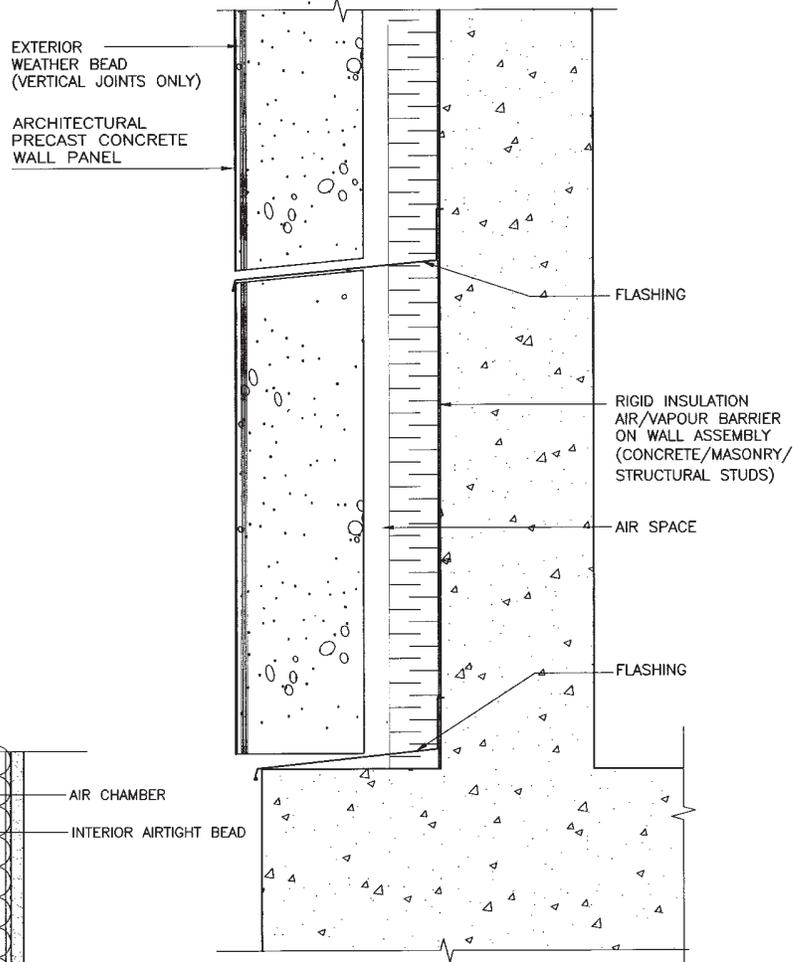
3.3 Cleaning

- .1 Clean exposed face work by washing and brushing only, as precast is erected, if required. Use approved masonry cleaner if washing and brushing fails to achieve required finish. Remove immediately materials which set up or harden.

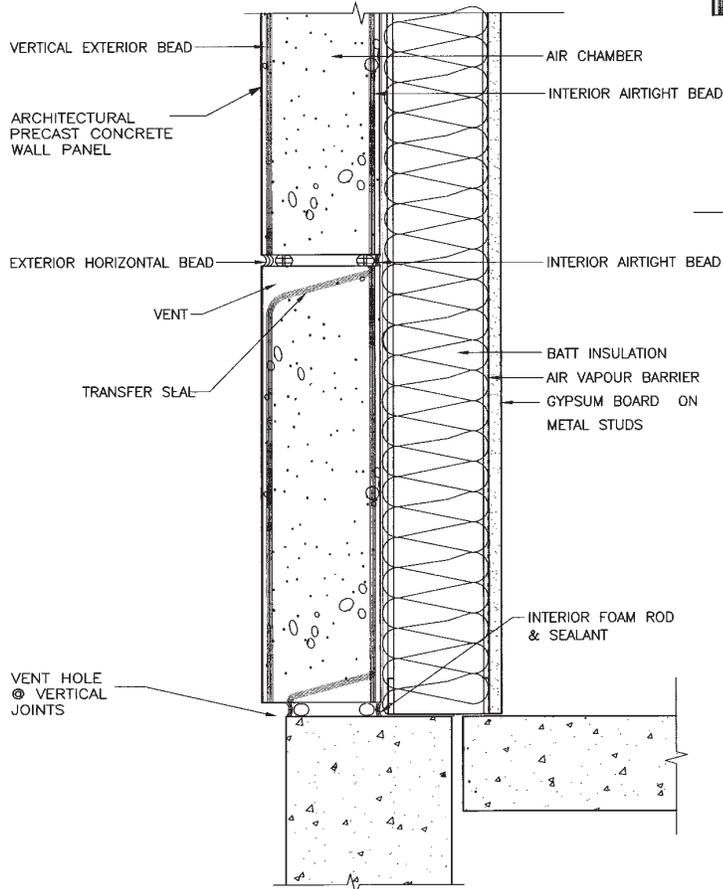
End of Section

*Note: Specification available in French. Contact CPCI for copies.*

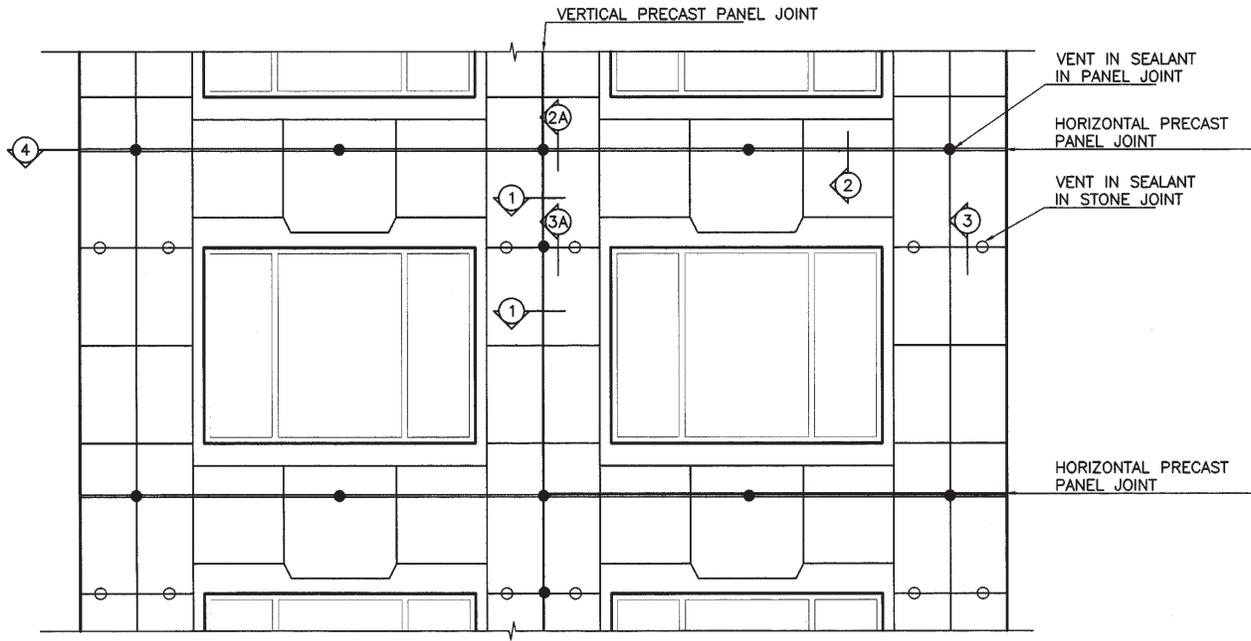
## Caulking Detail Rain Screen



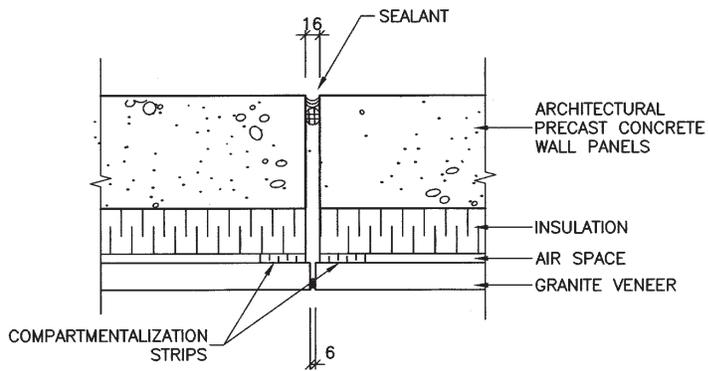
## Caulking Detail Modified Rain Screen



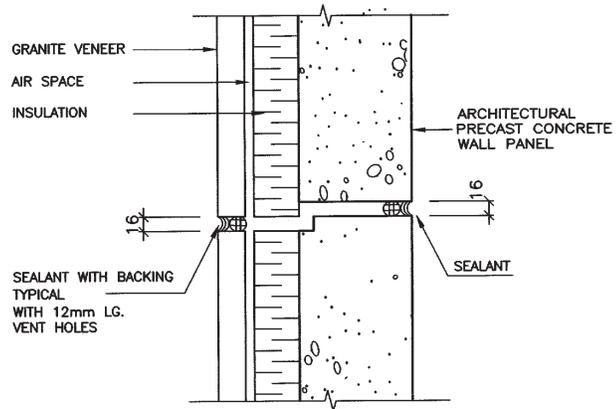
## Precast Concrete Caulking Details



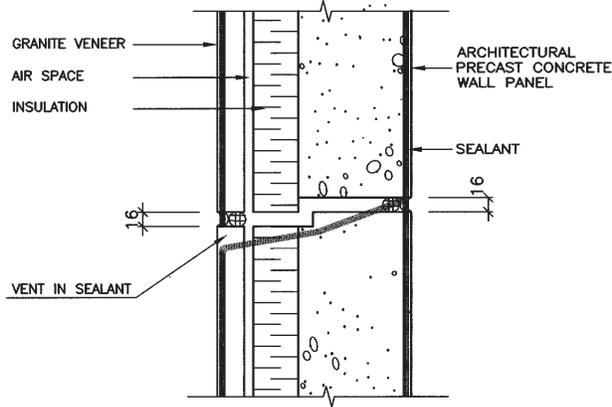
Part Typical Elevation  
of Granite Veneer Precast Panels



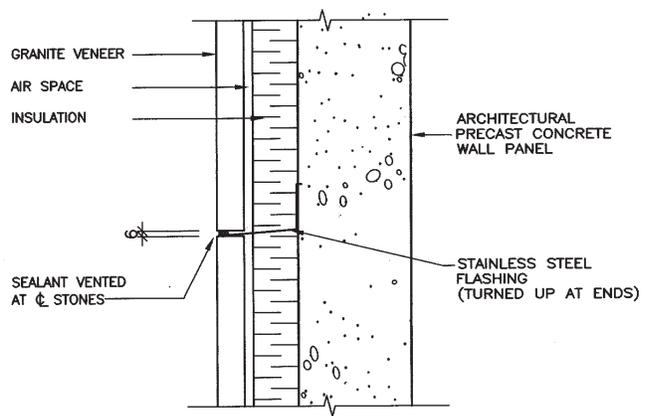
1 Granite Veneer  
Typical Vertical Joint



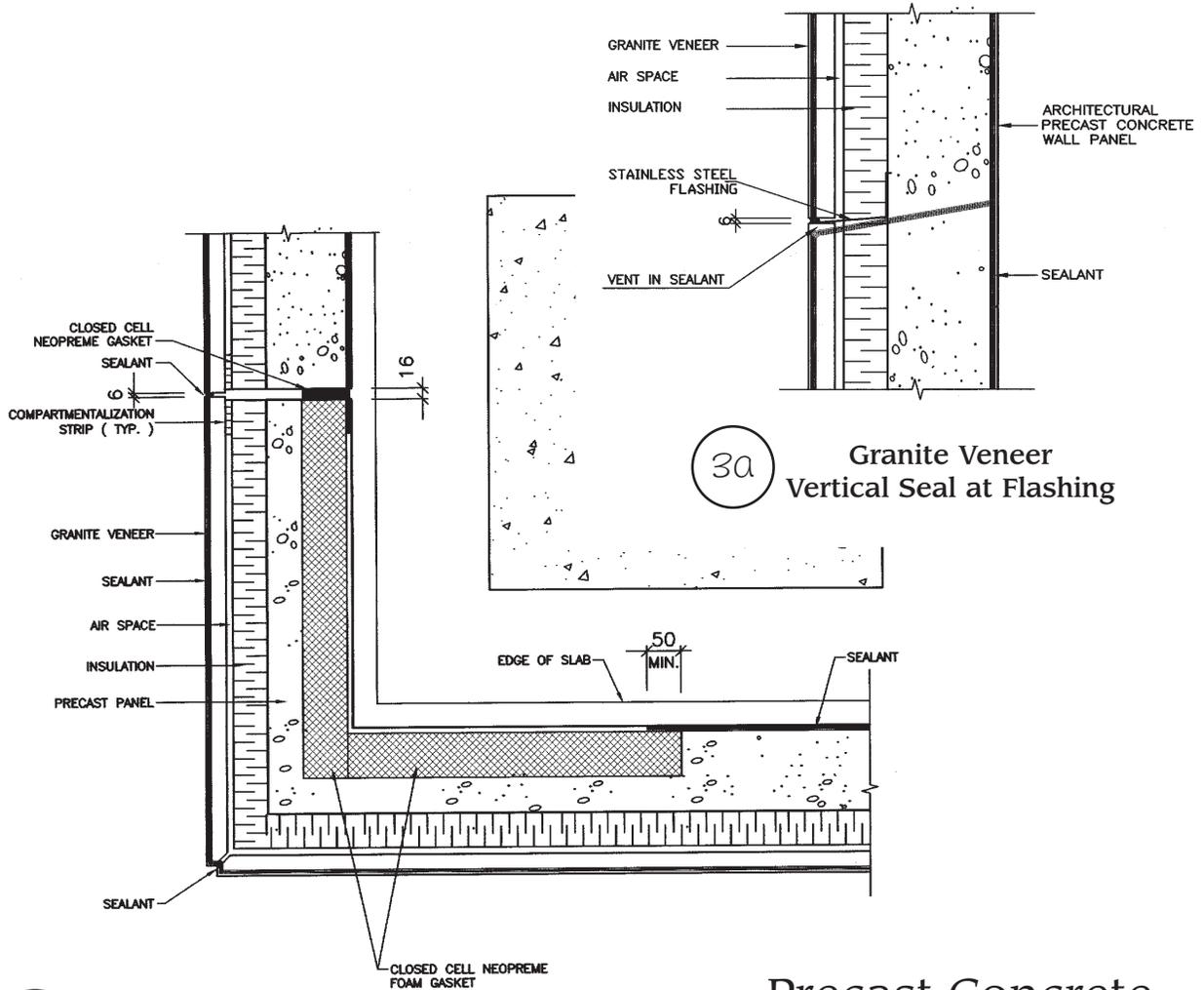
2 Granite Veneer  
Typical Horizontal Joint



2a Granite Veneer Vertical Seal at Horizontal Joint



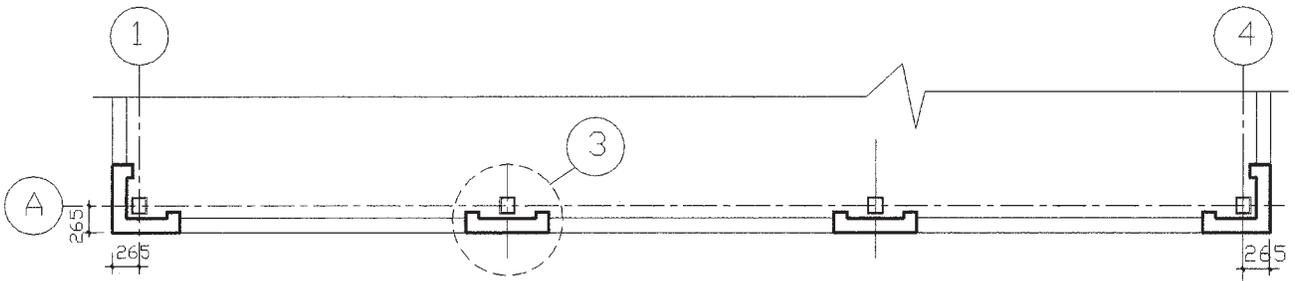
3 Granite Veneer Detail at Flashing



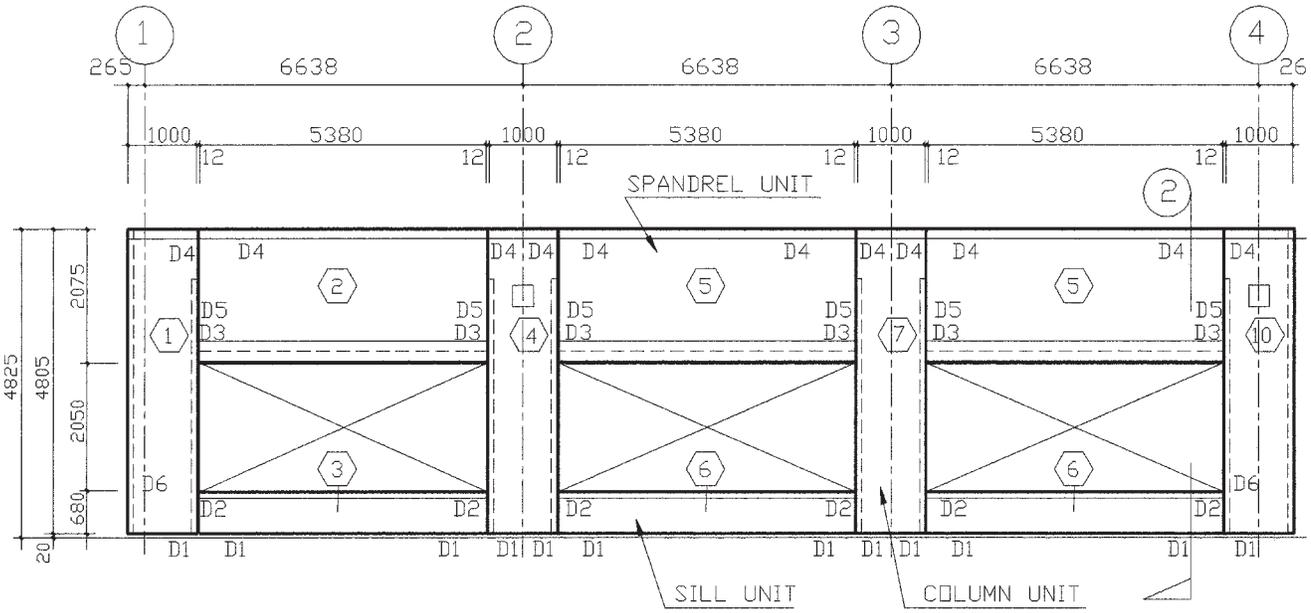
3a Granite Veneer Vertical Seal at Flashing

4 Granite Veneer Plan Detail at Corners

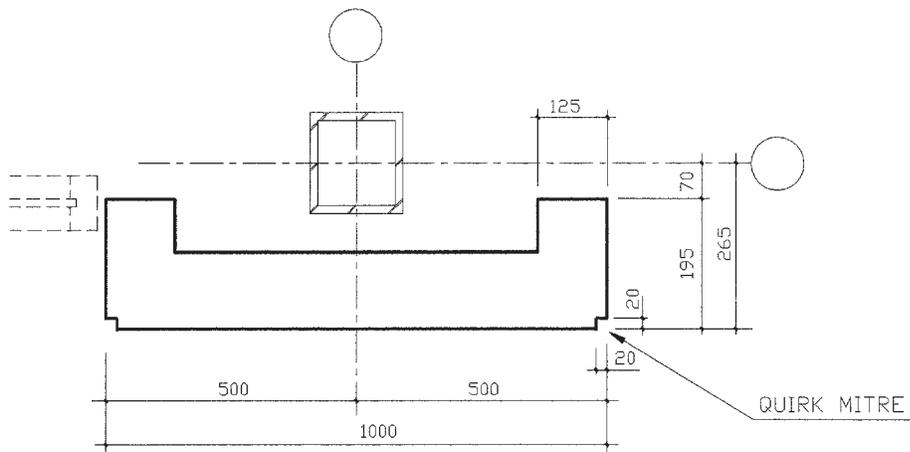
## Precast Concrete Caulking Details



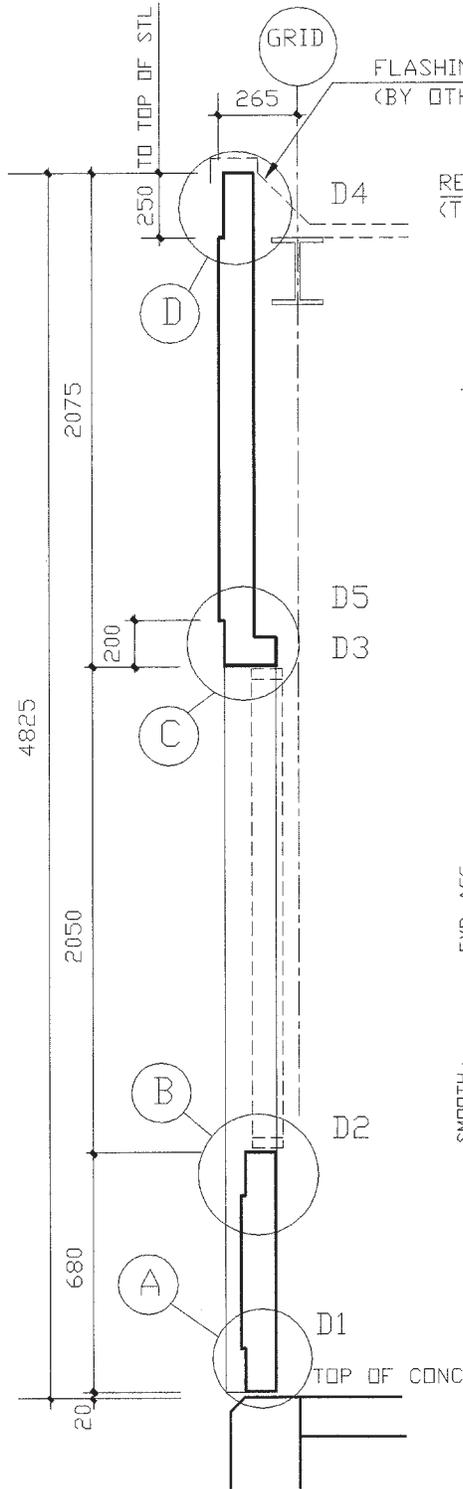
**Part Floor Plan**



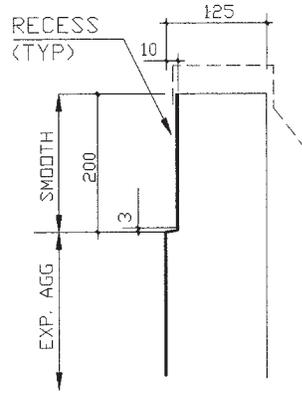
**South Elevation**



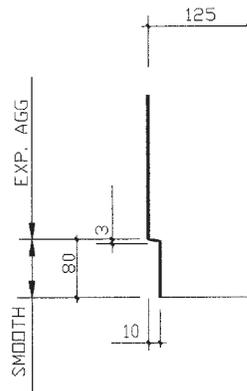
**Plan Detail 3**



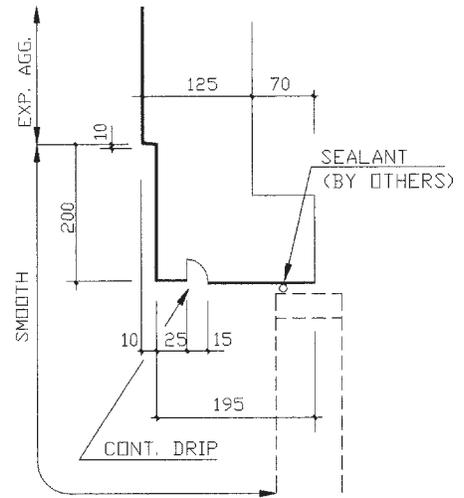
Section - 1



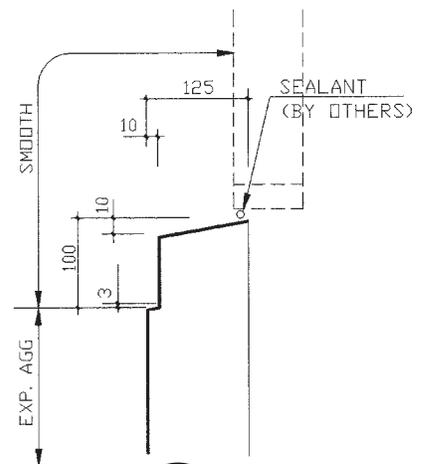
(D)



(A)



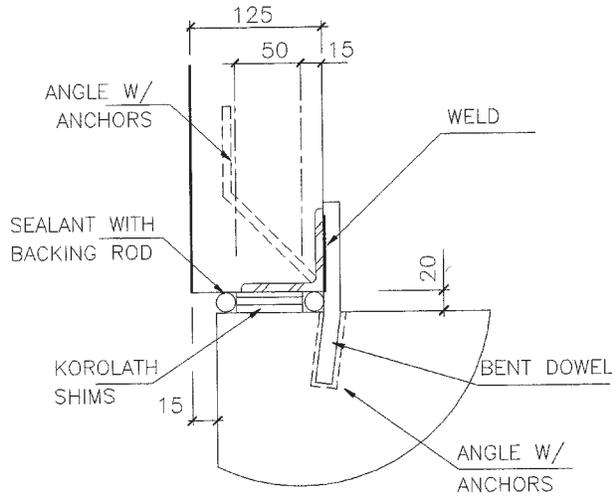
(C)



(B)

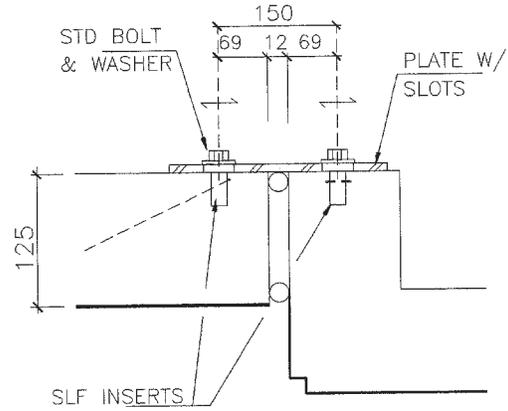
Suggested Features

Architectural Precast Panels  
Connected to a Steel Structure



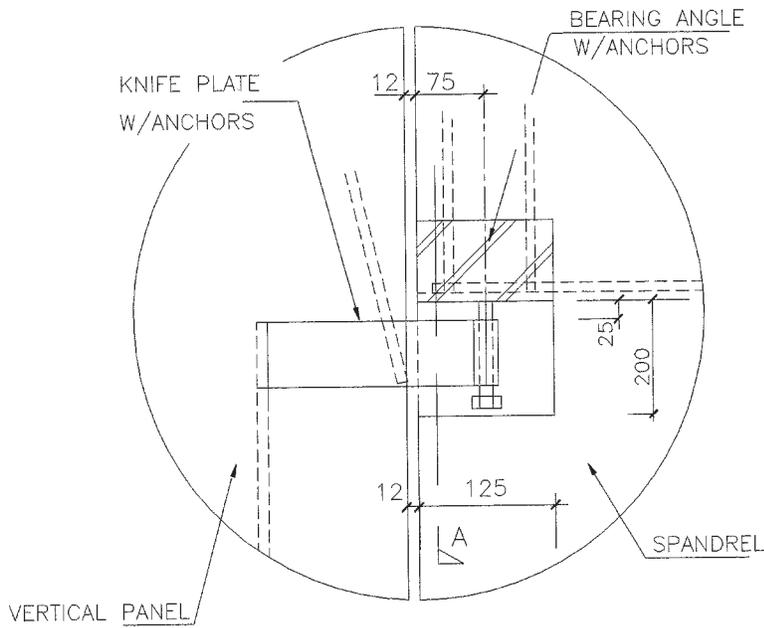
**Section**

**Load Bearing and Lateral Connection  
Conn D-1  
(Column & Sill Gravity)**



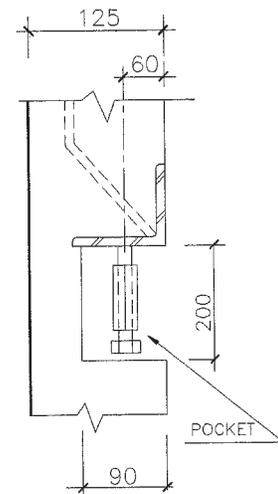
**Plan**

**Panel to Panel Connection  
Conn D-2  
(Sill Lateral)**



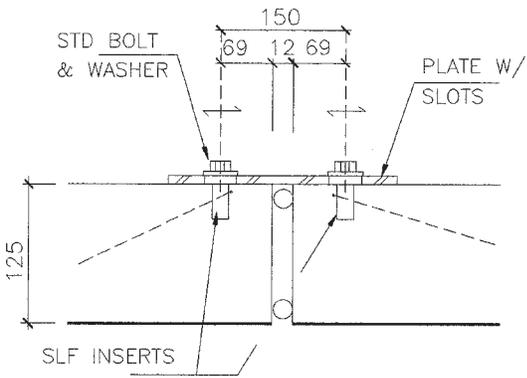
**Back View**

**Conn D-5  
(Spandrel Gravity)**



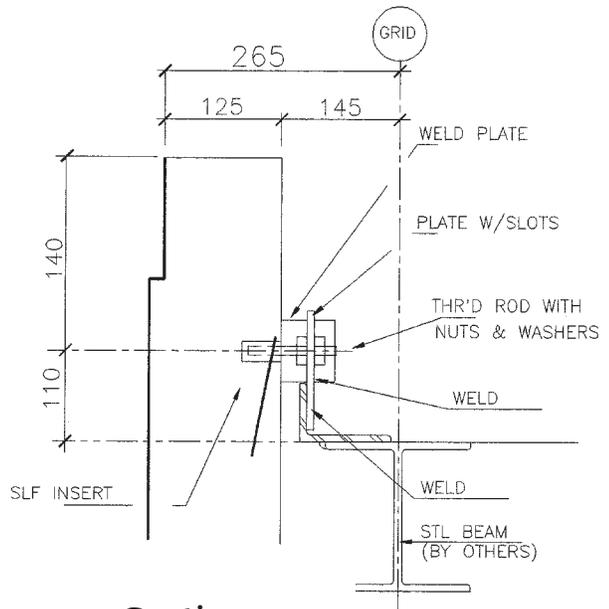
**Section A**

**Load Bearing**



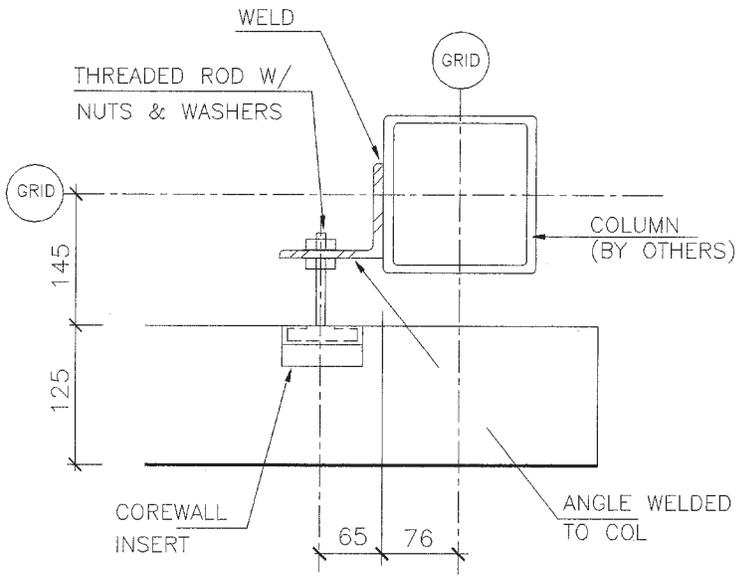
**Plan**

**Panel to Panel Connection  
Conn D-3  
(Spandrel Lateral)**



**Section**

**Conn D-4  
(Top Lateral)**



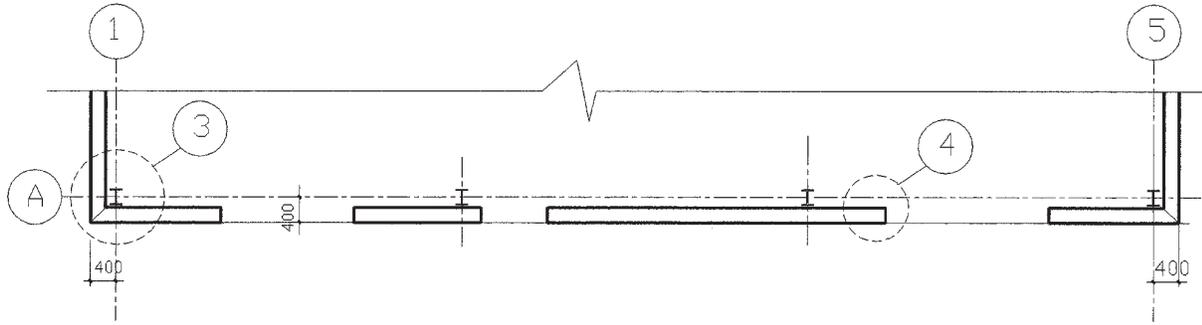
**Plan**

**Conn D-6  
(Mid-Span Lateral)**

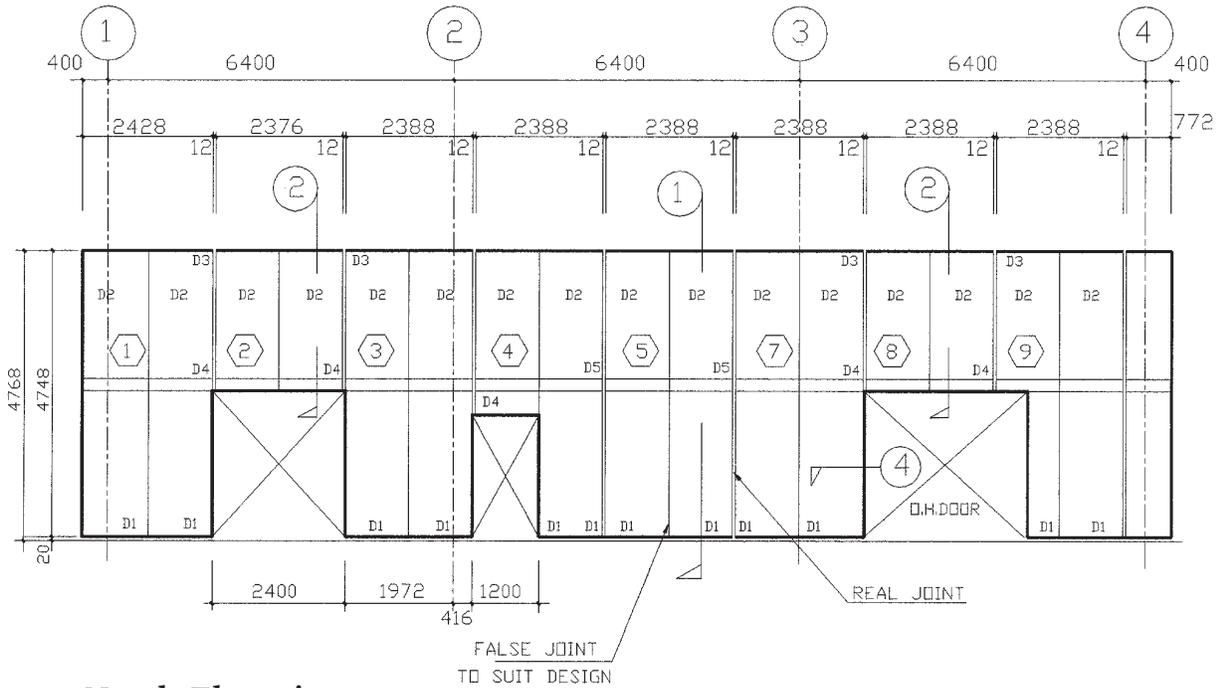
All connections shown are to be used for concept design only.

Panel connections will be heavier in seismic regions.

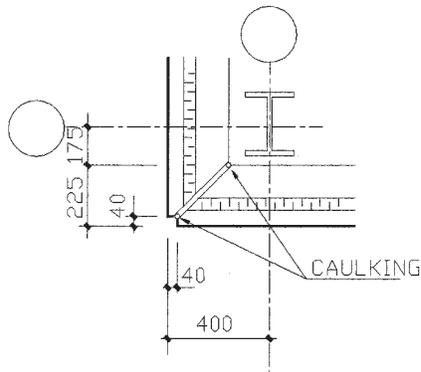
**Connection Details for  
Architectural Precast Panels  
Connected to a Steel Structure**



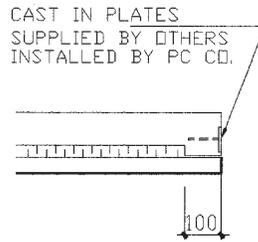
**Part Floor Plan**



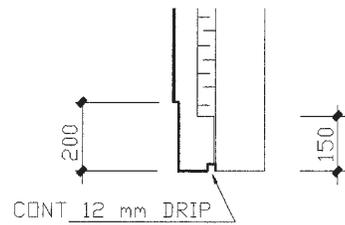
**North Elevation**



**Plan-Detail**

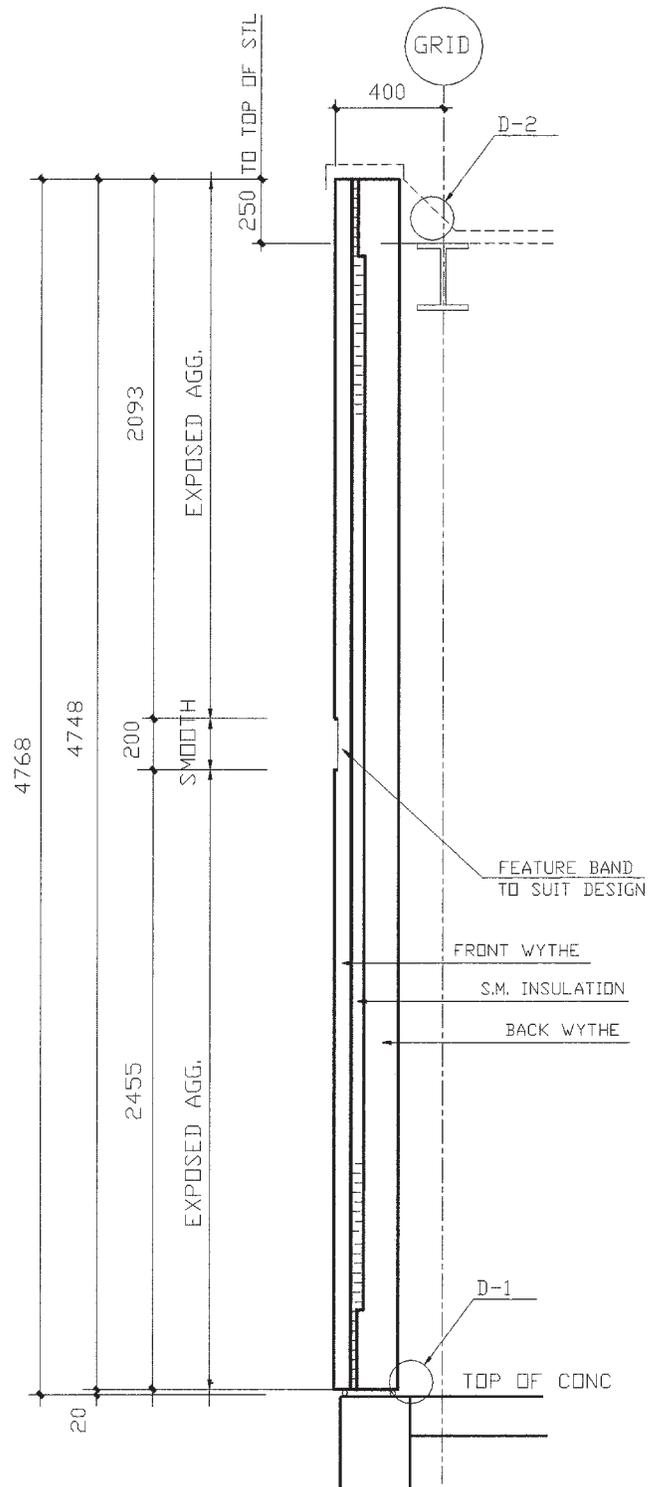


**Plan-Detail**

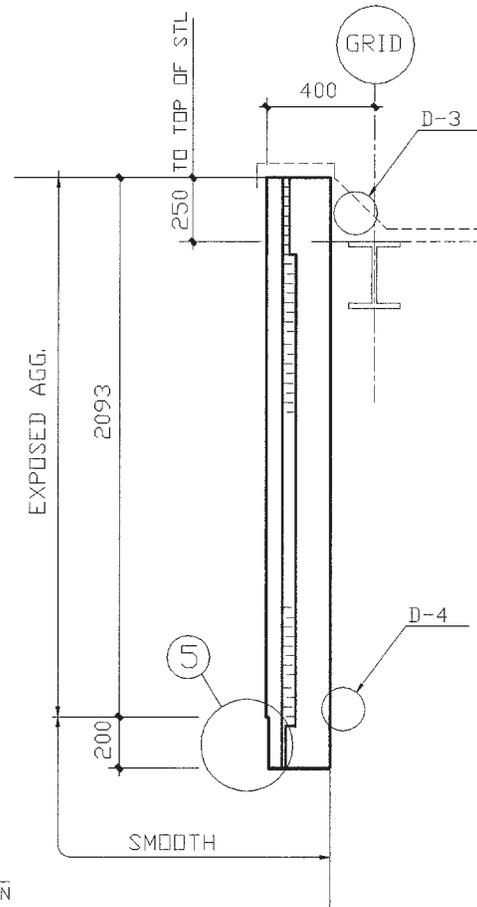


**Section**



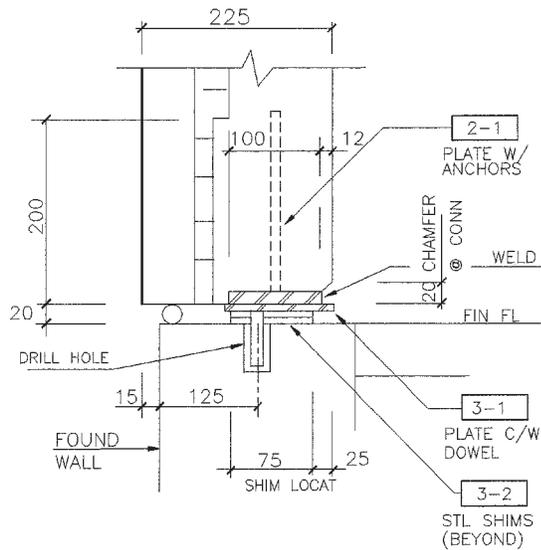


Section 1



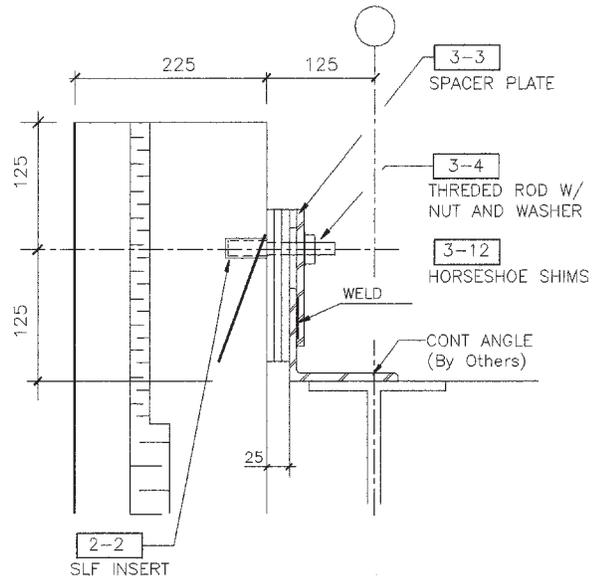
Section 2

# Single Storey Insulated Precast Panels



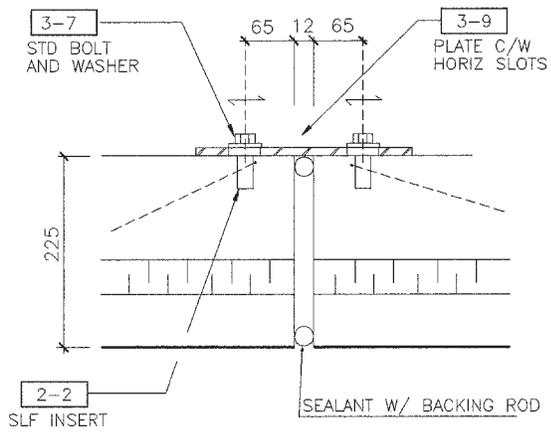
Section

Load Bearing and Lateral  
Conn D-1



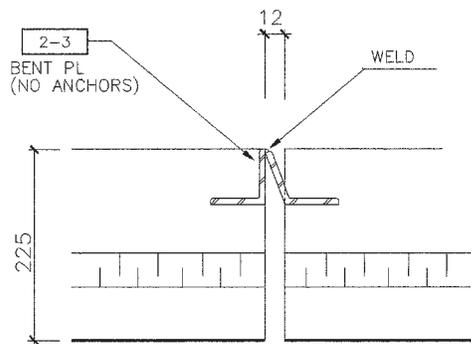
Section

Top Lateral  
Conn D-2



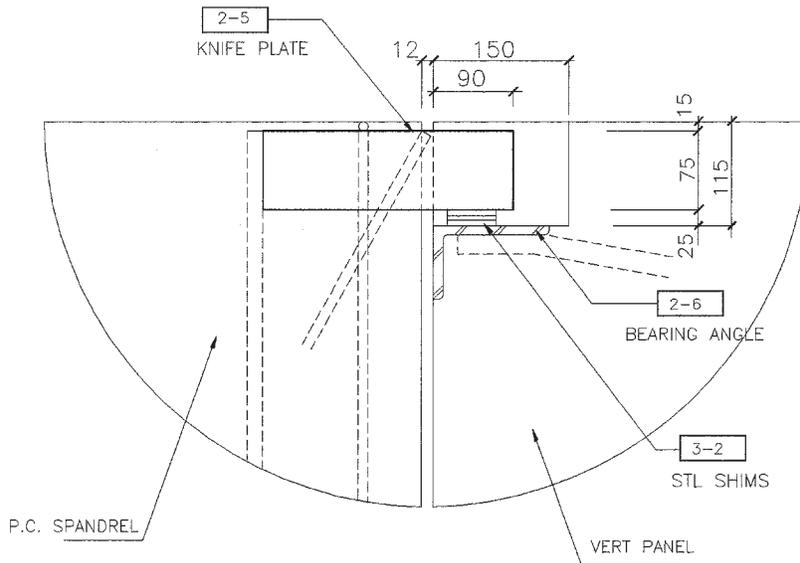
Plan

Panel to Panel Conn  
Conn D-4

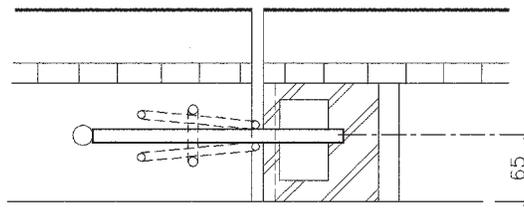


Plan

Panel to Panel Conn  
Conn D-5



**Back Elevation**

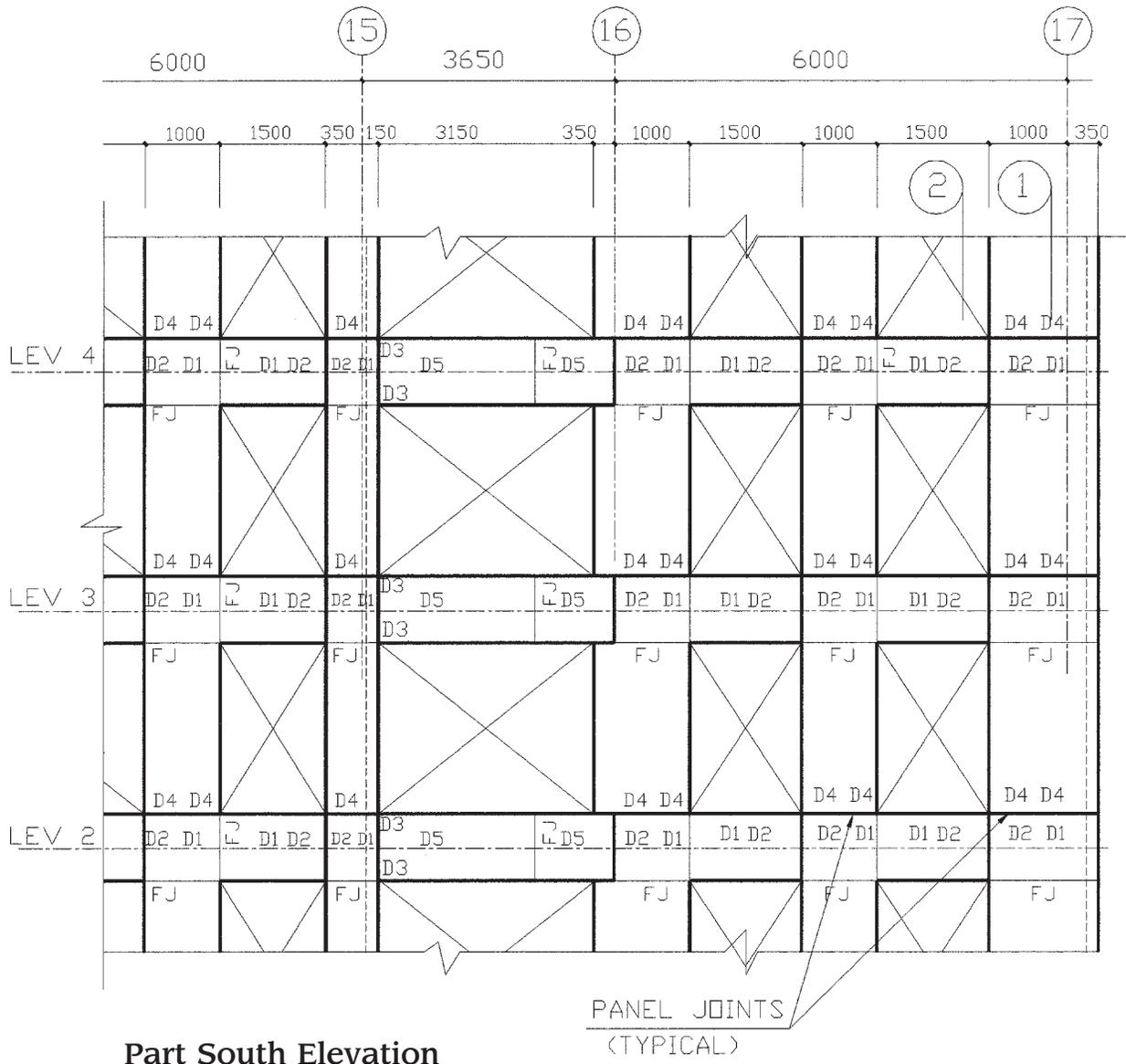
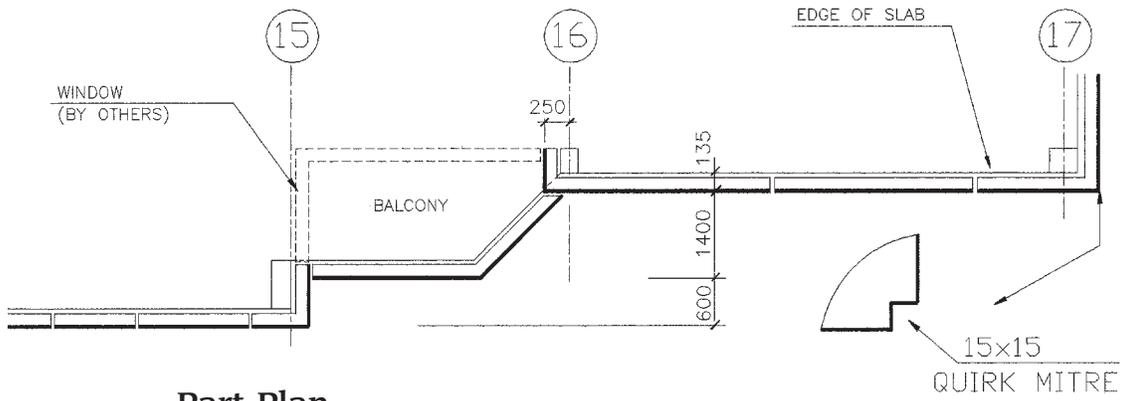


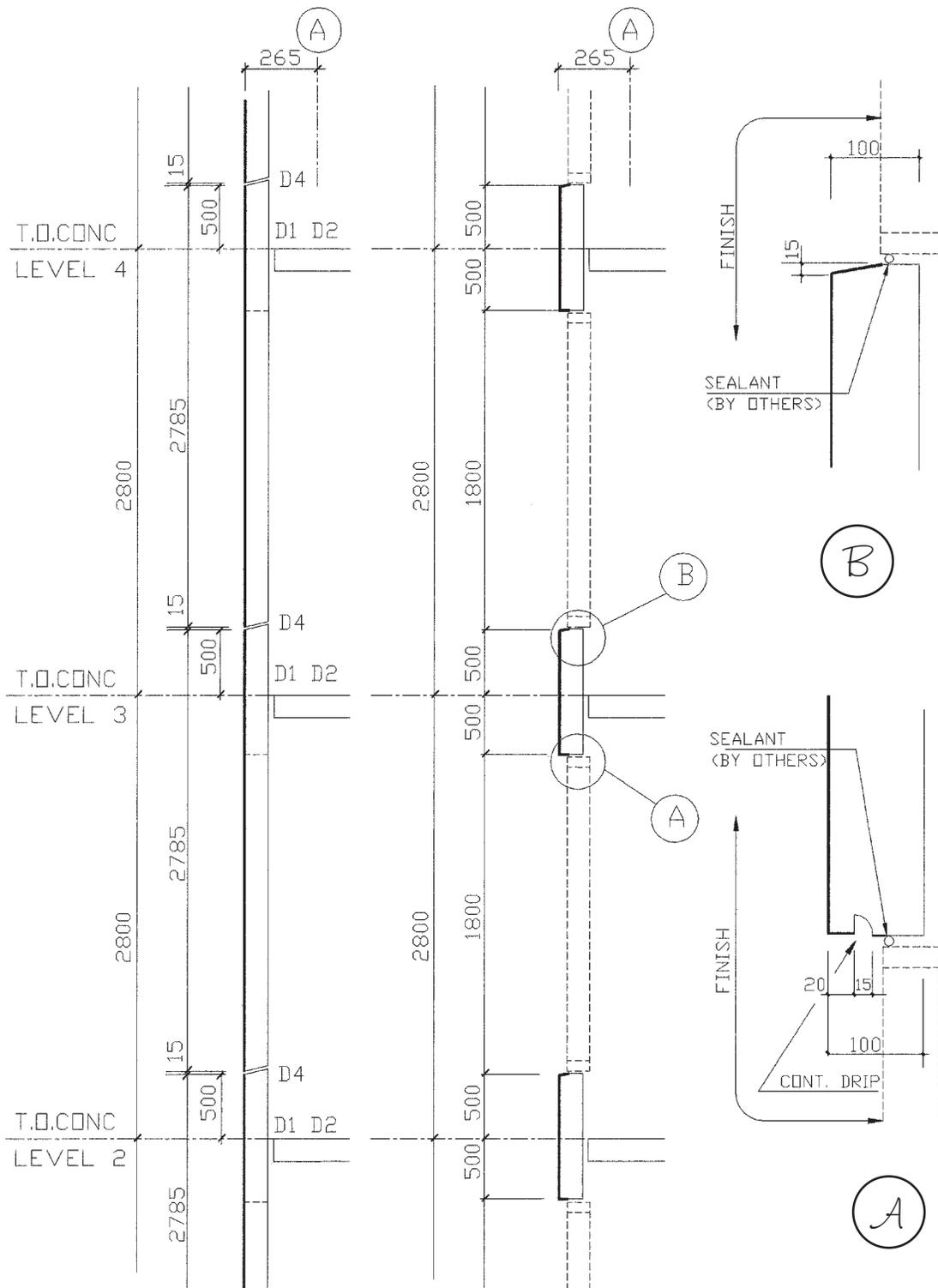
**Top View**

**Load Bearing at O.H. Doors  
Conn D-3**

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

**Connection Details for Insulated Precast Panels**

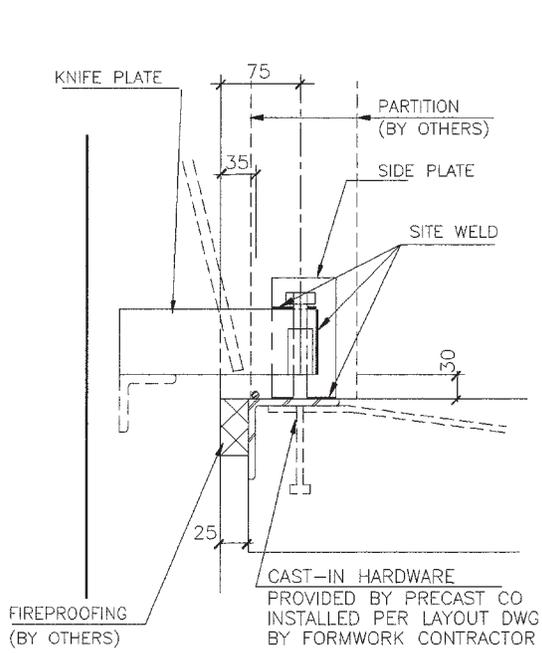




Section 1

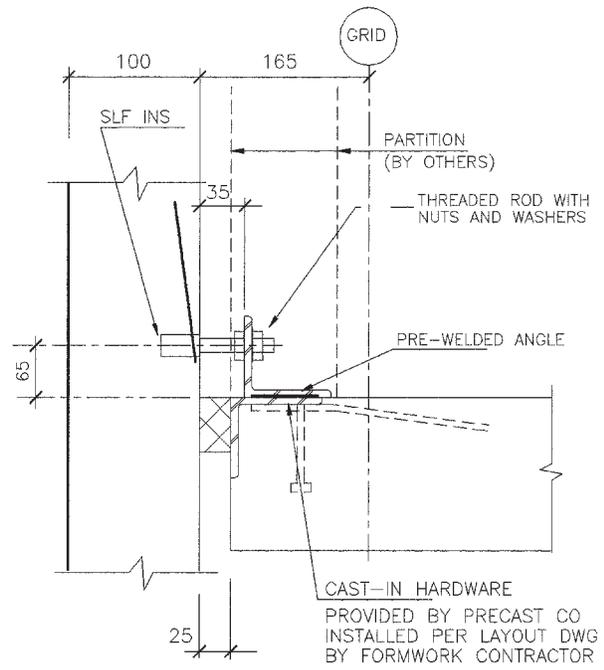
Section 2

Multistory Wall Panel Connected to a Concrete Structure



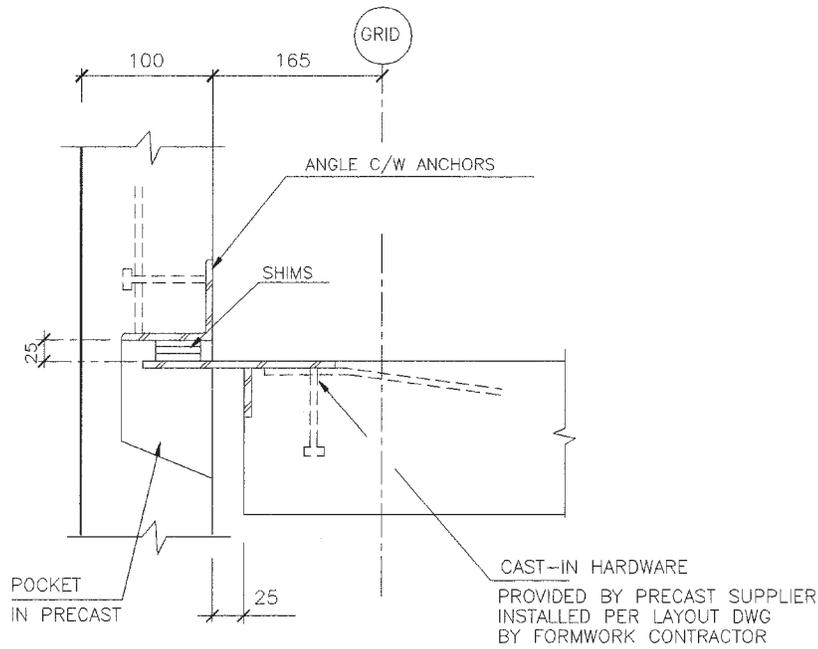
Section

Load Bearing & Lateral  
Conn D-1



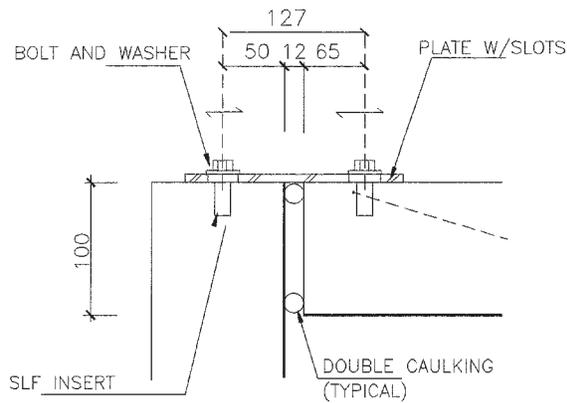
Section

Lateral Connection  
Conn D-2



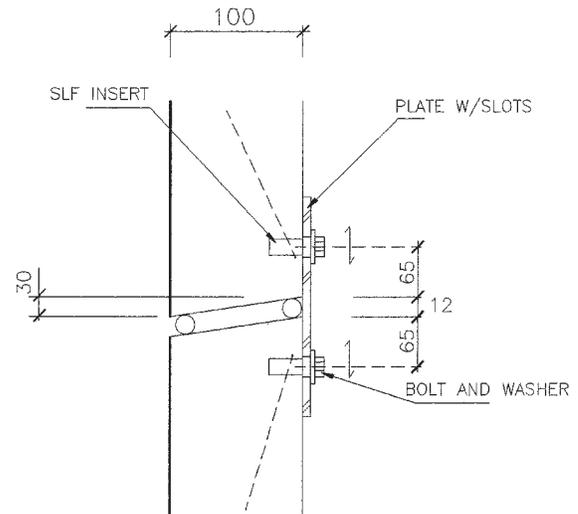
Section

Load Bearing Connection  
Conn D-5 (AT BALCONY)



**Plan**

**Panel to Panel Conn  
Conn D-3**

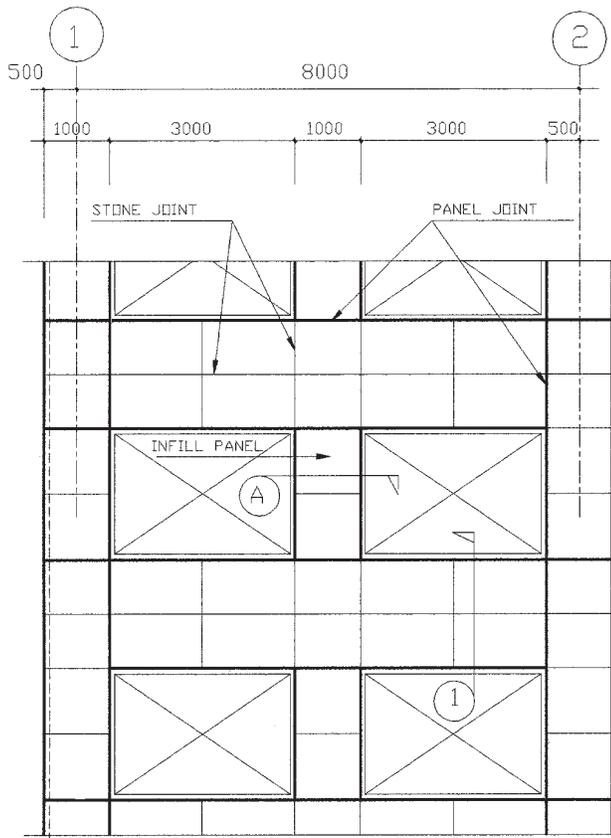


**Section**

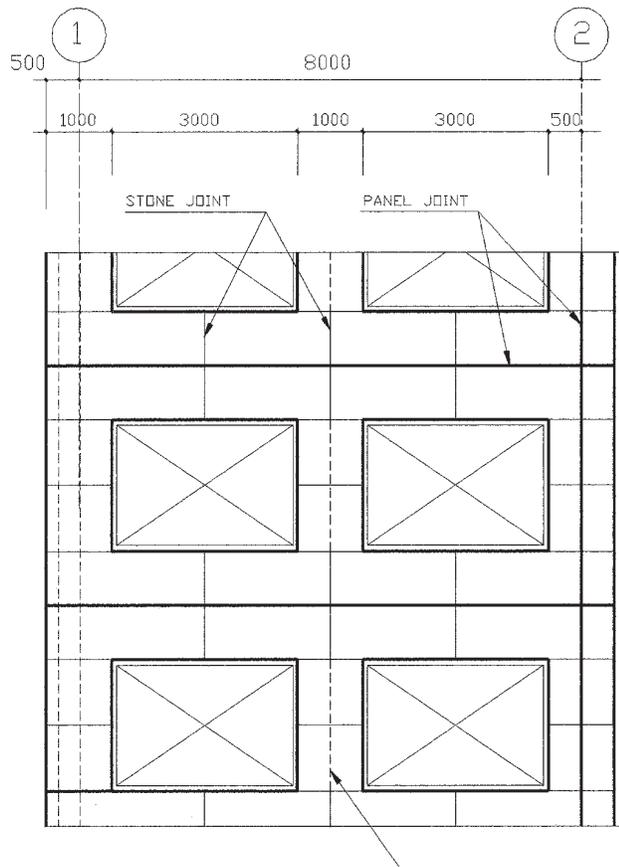
**Panel to Panel Conn  
Conn D-4**

*Note: All connections shown are to be used for concept design only. Panel connections will be heavier in seismic regions.*

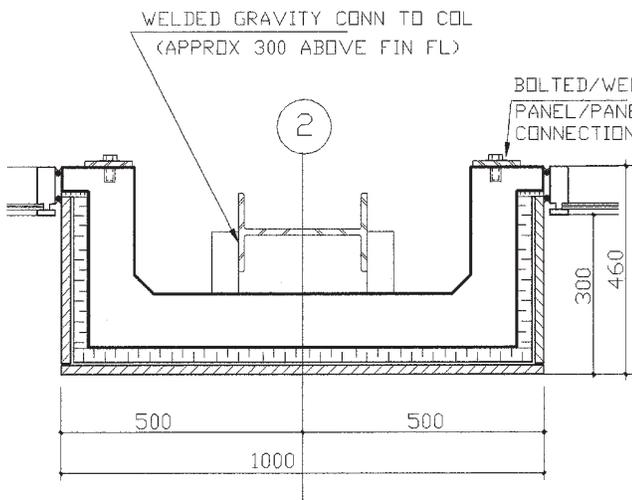
## Connection Details for Multistory Wall Panels Connected to a Concrete Structure



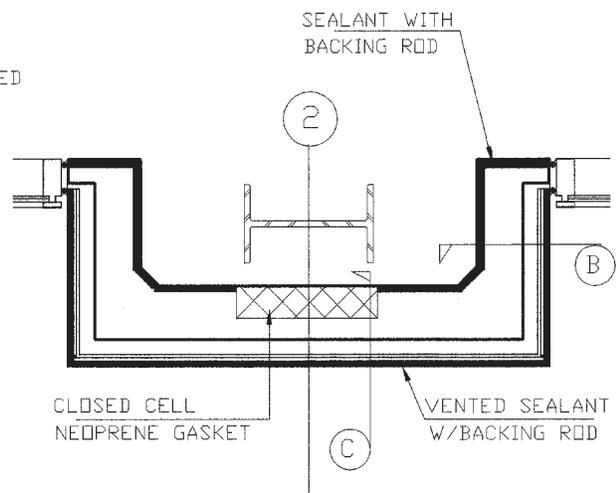
Part Elevation - Alternate 1



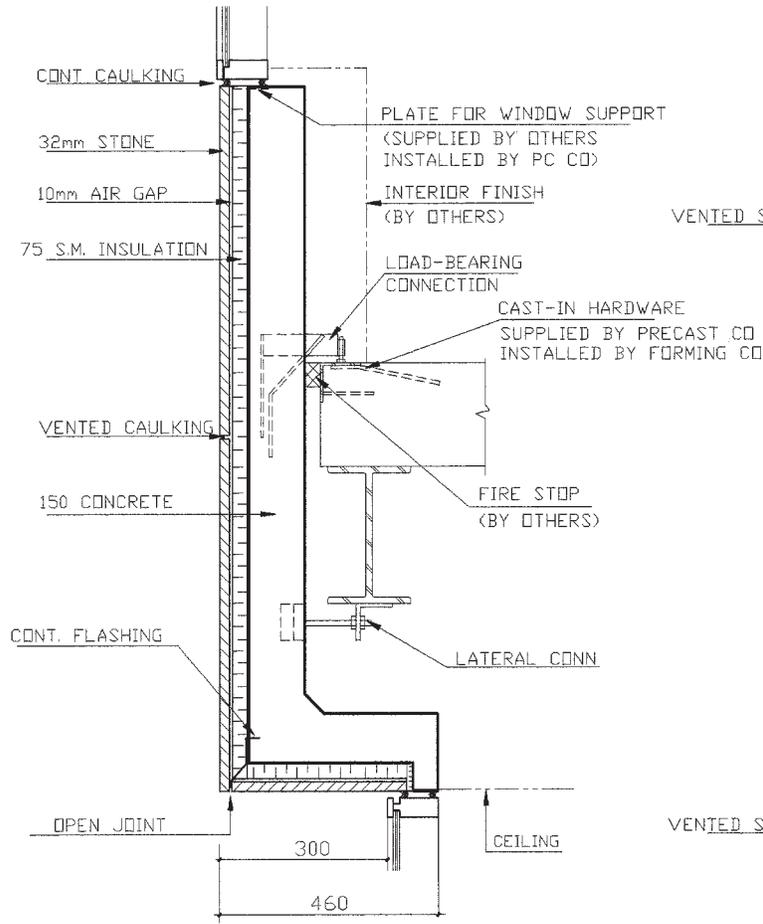
Part Elevation - Alternate 2



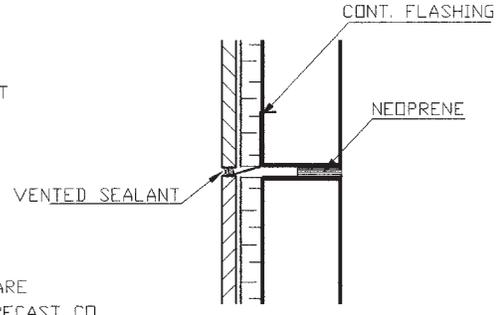
Plan



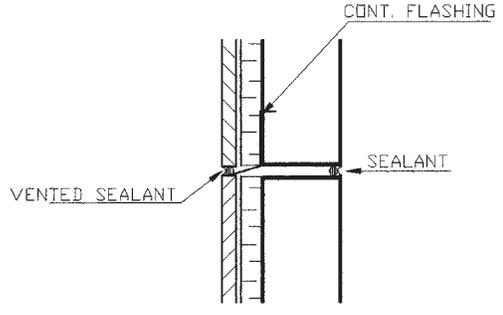
Plan at Joint



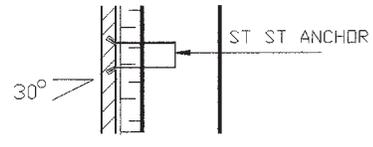
Section 1



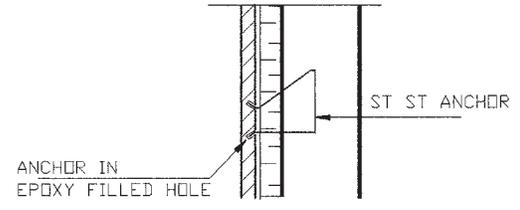
Detail C



Detail B



Plan  
Typical Anchor Details



Section

## Granite Face Rain Screen Panel Detail (Insulated)

# Maintenance of Precast Concrete Building Products

Precast Concrete is a durable and long lasting building product. 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 the building envelope. By following a simple program of inspection and maintenance precast concrete can guarantee the designed service life of a building.

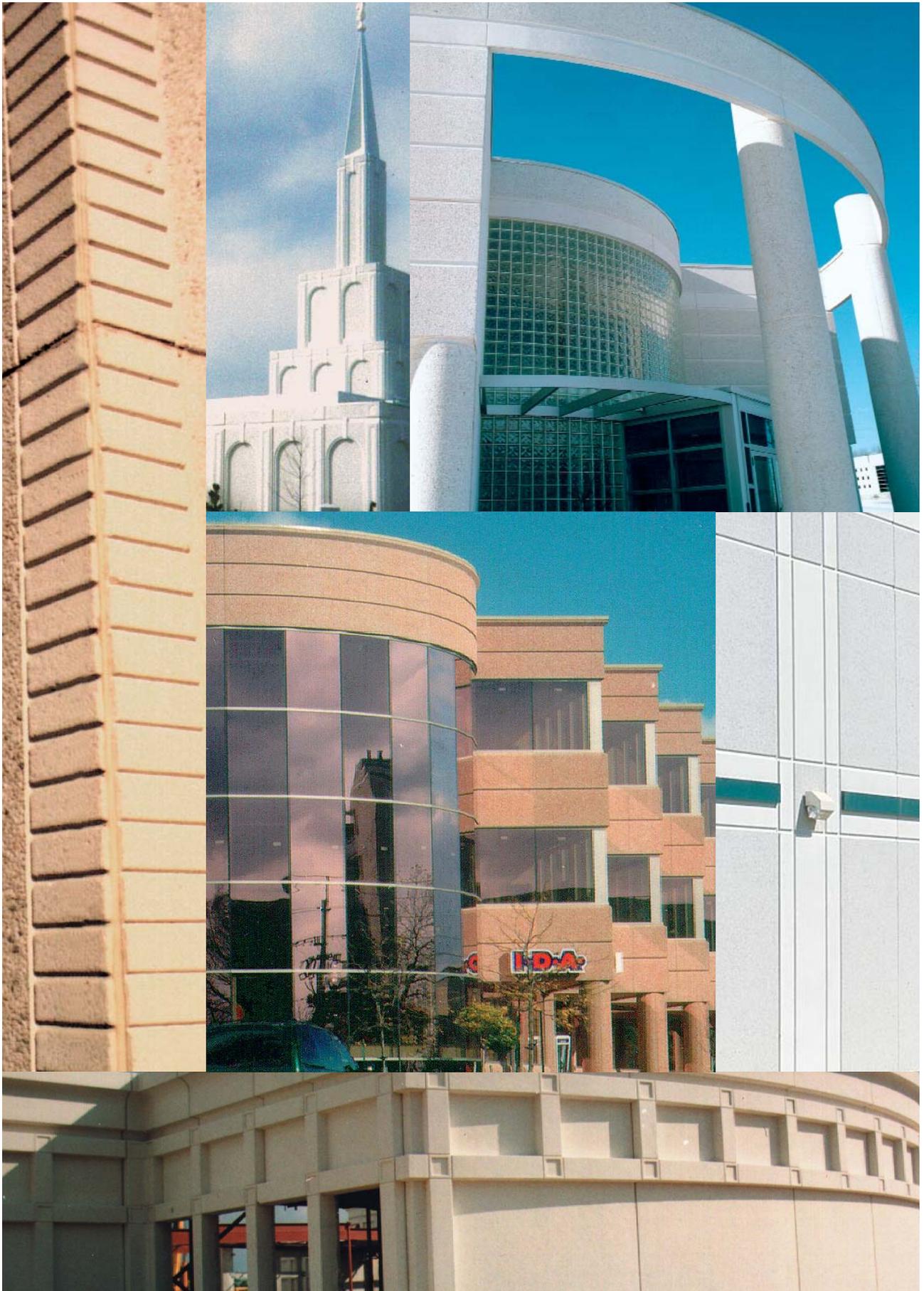
To ensure the continued performance of the wall system and to maintain the warranty, visual inspections should be carried out at regular intervals. It is recommended that these inspections be carried out annually. Attention should be paid to the caulked joints, surface appearance and connections.

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.
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-caulk with matching caulking as per manufacturer's instructions.
6. Follow applicable by-laws regarding use of sandblasting or acid cleaning procedures.
7. If using acid 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: \_\_\_\_\_

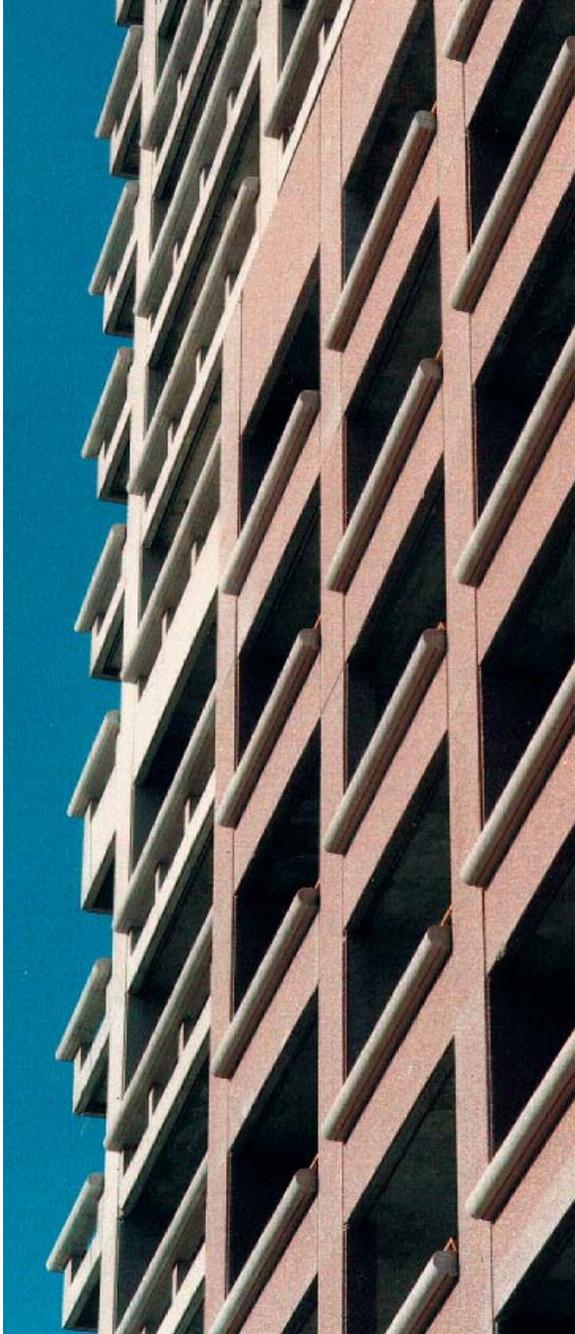
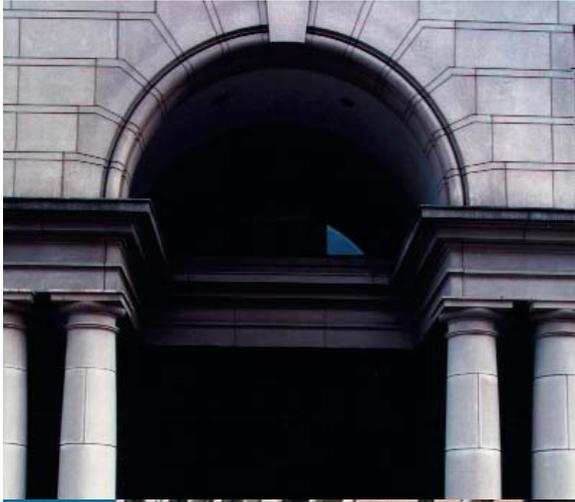
We hereby warrant that all precast components have been designed, manufactured and installed in accordance with the specifications and the contract documents for the above referenced project for a period of .....years, commencing on the date of the owner, or the owner's representative, certificate of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



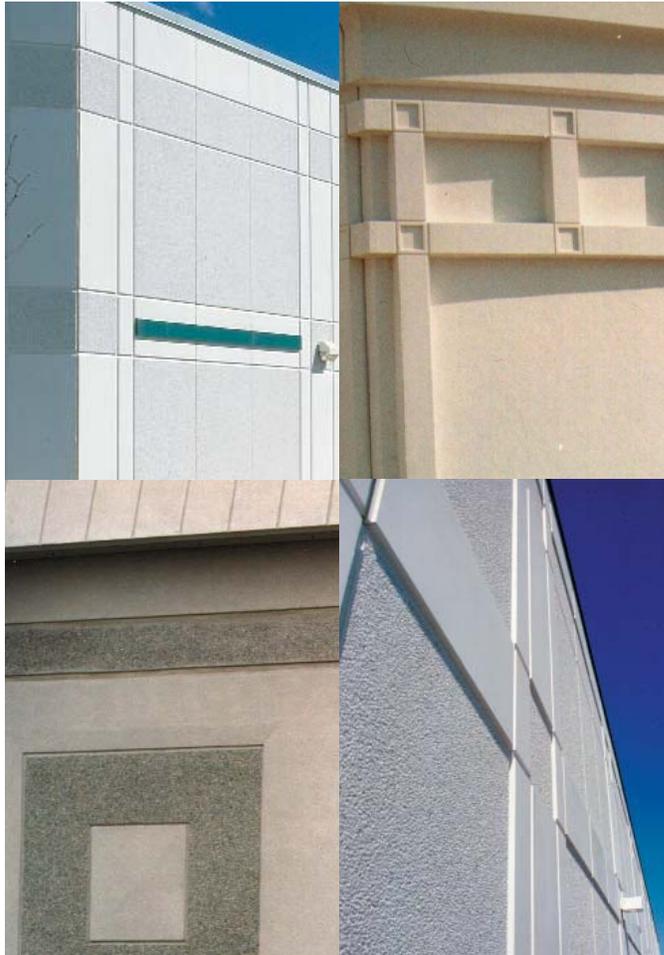
# Acknowledgements

*Photographs courtesy of the following companies:*

- Architectural Precast Systems Inc. • Global Precast •
- Res Precast Inc. • Tri-Krete Limited •

*Sponsored by:*

- Canadian Portland Cement Association (CPCA) •



Canadian  
Precast/  
Prestressed  
Concrete  
Institute

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