

SPECS

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:

.2 Precast concrete architectural wall panels.

.3 Field sealing and sealant of all precast concrete wall panels inside and outside between precast panels, between precast and foundation walls.

.4 Review of shop drawings of structural steel supplier. Supply information for installation of bracing, supports, inserts and similar accessories that are required for work under this contract to be supplied and installed by others.

.5 Take delivery and cast into precast work boxes/inserts/openings required by other trades.

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 other wise 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: The latest Standards are listed. Specifiers should update specifications to the latest CSA Standard.

- .1 CSA A23.1-04, Concrete Materials and Methods of Concrete Construction
- .2 CSA A23.2-04, Methods of Test for Concrete
- .3 CSA A23.3-04, Design of Concrete Structures
- .4 CSA A23.4-05, 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

1.5 Qualifications of Manufacturer

- .1 Fabricated precast concrete elements shall be supplied by manufacturers certified by the Canadian Precast/Prestressed Concrete Institute in the appropriate category(ies) according to CSA Standard A23.4-05 "Precast concrete - Materials and construction". The precast concrete manufacturer shall be certified in accordance with the CPCI 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 - Specialty

(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 company

1.6 By-Laws and Codes

- .1 Conform to applicable requirements of [Province of _____] 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 Manufacturer: certified to Canadian Precast/Prestressed Concrete Institute (CPCI) Certification Program.
- .2 Manufacturer must meet requirements of CSA A23.4, including Appendices A and B, together PCI MNL-116 and 117 and CPCI certification requirements.
- .3 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.
- .4 Cooperate with Inspector to facilitate his work.
- .5 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 job site dimensions. Precast concrete is a fabricated material. Site dimensioning would require the structure to be complete before fabrication could commence.

- .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 A23.4-00 - Appendix C5 Project Samples and Approvals

- .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 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 easels 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 precast panel loads, and superimposed wind, snow and rain loads, and seismic loads, without exceeding deflection of 1/360.

.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_____ [specify] wall assembly.

2.0 Products

2.1 Materials

.1 Cement, [white cement] [colouring material], aggregates, water and admixture: to CSA-A23.4 and CSA-A23.1. Supplementary cementing materials: to CSA-A23.5-00

Spec Note: Re: 2.1.2 - Due to the variety of exposed aggregate finishes for precast concrete and availability of local aggregates, it is necessary to preselect colour, texture and finish in cooperation with CPCI member producers. This should be done before the specification is written. Include the generic name of the selected aggregates, sizes of aggregates and proportions of different colours and 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 a 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.

- .12 Bearing pads: neoprene, [60] durometer hardness to ASTM D2240, and [17] MPa minimum tensile strength to ASTM D412, molded to size or cut from molded 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 Fabricate architectural precast concrete 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 the 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

2.5 Finish

Spec Note: Select from 2.5.1 to 2.5.5 for the type(s) of finish required. Delete those not applicable.

- .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 to 6 mm) [specify].

Spec Note: Specify other finishes (broomed, bushhammered rib, textured form liner, etc.) as required.

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 the general contractor for installation. Provide such items in ample time to meet construction program. 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 job site dimensions. Precast concrete is a fabricated 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 Offset in faces of adjacent panels to be 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 wherever possible. Protect work from damage by weld splatter.
- .4 Provide temporary erection anchorage for welded anchorage system.
- .5 Where bolts are used for installation, tighten with equal torque. Secure bolts with lock washers or tack-weld nut to bolt.
- .6 Clean field welds with wire brush and touch up with galvafroid paint or zinc rich primer.
- .7 Remove shims and spacers from joints between 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 that set up or harden.

SECTION 09285

GLASSFIBRE REINFORCED GYPSUM (GRG)

GENERAL

1.1 SECTION INCLUDES

- .1 Furnish all materials, labor, equipment and services necessary for the supply and installation of Petra Design G.R.G. Components as indicated on the drawings and contract documents, all in compliance with local codes and/or ordinances.
- .2 Works shall include supply of G.R.G. components, installation and joint treatment.

- RELATED SECTIONS

- .1 Sections 09100: Metal Support Systems
- .2 Sections 09250: Gypsum Board
- .3 Sections 09900: Painting

- INTENT

- .1 This specification is intended to generally outline the Petra Design G.R.G. requirements, as they pertain to the overall project design. In all cases, the manufacturer's printed specifications shall govern the work of this section.

- RESPONSIBILITY

- .1 The Gypsum Board Contractor shall install and tape the work under this section and he will be responsible for co-coordinating the installation with drywall work and other trades.

- SUBMITTALS

- .1 Submit a minimum of 3 – 3" x 3" Petra Design G.R.G. flat samples to the finishing contractor for paint selection.
- .2 Submit shop drawings for approval showing plans, sections, details, joint treatment, reinforcing, fastening devices and the relation of Petra Design G.R.G. components to the surrounding construction.

- **MOCK-UP**
- .1 Prior to production erect one proto-type on-site or at the Petra Design Inc. plant, for review by the architect.
- **SUBSTITUTIONS**
- .1 Manufacturers desiring to submit proposals other than Petra Design shall, at least 10 days prior to the bid date, submit to the architect all descriptive information of the system. These manufacturers must have a minimum of five years experience with the system and provide photographs and shop drawings of at least three projects similar in detail and scope with names, addresses and phone contacts of the respective architects and installation contractors. Independent test data showing compliance with the specified system and three samples of similar details must also be submitted.
- **PRODUCTS:**
 - **MANUFACTURER**
- PETRA DESIGN Inc.
14 Jody Ave
Toronto, Ontario
M3N 1H1 Canada
Tel: (416) 746 9668 / 877 738 7240
Fax: (416) 628 2228
www.petradesign.ca
- **MATERIALS**
- .1 Petra Design G.R.G. components shall be prefabricated with high density gypsum, free of resin and asbestos, reinforced with continuous filament random glass fibre mat.
 - .2 Petra Design components shall be reinforced with steel or wood.
 - .3 No additives such as retards, accelerators or polymers are permitted.
 - .4 Fabrications will be as per approved shop drawings and will not include assembly. If multiple components are required to complete design criteria as per contract drawings, additional site work under related section, installation or finishing may be required.
 - .5 Petra Design G.R.G. components shall be ready to receive primer and paint as specified under Section 09900.

- TOLERANCES (FABRICATION)

Dimensional – all directions	+/- 1/8”
Thickness – skin	+/- 1/16”
Thickness – total unit	1/8” – 3/16”
Warpage or Bowing	+/- 1/16”/foot

Site conditions and normal manufacturing variations may require additional site work to maintain these tolerances.

- PHYSICAL PROPERTIES

Shell Thickness		3/16”
Weight (depending on reinforcing)		1-1/2 – 2 lbs/sq.ft
Density		103 – 112 lbs/cu.ft
Flexural Strength	(ASTM C-947-89 MOD.)	4,820 p.s.i.
Compressive Strength	(ASTM C-472-90 MOD.)	13,800 p.s.i.
Modulus of Elasticity – In flexure	(ASTM C-947-89 MOD.)	3.38 X 10 ⁶ p.s.i.
Tensile Strength	(ASTM D-638-94 b MOD.)	1,810 p.s.i.
Impact Strength	(ASTM D-256-93a)	3.26 ft-lb/ in of notch
Hardness	(ASTM D-2583-93)	54
Fibre Content		5 – 6% by weight
Coefficient of Expansion	(ASTM D-696-91)	1.76 X 10 ⁻⁵ in./in./°F
Fuel Contribution	(ASTM E84-80)	0
Flame Spread	(ASTM E-136-94a)	0
Smoke Index	(ASTM E84-80)	0
Fastener Withdrawal – with wood embedded		329 lbs
- With steel embedded	764 lbs	

- INSPECTION

The Architect or his representative shall have access to the manufacturing facilities, either prior to contract award or thereafter, to inspect or verify compliance with the above specifications.

- EXECUTION:

- PRE-INSTALLATION RESPONSIBILITY

- 1 Field Measurements: Prior to manufacturing, the installer will be responsible for obtaining all field dimensions for inclusion on the manufacturers shop drawings.

- DELIVERY, STORAGE, HANDLING AND PROTECTION

- .1 Transports and handle units in a manner that avoids excessive stresses or damage.
- .2 Components displaying obvious damage must be rejected at site at time of delivery.
- .3 Stores the components in a controlled environment, weather protected, on level surfaces, with temporary supports as required. Do not stack or lean.

INSTALLATION

- .1 Components shall be lifted with suitable devices.
- .2 Components shall be installed plum and true. Shim where necessary.
- .3 Fasten components with self-drilling, self-taping, bugle head screws through face or back as indicated on shop drawings.
- .4 Where components are suspended, use as a minimum 12 gauge galvanized steel wire and the suspension points indicated on the shop drawings.
- .5 Framing, hangers, etc. as specified for Gypsum Board.
- .6 Butt joints are to be adhered together using “Liquid Nail” or equivalent.

3.4 JOINT FINISHING, PATCHING AND CONTROL JOINTS

- .1 Tapes fill and sand all joints and introduce control joints (+/- 35’-0” O.C.) as required under Section 09250 of the Specifications and as outlined in U.S.G. or C.G.C. Gypsum Construction Handbook.
- .2 Patch countersunk fasteners and any damage to match component texture.

- FINISHING

- .1 Refer to Painting Section of the Specifications.
- .2 The Paint Contractor shall comply with ASTM C 840-79 Specifications.

NOTES:

- .1 Petra Design G.R.G. components shall be used for Interior Applications only.
- .2 Unfinished G.R.G. may exhibit slight imperfections, normally hidden by textured or mat finished. To obtain satisfactory results with Gloss Finished, additional filling, sanding, priming and painting may be required.
- .3 Improper Sealing, more than crowning, can cause tape joint read-through after painting. This is due to the difference in porosity between joint compounds and G.R.G. Therefore, ensure that the Painting Contractor seals all surfaces properly prior to finishing.

SECTION 03540

GLASSFIBRE REINFORCED CEMENT (GRC)

GENERAL

1.1 SECTION INCLUDES

1. Furnish all materials, labour, equipment and services necessary for the supply and installation of Petra Design G.R.C. Components as indicated on the drawings and contract documents, all in compliance with local codes and/or ordinances.
2. Works shall include supply and installation.

1.2 RELATED SECTIONS

1. Sections 09100: Metal Support Systems
2. Sections 07920: Sealants and Caulkings
3. Sections 09900: Painting

1.3 INTENT

1. This specification is intended to generally outline the Petra Design G.R.C. requirements, as they pertain to the overall project design. In all cases, the manufacturer's printed specifications shall govern the work of this section.

1.4 RESPONSIBILITY

1. The Gypsum Board or Carpentry Contractor shall install the work under this section and he will be responsible for co-ordinating the installation with other trades.

1.5 SUBMITTALS

1. Submit a minimum of 3 – (7.6mm x7.6mm) (3" x 3") Petra Design G.R.C. flat samples to the finishing contractor for paint selection. Use only high-grade breathable exterior primer and paint.
2. Submit shop drawings for approval showing plans, sections, details, joint treatment, reinforcing, fastening devices and the relation of the Petra Design G.R.C. components to the surrounding construction.

1.6 MOCK-UP

1. Prior to production erect one proto-type on-site or at the plant, for review by the architect. Once approved this proto-type will establish standards by which the work will be judged.

1.7 SUBSTITUTIONS

1. Manufacturers desiring to submit proposals other than Petra Design shall, at least 10 days

prior to the bid date, submit to the architect all descriptive information of the system. These manufacturers must have a minimum of five years experience with the system and provide photographs and shop drawings of at least three projects similar in detail and scope with names, addresses and phone contacts of the respective architects and installation contractors. Independent test data showing compliance with the specified system and three samples of similar details must also be submitted.

**PRODUCTS:
MANUFACTURER**

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Tel: (416) 746-9668 / 877-738-7240
Fax: (416) 628-2228
www.petradesign.ca

2.2 MATERIALS

- .1 Petra Design G.R.C. components shall be prefabricated with fast cast Cement, free of resin and asbestos, reinforced with chopped strand fiber.
- .2 Petra Design G.R.C. components shall be suitable reinforced with galvanized steel.
- .3 Fabrications will be as per approved shop drawings and will not include assembly. If multiple components are required to complete design criteria as per contract drawings, additional site work under related section, installation or finishing may be required.
- .4 Petra Design G.R.C. components shall be ready to receive primer and paint as specified under Section 09900.

2.3 TOLERANCES (FABRICATION)

Dimensional –	all directions	(3.2mm) (1/8")
Thickness -	skin	(1.6mm) (1/16")
Thickness -	total unit	(6.4mm-9.6mm) (¼"-3/8")
Warpage or Bowing		(5.28mm/m) (1/16"/foot)
Out of Plane –	unit to unit	(3.2mm) (1/8")

Site conditions and normal manufacturing variations may require additional site work to maintain these tolerances.

SECTION 06600

FIBERGLASS REINFORCED PLASTIC (FRP)

1.1 SECTION INCLUDES

- .1 Provide special fiberglass reinforced plastic (FRP) shapes in accordance with the requirements of the contract documents.
- .2 The installing contractor shall be responsible for verifying that all required blocking is provided and installed in the correct locations for FRP component s proper installation.

1.2 WORK INCLUDED

- .1 Supply of FRP units.
- .2 Erections / installation.
- .3 Joint treatments.
- .4 Supply and installation of backup supports, shimming, labor and materials.

1.3 RELATED SECTIONS

- .1 Masonry work.
- .2 Structural steel: Support framing for fiberglass components.
- .3 Rough carpentry.
- .4 Joint sealants.
- .5 Finishing: Paint manufacturer shall recommend paint suitable for FRP surfaces.

1.4 INSPECTION

- .1 The Architect or his representative shall have access to the manufacturing facilities, prior to contact awarded.

1.5 SUBMITTALS

- .1 Submit a minimum of 3 – (7.6cm x 7.6cm) (3” x 3”) Petra Design FRP flat samples to finishing contractor for paint selection. Use only high-grade breathable exterior primer and paint.
- .2 Submit shop drawings for approval showing plans, sections, details, joint treatment, rein forcing, fastening devices and the relation of the Petra Design FRP components to the surrounding construction.

1.6 SUBSTITUTIONS

- .1 Manufacturers desiring to submit proposals other than Petra Design shall, at least 10 days prior to the bid date, submit to the architect all descriptive information of the system. These manufacturers must have a minimum of five years experience with the system and provide photographs and shop drawings of at least three projects similar in detail and scope with names, addresses and phone contacts of the respective architects and installation contractors. Independent test data showing compliance with the specified system and three samples of similar details must also be submitted.

1.7 TOLERANCES - ERECTED UNITS

- .1 Face width of joint (3.2 mm.) (1/8")
- .2 Variations from plumb (in any dist. of 20' max.) (3.2 mm.) (1/8")
- .3 Variations from level (in any dist. of 20' max.) (3.2 mm.) (1/8")
- .4 Max. Differential between adjacent units in erected position (non-cumulative) (3.2 mm) (1/8")

1.8 PHYSICAL PROPERTIES

Flexural Strength:	ASTM C – 947	(1682 Mpa) (244x10 ³ p.s.i.)
Impact Strength:	ASTM D – 256	(854 J/m) (16 ft. lb./sq.in.)
Ultimate Tensile Strength:	ASTM D – 638	(73 Mpa) (10,600 p.s.i.)
Young's Modulus:	ASTM D – 638	(9.99 Mpa) (1,450 x 10 ³ psi)
Flexural Modulus:	ASTM D – 790	(7.10 Mpa) (1,030x10 ³ p.s.i.)
Flame Spread Index	ASTM E – 84	Class 1 (<25 FSR)
Smoke Developed Index	ASTM E – 84	Class 1 (<375 FSR)
Shell Thickness		(3.2mm) (1/8") min.
Glass Content		25% by weight
Specific Gravity:		1.7
Barcol Hardness		45-60
Impact Strength		(582 J/m) (10.9 ft. lb./ sq. in.)

1.9 DESCRIPTION OF WORK

- .1 This specification is intended to outline the general requirements of the Petra Design Inc. (FRP) units as they pertain to the overall design of the project. The manufacturers Recommendations shall not govern the work in this section.
- .2 The installing contractor shall perform all work in this section, including installation, caulking (filling) and patching and will assume responsibility for coordinating installation with the work and associated trades.

1.10 DESIGN CRITERIA

.1 Unless otherwise stated on National Form's drawings, fabrication tolerances are as follow:

- .1 Dimensional - all directions (0-3m) (0-10') ($\pm 3.2\text{mm}$) ($\pm 1/8''$)
- .2 Dimensional - all directions (3m-6m) (10'-20') ($\pm 4.8\text{mm}$) ($\pm 3/16''$)
- .3 Straightness along an edge or surface ($\pm 5.28\text{mm/m}$) ($\pm 1/16''/\text{linear ft.}$)
- .4 All reveals, grooves, setbacks or returns 3° (draft minimum)
- .5 All outside corners (1.6mm-3.2mm) ($1/16''$ - $1/8''$) radius

1.11 SAMPLES

- .1 Submit duplicate min. (7.6mm x 7.6mm) (3" x 3") FRP samples.

1.12 SHOP DRAWINGS

- .1 Submit for approval, shop drawings of units which show sections, details, joint treatment and the relation of the FRP units to adjoining components.

1.13 SCHEDULING

- .1 Special scheduling for site coordination must be specified at time of bidding.

1.14 DELIVERY, STORAGE AND HANDLING

- .1 Units shall be handled and transported per manufacturer s recommendation, in a manner so as not to create damage or excessive stresses.