Section 071700

**AVM Aussie Clay 590 (PL/SW/SW-PL) Bentonite Composite Sheet Waterproofing Membrane for Shotcrete Property Line Foundation Walls**

PART 1 — GENERAL

1.01 SUMMARY

1. The Work of this Section includes, but is not limited to furnishing and installing the following materials, per project specifications and drawings, or as directed by the waterproofing manufacturer for the following property-line construction applications:
2. Horizontal Applications: Membrane applied on prepared subbase prior to placement of concrete slabs.
3. Vertical Applications: Membrane applied against soil retention system prior to placement of concrete foundation walls;

B. Related sections include, but are not limited to, the following:

1. Section 031000 - Concrete Forming
2. Section 312000 – Earth Moving
3. Section 031500 – Concrete Accessories
4. Section 032000 - Concrete Reinforcing
5. Section 033700 – Wet Mix Shotcrete / Pneumatically-Placed Concrete

1.02 SUBMITTALS

1. Product Data: Provide product criteria, characteristics, accessories, jointing and seaming methods, and termination conditions. Include manufacturer’s written instruction for evaluating, preparing, and treating substrate.
2. Shop Drawings: Show locations and extent of waterproofing and project-specific details of substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
3. Submit for typical and non-typical conditions of Project. Manufacturer’s standard sheets are not acceptable for Shop Drawings.
4. Clearly indicate and identify materials to be incorporated in the work, change in direction, dimensions, thickness of each material and system, and relationships to adjacent construction; provide a narrative of sequencing the two types of waterproofing.
5. Indicate extent of waterproofing, detail call-outs on plans and elevations of areas to receive waterproofing.
6. Shop drawings shall be approved by the waterproofing manufacturer prior to submission to the Architect for review and approval. Manufacturer’s approval shall be clearly noted on the shop drawings.
7. Coordinate shop drawings with Shoring, Architectural, Structural and MEP design.
8. Certificate: Provide a written certification letter from the manufacturer stating that all materials are suitable for site conditions, applications indicated and specified in the construction documents.
9. Manufacturer's Installation Instructions: Indicate special preparation of substrate, panel attachment methods, and perimeter conditions requiring special attention.
10. Qualification Data: For Installer, manufacturer.
11. Sample Warranty: Submit sample manufacturer’s warranty.

1.03 REFERENCE STANDARDS

1. Other specification Sections which directly relate to the work of this section include, but are not limited to, the following:

D 903 Standard Test Method for Peel or Stripping Strength of Adhesive Bonds

D 5385 Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes

E 96 Standard Test Methods for Water Vapor Transmission of Materials

E 154 Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover

ACI 506 Shotcrete to be placed in accordance with the American Concrete Institute (ACI)

1.04 QUALITY ASSURANCE

1. Manufacturer: Sheet membrane waterproofing system shall be manufactured and marketed by a firm with a minimum of 20 years’ experience in the production and sales of waterproofing. Manufacturers proposed for use but not named in these specifications shall submit evidence of ability to meet all requirements specified. Manufacturer shall be capable of providing field service representation during construction, approving an applicable installer, and recommended appropriate installation methods.
2. Installer: A firm which has at least 3 years’ experience in work of the type required by this section. All work of this Section shall be performed by a subcontractor who is trained and certified by the manufacturer of the waterproofing material.
3. Materials: For each type of material required for the work of this section, provide primary materials which are the products of one manufacturer.
4. Pre-Installation Conference:
5. Conduct preconstruction meeting at the project site to review the waterproofing requirements including substrate conditions and pretreatment, surface preparation, minimum curing periods, unique details, sheet flashings, installation procedures, testing and inspection procedures, protection and repair procedures, warranty requirements, and all other work covered under this Section.
6. The preconstruction meeting shall occur only after a complete submittal has been submitted, reviewed and approved by the Architect and Owner’s Consultant.
7. Attendees shall include the Owner’s Representative or Owner, Architect, Owner’s Consultant, General Contractor, Waterproofing Contractor, Manufactures’ Representative and any other trade Representatives from involved in this scope of work and adjacent work (e.g. shoring installer, concrete subcontractor, etc.).
8. Schedule Coordination: Schedule work such that membrane will not be left exposed to weather for longer than that recommended by the manufacturer.

1.05 DELIVERY, STORAGE AND HANDLING

1. Deliver materials in labeled packages. Store and handle in strict compliance with manufacturer’s instructions. Protect from damage from weather, excessive temperature and construction operations. Remove and dispose of damaged material in accordance with applicable regulations at no additional cost to the Owner.
2. Do not double-stack pallets during shipping or storage. Protect waterproofing materials from moisture, excessive temperatures and sources of ignition. Provide cover, top and all sides, for materials stored on-site, allowing for adequate ventilation.

1.06 PROJECT CONDITIONS

1. Environmental Limitations: Apply waterproofing only when existing and forecasted weather conditions are within the guidelines established by the manufacturer of the waterproofing materials. Do not apply waterproofing materials into standing or active water, nor over ice or snow. Though exposure to precipitation and ground water seepage typically will not adversely affect Aussie Clay, the General Contractor shall maintain site conditions to remove standing water from precipitation or ground water seepage in a timely manner. Should Aussie Clay be subjected to prehydration as a result of prolonged immersion, inspection of the material and written acceptance from AVM Industries is required prior to concrete or backfill placement.
	1. Proceed with installation only when existing and forecasted weather conditions permit waterproofing to be installed per manufacturer’s written instructions and warranty requirements.
	2. Do not apply waterproofing materials in areas with standing water.
2. Proceed with work only when substrate construction and preparation work is complete and in condition to receive waterproofing system. All plumbing, electrical, mechanical and structural items to be under or passing through the waterproofing shall be positively secured in their proper positions prior to membrane application. Substrate preparation shall be per waterproofing manufacturer’s guidelines.

1.07 WARRANTY

1. Manufacturer’s Warranty: Manufacturer's standard form in which waterproofing manufacturer agrees to furnish waterproofing material to repair or replace those materials installed according to manufacturer's written instructions that exhibit material defects or otherwise fail to perform as specified under normal use within warranty period specified.
	1. Access for Repair: Owner shall provide unimpeded access to the Project and the waterproofing system for purposes of testing, leak investigation, and repair, and shall reinstall removed cladding and overburden materials upon completion of repair.
	2. Cost Limitation: Manufacturer’s obligation for repair or replacement shall be limited to the original cost of the material
	3. Warranty Period: 5 years from date of Substantial Completion
2. Special Warranties specified in this article exclude deterioration or failure of waterproofing materials from the following:
	1. Movement of the structure caused by structural settlement or stresses on the waterproofing exceeding the manufacturer’s written specifications for elongation.
	2. Mechanical damage caused by outside agents.

PART 2 — PRODUCTS

2.01 MATERIALS

1. Aussie Clay 590 Bentonite Geotextile Waterproofing Membrane
	1. Aussie Clay 590: 3.77’ x 16.4’ roll of bentonite composite sheet waterproofing membrane consisting of needle punched woven and non-woven geotextile fabrics encapsulating a minimum 1-lbs per square foot (4.8 kg/sqm) of active sodium bentonite
	2. Aussie Clay 590 PL: 3.77’ x 16.4’ roll of bentonite composite sheet waterproofing membrane consisting of needle punched woven and non-woven geotextile fabrics encapsulating a minimum 1-lbs per square foot (4.8 kg/sqm) of active sodium bentonite with an HDPE liner on the non-woven side.
	3. Aussie Clay 590 SW: 3.77’ x 16.4’ roll of salt water grade bentonite composite sheet waterproofing membrane consisting of needle punched woven and non-woven geotextile fabrics encapsulating a minimum 1-lbs per square foot (4.8 kg/sqm) of active sodium bentonite blend to be used in saltwater and other ground contaminated (Chemicals, Acids, Hydrocarbons) sites
	4. Aussie Clay 590 SW-PL: 3.77’ x 16.4’ roll of salt water grade bentonite composite sheet waterproofing membrane consisting of needle punched woven and non-woven geotextile fabrics encapsulating a minimum 1-lbs per square foot (4.8 kg/sqm) of active sodium bentonite blend to be used in saltwater and other ground contaminated (Chemicals, Acids, Hydrocarbons) sites with an HDPE liner on the non-woven side.

Aussie Clay PL/SW/SW-PL Performance Properties:

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| **Property** | **Test Method** | **Test Results** |
| **Swell Index**  | ASTM D5890 | ≥24 ml/2g |
| **Fluid Loss**  | ASTM D5891 | ≤18 ml/2g |
| **Bentonite Mass Per Unit Area**  | ASTM D5993 | 1.0 (4.8) lb/sqft (kg/sqm) |
| **Hydrostatic Pressure Resistance** | ASTM D5385M | 231 (70) ft (m) |
| **Permeability**  | ASTM D5084 | 1 x 10-11 m/s max |
| **Tensile Strength** | ASTM D6768 | 8.0/8.0 kN/m min |
| **Puncture Resistance**  | ASTM D6241 | 337 lbs (1.5) lbs (kN) |
| **Peel Adhesion to Concrete**  | ASTM D903M | 15 (2.6) lbs/in (kN/m) |
| **Low Temperature Flexibility**  | ASTM D1970 | Unaffected at -25°F (-32°C) |
| **Water Vapor Transmission Rate****(Aussie Clay PL and Aussie Clay SW-PL)** | ASTM E96 | 0.03 Grains per hr/ft2 |

1. Accessory Waterproofing Products: All accessory waterproofing materials shall be provided by the waterproofing manufacturer or shall have manufacturer’s written approval for substitution:
2. Aussie Clay Sealant: Trowel-grade sodium bentonite-butyl rubber sealant.
3. Aussie Clay Granules: Sodium bentonite granules.
4. Aussie Seal M: Single-component polyether sealant and adhesive.
5. Aussie Swell Red: Hydrophilic block water stop
6. Drain Board 6000: Dimple drainage board core bonded to layer of woven filter fabric. Thickness 0.4 in. Min. 15,000 PSF compressive strength (ASTM D-1621). Min. 21 gal/min/sq. ft. flow rate (ASTM D-4491) through core.
7. Bottom Drain: Thickened base drain composite designed to collect water from sheet drainage pales and then discharge water through collector pipes to collection system.
8. Termination Bar: Extruded-aluminum or formed-stainless-steel bars with upper flange to receive sealant.
9. Staples: Galvanized staples approved by membrane manufacturer. Staples for securing vertical waterproofing panels to wood lagging prior to concrete placement.

PART 3 — EXECUTION

3.01 EXECUTION

1. The installer shall examine conditions of substrates and other conditions under which this section work is to be performed and notify the contractor, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory substrate conditions are corrected and are acceptable for compliance with manufacturer's warranty requirements. General substrate conditions acceptable for the waterproofing installation are listed below. For conditions not covered in this Section, contact the waterproofing manufacturer for guidance.

3.02 SUBSTRATE INSPECTION

1. It is essential to create a sound and solid substrate to eliminate movement during the concrete placement.
2. Mud Slab: Working concrete mud slabs should have a float finish to provide a planar surface; without sharp angular depressions, voids or raised features.
3. Compacted Soil or Gravel Sub-Grade: Sub-grade shall be compacted to a minimum Modified Proctor compaction of 85% or greater as specified by civil/geotechnical engineer. The finished sub-grade surface shall be well-leveled, uniform, free of debris and standing water or ice. Aggregate sub-grades shall consist of ¾” (19 mm) stone or smaller and rolled flat, free from any protruding sharp edges. If substrate consists of large aggregate, place a high-strength geotextile layer over the aggregate and then provide several inches of compacted soil or sand for uniform support and containment of waterproofing sheets. Specific sub-grade preparation shall be approved by the project’s civil or geotechnical engineer.
4. Wood Lagging Shoring: Wood lagging shoring should extend to the lowest level of the waterproofing installation with any voids or cavities exterior of the lagging timbers filled with compacted soil or cementitious grout. Interior surface of lagging boards should be planar and tight together with gaps less than 1”. Gaps in excess of 1” should be filled with cementitious grout, compacted soil, wood, extruded polystyrene (20 psi min.) or polyurethane spray foam. In areas where lagging gaps are 2” or less, AVM Drain Board 6000 sheet drainage can be installed over lagging to provide uniform surface to apply the waterproofing without requirement of filling gaps. All lagging board nails and other mechanical projections shall be removed or pounded flush. Install a protection material over all soldier piles with raised lagging hanger bolts, form tie rods, or other irregular surface; protection material should extend a minimum 4” to both sides of the steel piling.
5. Cut Rock Face or Auger Cast Caisson Shoring Walls: Interior surface of cut rock and concrete auger pile retention walls should be planar without irregular surface conditions, voids, and sharp transitions that would leave a void space to the outside of the drainage and waterproofing installation. Irregular rock, void pockets, cracks, sharp concave transitions should be completely filled or smoothed with cementitious grout, shotcrete, or other approved solid material.
6. Mechanical or Other Penetrations: Mechanical, structural, or architectural materials that will pass through the plane of the waterproofing membrane shall be properly installed and secured in their final position prior to the installation of the waterproofing system.
7. Concrete: Concrete to be waterproofed shall be properly placed and consolidated. Reinforced structural slabs should be a minimum of 6" thick when placed on a working mud slab. Reinforced concrete slab(s) on compacted grade shall be a minimum of 4” (100 mm) thick. When hydrostatic conditions exist, install Aussie Clay under all footings, elevator pits and grade beams. Cast-in-place concrete to receive waterproofing shall be of sound structural grade with a smooth finish, free of debris, oil, grease, laitance, dirt, dust, or other foreign matter which will impair the performance of the waterproofing and drainage system and which do not comply with manufacturer's warranty requirements. Aussie Clay can be installed on green structural concrete as soon as the forms are removed. Do not apply Aussie Clay waterproofing directly over lightweight insulating concrete, wood, or steel decking.

3.03 UNDERSLAB INSTALLATION

1. Reinforced structural foundation slabs should be a minimum of 6" thick when placed on a working mud slab. Reinforced concrete slab(s) on compacted grade shall be a minimum of 4” thick. Install Aussie Clay under all footings, elevator pits and grade beams when hydrostatic conditions exists or are anticipated per the historical high ground water elevation reported in the project’s geotechnical documents.
2. Install underslab Aussie Clay membrane extending to base of shoring wall (dark gray geotextile side up) fully overlapping the 12” horizontal tail of the Aussie Clay corner transition sheet. Secure corner edge of membrane with washer-head fasteners or pneumatic staples 12” on center.
3. Place Aussie Clay directly on properly prepared substrate (dark gray geotextile side up facing installer) with adjoining edges overlapped a minimum of 4”. Stagger sheet end seams a minimum of 12”. Mechanically fasten or staple Aussie Clay PL as required to prevent movement from construction operations or concrete placement. When the slab is poured in sections, extend Aussie Clay a minimum 12" beyond the slab edge to enable proper overlapping.
4. Install waterproofing system at all grade beams, pile caps, and other detail areas in accordance with manufacturer’s detail for specific project condition(s).
5. Slab Penetrations: For all pipe, rebar, structural or other penetrations install waterproofing system in accordance with manufacturer’s standard detail for specific project condition(s).
6. Inspect finished Aussie Clay installation and repair any damaged material prior to concrete slab placement. Assure that Aussie Clay is not displaced during concrete placement.

3.04 WOOD LAGGING WALL INSTALLATION

* 1. Install a strip of Aussie Clay over all soldier piles with raised lagging hanger bolts, form tie rods, or other irregular surface. Aussie Clay strip should extend a minimum 4” to both sides of the piling.
	2. Starting at the base corner, install course of Aussie Clay horizontally oriented (poly liner side against lagging; dark gray geotextile side facing installer) with the bottom edge extending out onto the horizontal substrate a minimum 12" and the top edge of the sheet extending a minimum 12" above the finished slab elevation. Secure Aussie Clay sheet to shoring wall through the AVM Drain Board 6000 with washer-head fasteners maximum 24" on center. Overlap edges of Aussie Clay PL sheets a minimum 4".
	3. After the bottom horizontal course, Aussie Clay sheets can be installed either vertically or horizontally oriented. Continue Aussie Clay installation up wall to finished grade elevation detail, staggering all sheet roll ends of adjacent courses a minimum 12". Do not allow horizontal Aussie Clay overlap joints to run at same elevation as the shotcrete lift joints. Overlap adjacent Aussie Clay sheet edges a minimum 4”. ***Hydrostatic conditions require two layers of Aussie Clay installed on the vertical substrate.***
	4. Tie-Back Heads: For all tie-back heads and soil nails, install waterproofing system with applicable size cover in accordance with manufacturer’s detail for specific project condition(s). For irregular shoring wall conditions at tie-backs or oversize tie-back heads consult manufacturer for alternate detail for specific project condition(s).
	5. Penetrations: For all mechanical, structural and other penetrations install waterproofing system per manufacturer’s detail for specific project condition(s).
	6. Rebar Anchors: Install Aussie Clay Sealant ¾" thick around all rebar anchor penetrating the Aussie Clay. Then install a length of Aussie Swell Waterstop around the rebar anchor tight against the Aussie Clay Sealant.
	7. Inspect finished Aussie Clay installation and repair any damaged material prior to shotcrete placement. Assure Aussie Clay overlap is not separated during shotcrete placement.

3.05 LAGGING WALL TERMINATION

* 1. Coordinate with General Contractor to remove the top few wood lagging timbers and top end of the metal soldier piles per project requirements. Identify and repair any waterproofing and drainage sheet damaged by excavation and removal of soldier pile heads and lagging. Where excavated, fasten all exposed Aussie Clay overlap seams.
1. Terminate Aussie Clay membrane below finished grade elevation secured with washer-head fasteners per manufacturer’s detail for specific project conditions.
2. Backfill shall be placed and compacted to minimum 85% Modified Proctor density promptly after waterproofing has been installed. Closely coordinate with contractor responsible for Backfill work by informing them each time a waterproofed area is ready for backfill. Backfill shall consist of compactable soil or angular aggregate (3/4” or less) free of debris, sharp objects, and stones larger than ¾” (18 mm). Care should be used during backfill operation to avoid damage to the waterproofing system. If damage occurs, cease backfilling and report damage. Damaged waterproofing must be repaired per manufacturer’s guidelines.

3.06 SHEET PILE RETAINING WALLS

1. Cut the underslab Aussie Clay to tightly contour with the metal sheet piling wall. Then pour 1-1/2” cant of Aussie Clay Granules on top of the Aussie Clay along the property line wall. Then install the base shoring wall Aussie Clay sheet overlapping the underslab Aussie Clay sheet a minimum 12”. Cut the bottom edge of the shoring wall sheet at piling transitions to allow the bottom strips to lay flat onto the underslab Aussie Clay. Finally, apply Aussie Clay Sealant at the cut Aussie Clay edges extending outward from the shoring wall for a minimum of 6”.
2. Starting at the base corner, install course of Clay (horizontally oriented) to metal sheet piling wall over the Aussie Clay corner transition course. Secure sheet edges to shoring wall with washer-head fasteners placed a maximum 24" on center around sheet edge.
	1. After the bottom horizontal course, Aussie Clay sheets can be installed either vertically or horizontally oriented. Continue Aussie Clay sheet and Aussie Clay sheet installation up wall to finished grade elevation detail, staggering all sheet roll ends of adjacent courses a minimum 12". Do not allow horizontal Aussie Clay overlap joints to run at same elevation as the concrete pour lift joints; extend membrane past a minimum 6”. Overlap adjacent Aussie Clay sheet edges a minimum 4”. ***Hydrostatic conditions require two layers of Aussie Clay installed on the vertical substrate.***
3. Tie-Back Heads: For all tie-back heads and soil nails, install waterproofing system with applicable size cover in accordance with manufacturer’s detail for specific project condition(s). For irregular shoring wall conditions at tie-backs or oversize tie-back heads consult manufacturer for alternate detail for specific project condition(s).
4. Penetrations: For all mechanical, structural and other penetrations install waterproofing system per manufacturer’s detail for specific project condition(s).
5. Inspect finished Aussie Clay installation and repair any damaged material prior to shotcrete placement. Assure Aussie Clay overlap is not separated during shotcrete placement.

3.07 CAISSON RETENTION WALLS

1. Cut rock face or auger cast caisson wall should be sufficiently planar to provide adequately smooth surface to apply Aussie Clay. Aussie Clay will conform to large gradual change in planes (e.g. around caisson column) but should not be installed over sharp surface deflections or voids. Deflections/voids should be filled with cementitious material to create suitable substrate for waterproofing installation.
2. Cut the underslab Aussie Clay to tightly contour with the caissonwall. Then pour 1-1/2” cant of Aussie Clay Granules on top of the Aussie Clay along the property line wall. Then install the base shoring wall Aussie Clay sheet overlapping the underslab Aussie Clay sheet a minimum 12”. Cut the bottom edge of the shoring wall sheet at piling transitions to allow the bottom strips to lay flat onto the underslab Aussie Clay. Finally, apply Aussie Clay Sealant at the cut Aussie Clay edges extending outward from the shoring wall for a minimum of 6”. ***Hydrostatic conditions require two layers of Aussie Clay installed on the vertical substrate.***
3. After the bottom horizontal course, Aussie Clay sheets can be installed either vertically or horizontally oriented. Continue Aussie Clay sheet and Aussie Clay sheet installation up wall to finished grade elevation detail, staggering all sheet roll ends of adjacent courses a minimum 12". Do not allow horizontal Aussie Clay overlap joints to run at same elevation as the concrete pour lift joints; extend membrane past a minimum 6”. Overlap adjacent Aussie Clay sheet edges a minimum 4”.
4. Tie-Back Heads: For all tie-back heads and soil nails, install waterproofing system with applicable size cover in accordance with manufacturer’s detail for specific project condition(s). For irregular shoring wall conditions at tie-backs or oversize tie-back heads consult manufacturer for alternate detail for specific project condition(s).
5. Penetrations: For all mechanical, structural and other penetrations install waterproofing system per manufacturer’s detail for specific project condition(s).
6. Inspect finished Aussie Clay installation and repair any damaged material prior to shotcrete placement. Assure Aussie Clay overlap is not separated during shotcrete placement.

3.08 PREFABRICATED DRAINAGE COMPOSITE INSTALLATION

1. At the base of the wall, place AVM Bottom Drain horizontally oriented with the open core side and tight against the wall over the previously installed Aussie Clay waterproofing using wash-head mechanical fasteners or general construction adhesive. Use AVM Bottom Drain accessory fittings, as required, to form a continuous installation. Install AVM Bottom Drain discharge outlet fittings to connect to discharge pipes as required for the project.

3.09 WATERSTOP INSTALLATION

1. Injection Tube Waterstop: Install an injection tube waterstop between the mat slab and basement wall transition around the building perimeter and between the elevator pit walls and mat slab. Complete installation in accordance with installation instructions in manufacturer’s published literature and inject waterstop after concrete has curing min. 28 days.
2. Hydrophilic Waterstop: At typical penetrations, and cold joints install hydrophilic waterstop in accordance with installation instructions in manufacturer’s published literature, including but not limited to, the following:
3. Surfaces should be clean and dry. Remove all dirt, rocks, rust, debris or other foreign matter that might inhibit the adhesive from bonding to the concrete. Do not install Aussie Swell in standing water.
4. Apply a continuous bead of Aussie Seal M along the substrate where Aussie Swell will be installed. Assure proper 3” concrete coverage will be maintained.
5. Mechanical fasteners should not be used to secure product alone, but may be used in conjunction with Aussie Seal M.
6. Tightly butt coil ends together to form a continuous waterstop (do not overlap coil ends). Place in maximum practical lengths to minimize coil end joints.

3.10 FIELD QUALITY CONTROL

1. Project waterproofing details must be installed in accordance with AVM’s standard published and/or project specific waterproofing details. Job specific details created by AVM Applicator or designer must be signed off by AVM Representative.

3.11 PROTECTION

1. Protect membrane in accordance with manufacturer’s recommendations until placement of concrete.
2. Use only water-based marking chalk on top of the installed waterproofing membrane. If other construction marking products are intended to be used, they must be reviewed and approved in writing by the waterproofing manufacturer.
3. Protect membrane during concrete placement from overspray with polyethylene sheeting or other approved means. Remove contamination and cured overspray material from membrane with mechanical means, taking extra care to not damage the waterproofing, prior to further placement of adjoining concrete.
4. Do not permit vehicular traffic on unprotected membrane.
5. Inspect for damage just prior to placement of concrete and make repairs in accordance with manufacturer’s recommendations.

END OF SECTION