PERVIOUS CONCRETE SPECIFICATION
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100. GENERAL PROVISIONS:

This specification is designed to become the central focus to define and regulate the Pervious Concrete work to be performed on a related job contract. It is designed as a description of work and the protocol to be observed by all involved in its installation.

It is intended to be for the benefit of all involved, i.e., owners, architects, engineers, inspectors, suppliers, contractors and subcontractors. Since many ASTM, DOT and AASHTOT standards often form a significant part of the contract documents and this specification, it is imperative that not only the Pervious Concrete Contractor, but the Ready-mix supplier, cement suppliers, aggregate suppliers, admixture suppliers and any other vendors or subcontractors, as well as any Architects, Engineers or Owner's Agents be thoroughly familiar with this specification. Any departure from its provisions shall be by the mutual consent of all involved.

Ready-mix suppliers shall be responsible for certifying compliance of each batch of Pervious Concrete delivered by it for the designated job. Its responsibility shall be limited to the portion of this specification which is under its direct or indirect control. That responsibility shall include acquiring certifications needed from their suppliers.

101. Scope of Work:

The work to be performed under this contract will be defined by appropriate referenced plans or drawings. The testing and preparation of the sub-base may be delegated to the general contractor, owner or owner's agents by mutual agreement. Specifications for base and subsoil preparation shall be the responsibility of the owner and his architect/engineers and shall be observed with certified strict compliance.

The Pervious Concrete Contractor does not assume any responsibility for site work impacting his services unless designated by contractual agreement prior to commencement of site work.

Included in the performance of the work is the furnishing of all labor, equipment and materials. The contractor shall also provide instruments required for leveling and placing forms, special and standard equipment required for placing and finishing materials, and also be responsible for the tight scheduling of the arrival of material at the appropriate time for placement. Extreme weather conditions will be a factor in scheduling and placement.

Material suppliers shall certify that each ready-mixed batch shall be in compliance with mix specifications. Damages or failures caused by deviations from mix specifications shall be the responsibility of the concrete mixture supplier.

102. Contractor Qualifications:

Pervious Concrete Contractors should be: "Certified Pervious Concrete Craftsmen," and must be able to demonstrate at least three years of competent work with Pervious Concrete. The contractor must be able to submit a list of at least three jobs completed within the previous three year period to those job's owners', engineers' or architects' satisfaction during that time. The

oldest jobs installed during that period must still be demonstrating durability. Any applicable test results from such previous jobs shall be furnished to the Owner/Engineer/Architect if requested.

Please note! Certification by any reputable organization **shall not substitute for years of demonstrated quality installations and workmanship.**

Observe, please, the following disclaimer from the PERVIOUS CONCRETE CONTRACTOR CERTIFICATION LIST published on the internet by the NATIONAL READY MIX CONCRETE ASSOCIATION: *"Certified personnel have achieved the stated criteria. NRMCA certification does not vouch for the proficiency or quality of work performed by these personnel. It is the prerogative of the purchaser of such services to verify the proficiency by seeking references of completed projects or by other means." (Italics ours)*

102.1:

If either the Pervious Placing Contractor or the Pervious Concrete Ready-mix producer have no prior experience with Portland Cement, Pervious Concrete Pavement; the Contractor shall retain an experienced Consultant to supervise production, base preparation, placement and finishing. Expense of the consultant shall be the responsibility of the Contractor.

A contractor who has been certified by passing a test or by receiving certification from a concrete or ready-mix association or supplier, without three years experience working under the guidance of a qualified Senior Pervious Concrete Craftsman, shall not be qualified under this specification.

Qualified contractors should have earned the support of their Pervious Concrete Ready-mix suppliers as demonstrated by their endorsement for installing Pervious Concrete.

103. Concrete Mix Design:

If requested, the Pervious Contractor with the consensus of the Ready-mix supplier, shall furnish a proposed mix design with proportions of materials to Owner, Owner's Agent or Contracted Engineer prior to commencement of work. It will be the responsibility of the Ready-mix supplier to certify that each batch delivered meets the Pervious Concrete mix design specifications.

The Ready Mix supplier shall be responsible for training all involved in creating, processing and delivering the Pervious Concrete mix. This includes the batch plant personnel as well as the Ready-mix truck drivers.

This responsibility begins with providing a cleaned silo for the no-fines aggregate which shall have been triple washed by the aggregate supplier or the batch plant. Trucks to be used in delivering and mixing the material shall have their drums thoroughly flushed and cleaned prior to loading. The batch plant shall load ingredients per mix design and order of addition. Drivers shall be thoroughly made aware of drum speed and number of rotations required to produce the homogenous mix required by time of discharge. Water amount per design mix is critical, and shall not be changed by either the batch plant or the drivers with mutual consent of all concerned. Drivers who do not understand, nor want to understand shall not be permitted to handle Pervious Concrete mixes.

It shall also be the responsibility of the Pervious Concrete Contractor to accept or reject each shipment. The contractor, based upon years of experience, will be able, in addition to the certification from the supplier, be able to judge the appearance, feel, workability and consistency of the batch. **Also, from years of experience, some craftsmen can spot a bad batch of Pervious Concrete from the sound of the rotating drum of the ready-mix truck.** Any questions shall be discussed with the driver and if there is justification to reject a batch, the Ready-mix plant will be immediately notified, followed up with appropriate documentation.

It shall be the responsibility of the Ready-mix supplier to train batch plant operators, supervisors and ready-mix truck drivers how to properly measure, mix, deliver and discharge Pervious Concrete.

Since Pervious Concrete is much different in performance characteristics, **the rodded unit weight sampling is inappropriate and meaningless.** However, if testing is required, core samples can be tested after 28 days for compressive strength according to ASTM C-39 with a minimum of three samples being tested, from a 1,000 square foot slab and one additional sample taken for each additional 2,000 square feet. Samples should be randomly taken from the slab and core cavities must be refilled with pervious concrete. Samples can also be measured for thickness, density and compaction.

104. Testing Agency Procedures:

Testing procedures shall be established as an integral part of this specification. The level of testing and methods to be used shall be agreed to by all involved parties. **Charger Enterprises and/or its material suppliers reserve the right to exclude any test procedures which do not properly address the unique characteristics of pervious concrete.** If a testing laboratory is to be employed, it shall be the responsibility of the owner to select and pay for such testing. Only qualified testing laboratories employing experienced technicians or engineers who are thoroughly familiar with Pervious Concrete installations shall be used. Testing agencies shall have at least three years experience with Pervious Concrete work.

104.1. Test Panels:

If so required by the contract, the Pervious Contractor may be required to prepare test panels as specified by the architect, engineer or owner. Cost of creating and removing such panels shall be covered by a line item in the contract and contract proposal. If 12' x 12' or some other size, sample panels are required for evaluation, they will be provided, if so directed by specification. Test panels shall be of the same thickness as the poured slab, with the same sub-base, and shall be identified by date and batch or truck load. When practical, sample panels shall be of a size that will allow them to be integrated into the final pavement project, if accepted.

- Requirements for acceptance of panels: The thickness of the slab shall measure no less than ½" of the designed thickness.
- Panels shall be devoid of any skin of Portland Cement at the bottom or top of the slab. Such skin can prevent the passage of water through the slab at its designed percolation rate.
- Void containment of the slab should be between 15% minimum and 22% maximum. However, if a wet mix has been applied, a cement skin may form at the base of the slab. Though the void content may be within acceptable limits, the percolation specification may not be met.

- Unit weight shall be within ± 5% of the mix design.

- A minimum compressive strength according to ASTM C-39, of 300 psi shall be required. **(This number would be inconsequential and discourage the use of Pervious Concrete. Please see item below):**

- **Charger, working jointly with Cemex Laboratories has developed a compression test using 12" x 12" x 6" thick samples. Results have averaged above 2900 psi compressive strength.**

- Using a Constant-Head Permeameter, or a mutually agreed to procedure, samples shall demonstrate a percolation rate of 90% or more of the percolation of the Base under the Pervious Concrete slab.

- In the event that the owner or his agent does not want samples taken from the final pavement, test samples, 4' x 4' . placed adjacent to the final pavement may be created during the pours. Base, thickness and batch shall be identical to the final pavement.

Removal of noncompliant panels shall be the responsibility of the Pervious Contractor as well as removal to an approved disposal site.

104.2. Previous Pervious Projects:

Demonstration of pervious installation skills may also be provided through the available inspection and evidence of satisfactory performance of previously completed projects using Pervious Concrete. References by Owners, Engineers or Architects, related to previous successful projects may be provided as appropriate or as requested. If the contractor can show no examples of previously installed work please see **102.1** above.

200. MATERIALS:

201. General:

Locally available materials having a record of consistency and satisfactory performance shall be used. In the past in Florida, limestone has proven to be the aggregate of choice. River gravel lacks the characteristics of limestone and reduces bond strength with cement paste.

Recently, limestone with less strength and integrity is finding its way into Southeast markets. It is subject to some crumbling and producing of fines. When such is the case, granite shall be the aggregate of choice.

Any deviation shall be by mutual agreement. Charger Enterprises has evolved, with the cooperation of its material suppliers mixtures that provide the optimum of strength, workability and price. These formulas can be submitted to the owner's engineer if so requested, but such knowledge shall be considered privileged and proprietary, and distribution to unapproved parties shall be prohibited.

202. Ingredients:

Components of mixture shall consist of Portland cement, limestone, or other locally available, proven satisfactory aggregate, admixtures and stabilizers as appropriate, and water which complies with local concrete paving mix specifications. The addition of water to the mix shall not be the decision of the truck driver.

202.1. Cement:

Cement shall be Portland Cement Type I or II conforming to ASTM C-150 or Portland Cement IP or IS conforming to ASTM C-595.

202.2. Fly ash and Ground Iron Blast Furnace Slag:

Flyash conforming to ASTM-C618 may be used in amounts not to exceed 20 percent of total cementitious material. Ground Iron Blast Furnace Slag conforming to ASTM C989 may be used in amounts not to exceed 50 percent by weight of total cementitious material.

202.3. Aggregate:

Though No. 8 coarse aggregate as specified by FDOT (3/8 to No. 16) per ASTM C 33 or No. 89 Coarse Aggregate (3/8 to No. 50) per ASTM D 448 has been widely used, Charger has had better percobility results using Vulcan rock ½". For mix design incorporating fine aggregate it shall conform to FDOT Specification #902. Other limestone or granite aggregates up to 1" may be used upon approval of Charger Enterprises, the Ready Mix Concrete vendor, and any involved Engineer, Architect or Owner's Representative. For best results aggregate shall be triple washed to remove fines thus enhancing percolation. It shall be the responsibility of the aggregate supplier to certify the triple wash compliance.

202.4. Air Entraining Agents:

Air entraining agents shall comply with ASTM C- 260.

202.5. Admixtures:

Type A Water Reducing Admixtures shall comply with ASTM C-494.
Type B Retardation Admixtures shall comply with ASTM C-494.
Type D Water Reducing/Retarding Admixtures shall comply with ASTM C-494.

Hydration stabilizers which are often recommended and sometimes required shall also meet the requirements of Type B Retardation Admixtures or Type D Water Reducing/Retarding Admixtures.

Additional bonding agents may be included in mix based upon proven advantages and by mutual acceptance of all parties, who have a vested interest involved. They may include, but are not limited to polymer based, or silica-based ingredients and must not interfere with necessary hydration processes. These will be considered as admixtures.

202.6. Water:

Water shall be potable or shall comply with FDOT Standard Specifications, Section 923.

300. PROPORTIONS:

301. Cement Content:

For pavement being used by vehicular traffic, the total cementitious material shall not be less than 500 lbs. per cubic yard of mix.

301.1. Lower Cementitious Material Content:

If required, and if material performance can be achieved and verified using a lower cementitious content, minimum cement content may be lowered upon approval of owner's engineer or its agent.

302. Aggregate Content:

The volume of aggregate specified above shall be equal to 27 cu. ft. per cu. yd. when calculated as a function of the unit weight determined in accordance with ASTM C-29 jiggling procedure. The 27 cu..ft. includes the 15% to 25% Fine aggregate, if used, should not exceed 3 cu. ft. and shall be included in the total aggregate volume. Such fine aggregate will reduce water percolation and retention of the pavement.

(Note! Some specifications have called for 27 cubic feet of aggregate per cubic yard of Pervious concrete. That does not allow for voids or the volume of Portland Cement, water or admixtures.)

303. Admixtures:

Admixtures may be appropriate for numerous reasons. They shall be used according to manufacturer's directions including storing, mixing, placing and curing. Admixtures which simply improve placement or reduce cost, but which may adversely affect the quality of the installed Pervious Concrete may not be used.

304. Water:

Water quantity which is an extremely critical component shall be such that the cement paste displays a wet metallic sheen without causing the cement paste to flow from the aggregate. (If mix appearance is dull-dry, insufficient water has been added for hydration to properly occur. The pavement will not develop its designed strength.)

- Insufficient water content will also cause inconsistency in the mix and reduce bond strength. This will cause aggregate to separate from the pavement over time.

- Too much water content will result in the paste forming membranes which seal the void system primarily at the bottom of the slab. It also may cause a poor surface bond, resulting in unnecessary raveling.

305. Fibers:

Fibers have demonstrated a very positive role in replacing 6" x 6" wire to reinforce concrete slabs. However, they should not be used in Pervious Concrete slabs. Like spider webs they will collect fines and cement paste which will reduce the permeability of a Pervious Concrete slab.

In case the subsoil contains fines that have demonstrated an ability to migrate to the surface, fiber filtration fabric may be integrated between the sub-soil and the base to reduce possible intrusion into the base above. This may be installed at the potential risk of diminishing percobility of the subbase. The Pervious Contractor shall be absolved from any liability from such inclusion. Pollution from hydrocarbons is reduced by filtration by the pervious structure which allows volatile organic chemicals (V.O.CS.) to be evaporated by sunlight. Also, the distribution of remaining hydrocarbons over a large area of pervious pavement and by microbial conversion prevents pollution of the aquifer below.

400. SUBGRADE PREPARATION AND FORM WORK:

400.1. Preliminary Engineering:

Prior to the specification of Pervious Concrete for any paving application, the Owner through a qualified Engineer and/or the General Contractor shall be responsible for evaluation of existing soils relative to stability, drainage and the identifying of any buried organic material or hazardous waste.

Any problems will then be professionally identified and properly addressed and remedied as appropriate, either under the responsibility of the Pervious Contractor, the General Contractor or any other specialty contractor designated by the owner or engineer involved.

In no case can any organic material such as roots, wood, stumps, sod, etc. be allowed to remain in soil below sub-base. Neither can clay nor organic sludge be tolerated.

400.2. Grading Undisturbed Material:

In order to achieve the designed elevations, undisturbed earth must be graded. At the same time problem materials and clay concentrations should be removed. In much of Florida's sandy soils grading and compaction of the sandy soils can convert the graded undisturbed soil into a base as long as it is compacted to a modified proctor value of 92% to 95% of a maximum dry density as established by ASTM D 1157 or AASHTO T 180.

401. Sub-grade Material:

After any problems with the previously undisturbed soil have been corrected, and if the native soil is not suitable to serve as a base, stone aggregate or crushed, recycled concrete may be installed as a base, a minimum of 6"thick. It shall be compacted by a vibratory compactor to a proctor value of 92% of 95% of a maximum dry density as established by ASTM D 1157 or AASHTO T 180.

To create an under pavement reservoir a bed of 6" to 10" of crushed stone or recycled, crushed concrete may also be used to enhance water storage. A choice of the best available soil shall be made by an engineer if appropriate. The use of such a bed may be used to offset the need for open detention ponds, if supported by design engineering,

402. Sub-grade Permeability:

Prior to the placement of Portland Cement Pervious Pavement, the sub-grade shall be tested for the rate of permeability by the double ring infiltrometer, or such other suitable test that will be agreeable to all parties concerned. Test borings are recommended to determine soil conditions and water table level. A layer of clay discovered less than 5' below the base may restrict the permeability of the Pervious system. Borings may not be required if undisturbed soil under base demonstrates good permeability and stability and has not been disturbed for three years or more. Permeability testing and certification if required will be the responsibility of the Owner or General Contractor.

403. Sub-grade Support:

The sub-grade material shall be placed and compacted in layers of a thickness that can be compacted by a mechanical vibratory roller or compactor to a minimum density of 94 % ± 2% as determined by ASTM D-1557 or AASHTO-T-180. A minimum Limerick Bearing Ratio (LBR) of 20 ± 2 shall be obtained in the top 6 inches of sub-grade. Sub-grade stabilization shall be performed if, and as, directed by a qualified engineer. Such engineering services shall be performed if needed at the expense and oversight of the Owner or the General Contractor.

If fill material (embankment) is required to bring sub-grade to final elevation, it shall be clean and free of deleterious materials. It shall be placed and compacted in maximum layers of 8". Layers shall be compacted by a mechanical vibratory roller or compactor to a minimum density of 92% of maximum dry density as established by ASTM-D 1557-D or AASHTO-T-180.

404. Sub-grade Moisture:

The sub-grade shall be in a moist condition with no free standing water (within ± 3% of the optimum moisture content as determined by the modified compaction test ASTM-D-1557 or AASHO-T-180).

405. Forms:

Forms shall be primarily of roll formed steel or reinforced plastic. If wood products are used they should be used sparingly for curves or fill-in pieces. This is because wood is more likely to swell and warp from moisture, and may move more easily under screed vibration and compaction.

Forms shall be the depth of the pavement, or be elevated with steel pins and supported to provide the desired depth of pavement. (Steel forms have proven to provide the best support for power screed machines and to contain the pressures exerted by compacting rollers.)

At present forms for passenger vehicle parking spaces usually are set to produce slabs of 4" to 6" thick. Low speed truck traffic is usually successfully accommodated by forms set to create slabs 6" to 10" thick.

Appropriate release agents shall be applied to the forms before placing concrete and to be regularly applied to rollers used in compaction. When debris or aggregate begins to stick to compaction rollers, they shall be cleaned and recoated with a release agent. Rollers with detached aggregate on their surface when used on fresh Pervious Concrete are a major cause of raveling.

If screed machines pick up traces of debris thy too should be pressure cleaned between truckloads or as otherwise needed.

Forms shall be set to specified elevations and those elevations shall be rechecked immediately prior to the placement of the pervious concrete, aggregate mix. Elevations shall be established and checked by a laser or other suitable device. Any disturbance of forms or base by vehicles or workers shall be repaired and elevations reconfirmed prior to Pervious Concrete Placement. Concrete with footprints should be immediately removed and replaced with fresh concrete..

A suitable material cut into 3/8" thick, spacing strips shall be placed on top of forms or of previously placed material to support the vibrating screed during its operation. This allows for final compaction by steel compaction rollers applied to surface both lengthwise and crosswise.

500. MIXING, HAULING AND PLACING:

501. Mix Time:

Truck mixers shall be operated at the speed designated as mixing speed by the manufacturer for 75 to 100 revolutions of the drum. Commencing mixing too soon and exceeding 100 revolutions may result in a hot, unworkable mix which may result in premature failure of the pervious slab.

502. Transportation:

The Portland cement aggregate mixture may be transported or mixed on site and must be used within one (1) hour of the introduction of mix water, unless otherwise approved by an involved engineer. This time may be increased to 120 minutes when utilizing an approved retarding admixture or the hydration stabilizer specified in Section 205.

503. Discharge:

Each mixer truck driver shall provide a certificate guaranteeing mix conformity with specification. Each batch will be inspected as described above, by the Pervious Concrete Contractor or his qualified agent, for appearance, workability and uniformity of concrete according to Section 304.

A minimal amount of water may then be added to obtain the required mix consistency. A minimum of 20 revolutions at the manufacturer's designated mixing speed shall be required following any addition of water to the mix.

Discharge shall be a continuous operation and shall be completed as quickly as possible. Concrete shall be deposited as close to its final position as practicable and at a point so that fresh concrete enters and adheres to the mass of previously placed green concrete. **The practice of discharging onto sub-grade and pulling or shoveling to final placement is not allowed.**

504. Placing and Finishing Equipment:

Unless otherwise approved by the Owner or Engineer in writing, the contractor shall provide mechanical equipment of either slipform or form riding with a following compactive unit that will provide a minimum of 10 psi vertical force. The pervious concrete pavement will be placed to the required cross section and shall not deviate more than ± 3/8" in 10' from the profile grade (3/8 inch in 10 feet). If placing equipment does not provide the minimum specified vertical force, a full width roller or other full width compaction device that provides sufficient compactive effort, shall be used immediately following the strike off operation.

After mechanical or other approved strike off and compaction operation, no other finishing operation will be allowed. If vibration, internal or surface applied, is used; it shall be shut off immediately when forward progress is halted for any reason. The Contractor will be restricted to pavement placement widths of a maximum of fifteen (15) feet unless the contractor can demonstrate competence to provide placement greater than the maximum width specified, to the satisfaction of the Engineer.

During placement, care should be taken to prevent workers from stepping into the slurry mix. Footprints can compress and force cement paste into the voids at the bottom of the slab, forming resistance to percolation through the slab.

Pervious Concrete does not lend itself to being pumped. However, it can be placed using a belt conveyor.

During placement all tools including screed machines, compaction rollers, rakes, trowels and forms shall be kept clean, and coated with a release agent to reduce the possibility of raveling. **Compaction rollers displaying aggregate adhesion will accelerate raveling and disintegration.**

505. Curing:

Curing procedures shall begin within twenty (20) minutes after the final placement operations. The pavement surface shall be covered with a minimum six (6) mil thick, unpigmented, polyethylene sheet or other approved covering material. Prior to covering a fog or light mist shall be sprayed above the surface when required, due to ambient conditions (temperature, wind and humidity). The cover shall overlap all exposed concrete and film edges by a minimum of 1 foot and shall be secured to pervious surface to avoid bubbles which will cause uneven curing and discoloration. Polyethylene shall be covered evenly with a layer of soil. This is to prevent polyethylene dislocation due to winds or adjacent traffic conditions.

Though rebar and wood has been often been used for this purpose, air invades the space between the them under the polyethylene between the rebars which results in uneven curing, strength and coloration. This dirt must be thoroughly removed by sweeping prior to removing the polyethylene to prevent any clogging of the Pervious Concrete. Care must be taken to prevent seepage through any overlap joints.

505.1. Cure Time:

1. Portland Cement Type I, II, or IS - 7 days minimum.

2. Portland Cement Type I or II with Class F Flyash (as part of the 500 lbs./cy minimum cementitious) or
3. Type IP - 10 days minimum.

No truck traffic shall be allowed for 10 days following placement. (For passenger cars/light trucks no traffic shall be allowed for 7 days.)

506. Jointing:

Though some engineers have recommended the installation of control (contraction) joints installed with joint rollers at 40 foot intervals, we have learned that the use of these rolled joints are counter productive causing excessive raveling, particularly adjacent to the joints.

When required we have also found that **saw cut joints at 40 to 60 foot intervals have also proven to accommodate contraction without causing significant stress cracking.** Saw cutting should be performed seven (7) days after placement, preferably within four days of completion of the placement procedure.

When saw cut joints are performed after four days, the plastic covering will be swept clean, then slit and folded back to accommodate the saw cut. Upon completion the plastic will be folded back over the edges and covered with a new piece of plastic allowing a minimum of 1 foot overlap on each side. The plastic will then be covered with soil for the remainder of the seven-day period.

Saw-cut joints will be installed at a depth of 1/4 of the thickness of the pavement.

When a pour is interrupted it should be terminated against a form and properly compacted. A 45° groove 1" deep shall be created adjacent to the form. When the pour is continued thereafter, a similar groove would be formed into the joint formed by the new pour, matching the previous groove. The “V” shape resulting can then be filled with an approved elastomeric or asphaltic joint sealing product. Isolation (expansion) joints will not be used except when the pavement is abutting slabs or other adjoining structures particularly where a difference in thermal expansion exists.

600. TESTING, INSPECTION AND ACCEPTANCE:

601. Laboratory and/Or Field Testing:

All laboratory test procedures shall be established by the mutual consent of the pervious concrete contractor, the Owner, General Contractor and any engineer or architect representing the concerns of the Owner, or any other entity having a financial interest in the project.

601.1. Laboratory Testing:

Most currently used procedures for testing pervious concrete, beyond establishing void content have little benefit in establishing the physical properties other than the performance of properly formulated and placed Pervious Concrete which has functioned properly for decades. Some more relevant test methods are being evaluated and may be proposed.

At present the Owner or General Contractor may retain **a pervious qualified,** independent testing laboratory. The laboratory must provide evidence of conforming to the requirements of ASTM E-329 "Standard Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials used in Construction," and **must have at least three (3) years of experience in working with pervious concrete.** All test samples shall be made and taken at the time of placement. All samples shall be identified by date and batch mix or truck load. Laboratory testing shall be done expeditiously, and results communicated to all concerned in a timely manner.

601.2. Field Testing:

Field testing shall be performed as per contract documents or specification by either the General Contractor, his agent, or if specified by a **pervious concrete qualified, test laboratory.** To qualify, field agents shall have a minimum of (1) one year and 3 three projects experience in field testing pervious concrete. **Laboratory shall be thoroughly familiar with the unique methods for testing Pervious Concrete.**

Testing procedures are in a state of evolution at present. Permeability may be field tested using a constant-head Permeameter or an Embedded Ring Infiltrometer. (ERIK)

For Lab testing of percobility samples, 2' x 2' can be cut from a typical slab, or made in on-site in forms. The sample, 2' x 2' by 6", or the thickness of the pervious concrete being placed shall have a 2' x 2' x 12" form built around Caulk is then applied between the form and the pervious concrete. The added height provides a dam for the addition of water. The caulk prevents the water from seeping between the form and the edge of the pervious concrete. The form can be placed on a typical compacted base. Three inches of water can be placed inside the form after the concrete has cured partially, and the drainage time can be measured. The three inches of water should be accommodated below the upper surface of the pervious concrete at the same rate as the sub-base is capable of receiving the water. The three inches of water should pass through the pervious and the base in 3 minutes or less, if sub-base can accommodate that amount of water. (See SWFMD RESOURCE REGULATION TRAINING MEMORANDUM TM/ERP – 980521.a, Dated May 01, 1998, Page 2. **"Site Drainage Conditions.**)

700. PAVEMENT TEST PROCEDURE:

701. Paving Material:

701.1. Responsibility:

The Pervious Contractor shall be responsible for requiring a pervious concrete material supplier to provide a mix compliance statement on each shipping document. No deviation of the approved mix design will be accepted without the concurrence of the owner's engineer or agent. Final addition of water is primarily the responsibility of the Pervious Contractor.

701.2. Paving Material:

At the owner's request, if batch certification is not adequate, a minimum frequency of one (1) test for each day of placement shall be conducted to verify the weight of material as delivered. As noted above rodded samples have no relevance to pervious concrete paving. The test shall be conducted in accordance with ASTM C-172 and C-29.

Mix shall be within ± (5%) five percent of the design unit weight. If outside of range, mix proportions shall be modified to comply.

702. Pavement Thickness Acceptance:

Prior to placement, Contractor shall confirm grade peg and/or form elevations to provide required thickness of the pervious slab. If an outside testing laboratory is employed, the following procedure shall be followed:

During placement a field engineer will verify form elevations and measure depth of placement at appropriate time intervals. Within 24 hours of placement core samples may also be taken in accordance with ASTMC-42. This must be done in the presence of the pervious concrete contractor or his agent, and core cavities shall immediately be filled with pervious concrete. These cores shall be used for verification of pavement thickness. At seven days from the placement of the slab, these core ends shall be trimmed to facilitate volume determination. Core unit weights shall be calculated based upon weight results when tested in accordance with ASTM-C-140 paragraph 14.1 (disregard suspended weight.)

Pavement acceptance shall be based on the average weight of the cores being within ± (5%) five percent of the design unit weight. The thickness of the pavement shall be a minimum of five (5) inches for light traffic loadings. Additional thickness will be required for pavements subjected to frequent, heavy axle loadings.

As noted above, compressive strength tests can only be performed 28 days after concrete has been cured. Tests shall be performed in accordance with ASTM-C-39.

703. Permeability:

One of the most important properties of pervious concrete is its percolation rate, which is directly related to its void content. A testing apparatus called a falling head Permeameter can be used to test a core sample to establish its coefficient of permeability. Please see the two references below:
http://www.geology.sdsu/edu/classes/geol.552/permeameter/permeameters.htm

http://www.dot.state.fl.us/research-center/Completed_proj/summary_RD/FDOT_BD521__02.pdf

800. MAINTENANCE:

Maintenance is the responsibility of the owner after the Pervious project has been completed and accepted.

801. Protect Pervious Pavement from potential clogging:

Do not permit landscape or other contractors to store sand or soil on pervious surfaces. Schedule pervious installation near the conclusion of a construction project. Owner or General Contractor shall arrange to have pervious concrete vacuumed before area is opened to traffic.

802. Quarterly Pervious Maintenance:

Pavements shall be examined for damage or deterioration which will be rare. They shall be cleaned with parking lot vacuums. If oil has spilled or dripped in any area treat with oil-digesting microbial compound.

802.1. Adjacent Soil Impact:

Stabilize any adjacent landscape areas that may be allowing soil to wash onto pervious surfaces.

803. Organic debris:

Any leaves or grass cuttings shall be removed by blower or parking lot vacuums as part of a landscape maintenance contract. This response should follow every mowing and leaf removal from landscape areas.

804. Repairs:

When utility work or other activity damages Pervious Pavement, it shall be replaced with Pervious concrete. Use of original Pervious Contractor will preserve any warranty. Under no circumstances should effective storm water management be diminished by repaving with any impervious paving material.

NOTE:
This specification is provided on the basis of our many years of pervious concrete work experience. It reflects the state of the art of pervious concrete design and placement as seen through the eyes of a successful, pioneer, Pervious Contractor, Charger Enterprises, Inc. It is not intended to be applied to conditions unforeseen at the time of contractual agreement, and it may be altered with notice if significant changes in material sources, new equipment, or new techniques become available. Responsibility for its application and its wording is limited to contractual agreements between Charger Enterprises, Inc. and its customers and suppliers.